A mixed-method exploration into the experiences of members of the International Food Safety Authorities Network (INFOSAN)

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I declare that this thesis is my own work and has not been submitted for the award of a higher degree elsewhere

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Table of contents

Acknowledgements i
Table of contents ii
Abstract vi
Abbreviations viii
List of figures ix
List of tables x
Statement of authorship for chapters deriving from co-authored publications xi
Chapter one – Introduction 1
1.1 Thesis aims and structure 1
1.2 Positionality 5
1.3 INFOSAN in review, 2004-2018: Learning from the past and looking to the future 7
1.3.1 Introduction to INFOSAN 7
1.3.2 History and status of INFOSAN before launching the study 9
1.3.3 Interactions with other networks 13
1.3.4 Emergency network activities (2011-2017) 14
1.3.5 Learning from the past: potential barriers to active participation in INFOSAN 20
1.3.6 Conclusions and directives for this PhD study 21
1.4 Research aim 23
1.5 Research objectives 23
1.6 Main research questions 23
Chapter two – Literature review: The utilisation of tools to facilitate cross-border communication during international food safety events, 1995-2020 - A realist synthesis 24
2.1 Rationale for the review 24
2.2 Objectives and focus of the review 27
2.3 The realist approach 28
2.4 Preliminary work to identify initial program theory 29
2.5 Methods/design 29
2.6 Main findings 31
2.6.1 Communication tools to facilitate cross-border communication during international food safety events. 33
2.6.2 Contextual factors that trigger mechanisms to influence the outcomes observed in relation to the use of different communication tools 36
2.6.3 Mechanisms that influence the outcomes observed in relation to the use of different communication tools 39

2.6.4 Outcomes observed in relation to the use of different communication tools by competent authorities to relay information about international aspects of food safety events abroad 46
2.6.5 Realist programme theory 53
2.7 Discussion 56
2.7.1 Strengths, limitations and future directions 58
2.7.2 Comparison with existing literature 59
2.7.3 Conclusion and recommendations 59
Chapter three – Study methodology 61
3.1 Knowledge Transfer and Exchange in Communities of Practice 61
3.2 Theoretical perspectives underpinning this PhD study 62
3.3 Setting 67
3.4 General comments on sampling 68
3.5 General comments on recruitment 68
3.6 General comments on the analysis 68
3.7 Phase one (website analysis) – recruitment and consent 68
3.8 Phase one (website analysis) – data collection and analysis 69
3.9 Phase two (administration of online survey) – recruitment and consent 70
3.10 Phase two (administration of online survey) – data collection (including questionnaire development and adaptation from English into Spanish and French) and analysis 70
3.11 Phase three (semi-structured interviews) – Interpretative Phenomenological Analysis 72
3.12 Phase three (semi-structured interviews) – sampling, recruitment and consent 73
3.13 Phase three (semi-structured interviews) – data collection and analysis 75
3.14 Ethical considerations 78
Chapter four – Results 81
4.1 Results from phase one: Analysis of the INFOSAN Community Website 81
4.1.1 Types of INFOSAN members 81
4.1.2 Geographical representation 82
4.1.3 Government sector represented by members. 83
4.1.4 Primary function of members 83
4.1.5 Scientific expertise of members 84
4.1.6 Length of membership 84
4.1.7 Access to the ICW 84
4.1.8 Use of the discussion forum 85
4.1.9 Number of food safety events on the ICW 87
4.2 Results from phase two: global survey of INFOSAN members 90
4.2.1 Demographics 90

4.2.2 INFOSAN aims and objective 91
4.2.3 Barriers to active participation in INFOSAN activities 93
4.2.4 Information and communication technology support 94
..... 95
4.2.5 Goals 95
4.2.6 Organisational support 96
4.2.7 Impact of INFOSAN as a Community of Practice 97
4.3 Results from phase three: an IPA study of INFOSAN member experiences 101
4.3.1 Trust: Authenticity and reputation are drivers for the acceptance of information from the network 103
4.3.2 Learning: International collaborations create valued opportunities for professional development and knowledge exchange among members 107
4.3.3 Health protection: Collective actions to safeguard the global food supply are seen as noble endeavours and worthy investments by members 111
4.3.4 Sense of community: shared ownership for INFOSAN creates feelings of mutual respect and opportunities for collaboration within the network 114
4.3.5 Potential: recognition of untapped potential is a significant motivating factor that leads members to lend time and energy to network activities 119
Chapter five – Discussion 124
5.1. INFOSAN's structuring characteristics as a community of practice 125
5.2 How the ICW is being used to support the network activities and how it could be improved 130
5.3 Barriers to active participation in INFOSAN 132
5.4 Impact of participation in INFOSAN on foodborne illnesses 134
5.5 INFOSAN and value creation 136
5.6 Implications for practice 138
5.7 Looking beyond INFOSAN 141
5.8 Study limitations 142
Chapter six – Conclusion 145
6.1 Achieving the study objectives 145
6.2 Reflections 148
References 150
Appendices 166
Appendix one – Publications 167
Appendix two – Examples of recent large-scale food safety events 174
Appendix three – Additional details on the conduct of the realist synthesis 175
Appendix four – Development of questionnaire for phase two 177
Appendix five – Interview schedule for phase three 178
Appendix six – Research proposal and ethics application 180

Appendix seven – Ethics approval letters 257
Appendix eight – Regional authorities with one or more Focal Point(s) registered on the ICW, January 2019 261
Appendix nine – WHO Collaborating Centres with Focal Points registered on the INFOSAN Community Website, January 2019 262
Appendix ten – Specific functions and characteristics to be included in a new ICW 263
Appendix eleven – Research posters 268
Appendix twelve – Research presentations 270
Appendix thirteen – Media interest in my research 273

Abstract

Every year, people around the world become sick following the consumption of food containing dangerous bacteria, viruses, chemicals and other harmful contaminants. In an increasingly globalised world, unsafe food in one country can quickly travel beyond national borders, resulting in illness and death abroad. For this reason, the International Food Safety Authorities Network (INFOSAN) was established and has been conceptualised as a global community of practice that aims to limit the negative public health impact when contaminated food reaches the international market. This is mainly done by promoting the rapid exchange of information between contact points worldwide, enabling the swift implementation of control measures to protect the public and ensure the safety of the food supply. However, until now, INFOSAN has never been fully characterised or examined as a functional community of practice and its value, as understood from the perspective of its members, has never been determined in a systematic or rigorous way. To address this gap, this thesis presents a variety of data collected during three distinct study phases using quantitative and qualitative methods, to explore, understand, describe and interpret the experiences of INFOSAN members.

Specifically, in phase one, website analytics were applied to examine members' access to, and use of, the INFOSAN Community Website. In phase two, an online survey was administered to the global membership to obtain broad, systematic insights into the characteristics and performance of INFOSAN as a community of practice, and the opinions of members. In phase three, semi-structured interviews were conducted with a small subset of INFOSAN members, using Interpretative Phenomenological Analysis to explore their personal, lived experiences more deeply. To contextualise this research, a realist synthesis has been conducted to investigate the utilisation of tools such as INFOSAN to facilitate cross-border communication during international food safety events. The resulting programme theory provides a novel understanding of these communication tools, how they are being used, by

whom and in what contexts. The programme theory will be helpful to policymakers and those coordinating the operation of tools currently in use, who may adapt their components according to different contextual factors to promote, support and improve their use.

Overall, the research conducted provides insights into the characteristics and performance of INFOSAN and the opinions of members and their perceptions of the use of INFOSAN as a global communication tool for the prevention of foodborne illness. In addition, it provides a novel understanding of the role of INFOSAN in improving food safety and mitigating the burden of foodborne illness globally. Further, the results have been applied to develop a value creation framework, which suggests that focusing on outreach to sustain personal interest, training to improve technical capacity, and advocacy to obtain political buy-in are ways in which the INFOSAN Secretariat could enable participation and create value at the individual, organizational, and national level, respectively. Such engagement could translate into more effective international communication during urgent food safety events and fewer cases of foodborne illness worldwide. Looking beyond INFOSAN, the results have implications for how other international communities of practice are coordinated in the realm of food safety and public health more broadly.

Abbreviations

ASEAN – Association of Southeast Asian Nations
BSE – Bovine Spongiform Encephalopathy
CAC – Codex Alimentarius Commission
CAT – Community Assessment Toolkit
C-M-O – context-mechanism-outcome
CoP – Community of Practice
CVI – Content Validity Index
EC – European Commission
ECDC – European Centre for Disease Prevention and Control
EHEC – Enterohemorrhagic *Escherichia coli*
EPIS-FWD – Epidemic Intelligence Information System for Food- and Water-borne Diseases and Zoonoses
EU – European Union
EWRS – Early Warning and Response System
FAO – Food and Agriculture Organization of the United Nations
FHMREC – Faculty of Health and Medicine Research Ethics Committee at Lancaster University
GCC – Gulf Cooperation Council
HAV – Hepatitis A Virus
ICT – Information and Communication Technology
ICW – INFOSAN Community Website
IHR 2005 – International Health Regulations
INFOSAN – International Food Safety Authorities Network
IPA – Interpretative Phenomenological Analysis
KTE – Knowledge Transfer and Exchange
MLVA – multilocus variable-number tandem repeat analysis
MS – Member State
PFGE – Pulsed-field Gel Electrophoresis
PulseNet International – International Molecular Subtyping Network for Foodborne Disease Surveillance
RAMESES – Realist and Meta-narrative Evidence Synthesis: Evolving Standards
RASFF – Rapid Alert System for Food and Feed
UK – United Kingdom of Great Britain and Northern Ireland
USA – United States of America
USD – United States Dollar
vCJD – Variant Creutzfeldt-Jakob Disease
WGS – Whole Genome Sequencing
WHA – World Health Assembly
WHO – World Health Organization
WHOERC – WHO Ethics Review Committee

List of figures

Figure 1. Relationship between published components of this thesis and corresponding chapters 4
Figure 2. Average number of Member States involved in each food safety event communicated through INFOSAN, 2011–2017. Each food safety event communicated through INFOSAN between 2011 and 2017 has involved an average of four Member States with a minimum of 1 and maximum of 73..... 17
Figure 3. Member State involvement in food safety events communicated through INFOSAN, 2011–2017. Between 2011 and 2017, 293 food safety events were communicated through INFOSAN. The majority of Member States (123/194, 63%) have been involved in three INFOSAN events or less during this entire period, including 36 of 194 (19%) that have never been involved in an event. 17
Figure 4. Overall responsiveness of INFOSAN members to requests for information from the INFOSAN Secretariat during international food safety events, 2011–2017. To understand how responsive INFOSAN members have been, data from 459 requests for information relating to 192 food safety events between 2011 and 2017 have been analysed. 19
Figure 5. Overview of the stages of this review 31
Figure 6. Flow diagram of the search strategy..... 32
Figure 7. Networks/systems/tools currently in use to facilitate cross-border communication during international food safety events. Numbers represent the number of countries that are members of each network; overlapping areas indicate national membership to more than one network. 35
Figure 8. Realist programme theory to explain how different tools facilitate cross-border communication during international food safety events 55
Figure 9. Theoretical perspectives underpinning this PhD study 66
Figure 10. Schematic overview of the mixed-method approach taken to conduct this PhD study..... 67
Figure 11. Sample interview transcript extract with exploratory comments and themes 77
Figure 12. INFOSAN members registered on the INFOSAN Community Website, January 2013- January 2019 including all members (ALL –), Focal Points (FP –), and Emergency Contact Points (ECP –). 82
Figure 13. INFOSAN member perceptions on network aims and objectives..... 92
Figure 14. Global ranking of potential barriers to active participation in INFOSAN activities 93
Figure 15. INFOSAN members' perceptions of the utility of the INFOSAN Community Website 94
Figure 16. Reported reasons for INFOSAN members to access the INFOSAN Community Website 95
Figure 17. Knowledge transfer and exchange among INFOSAN..... 99
Figure 18. Organizational consequences of participation in INFOSAN..... 100
Figure 19. Fourteen specific functions and five characteristics proposed for inclusion in a redesigned INFOSAN Community Website including new features to be added and existing features to be improved..... 139
Figure 20. Value creation framework for INFOSAN members..... 141

List of tables

Table 1. Number of Member States (MS) involved in food safety events communicated through INFOSAN, by region, 2011-2017 16
Table 2. Top 10 Member States most frequently involved in food safety events communicated through INFOSAN, 2011-2017 16
Table 3. Regional differences in responsiveness (acknowledgement of requests and provision of information requested by INFOSAN Secretariat during food safety events, N =459), 2011-2017 19
Table 4. Potential barriers to active participation 21
Table 5. Communication tools to facilitate cross-border communication during international food safety events 34
Table 6. Characteristics of participants recruited for study phase three 74
Table 7. Geographical representation of INFOSAN members registered on the INFOSAN Community Website, by region, January 2019. 83
Table 8. Last access to the INFOSAN Community Website by INFOSAN members, stratified by type of member (Emergency Contact Point or Focal Point), January 2019 85
Table 9. Last access to the INFOSAN Community Website by INFOSAN members, stratified by geographic region, January 2019 85
Table 10. INFOSAN Community Website Discussion Forum Activity, 2012-2018 87
Table 11. Number of Food Safety Events documented on the INFOSAN Community Website, 2005-2019 88
Table 12. Frequency of hazards involved in food safety events (482) documented on the INFOSAN Community Website, 2005-2019 89
Table 13. Top 10 specific hazards involved in food safety events documented on the INFOSAN Community Website, 2005-2019 89
Table 14. Top 10 foods involved in food safety events documented on the INFOSAN Community Website, 2005-2019 90
Table 15. Regional representation of respondents 91
Table 16. Ranking of reasons for participating in INFOSAN by relative importance according to respondents 96
Table 19. Important ways of finding new information related to food safety 99
Table 20. Extent of personal achievements due to membership in INFOSAN 100
Table 21. Final themes identified in the analysis with brief illustrative quotes 102

Statement of authorship for chapters deriving from co-authored publications

Chapter one – Introduction

- Savelli CJ, Bradshaw A, Ben Embarek P & Mateus C. (2019). The FAO/WHO International Food Safety Authorities Network in Review, 2004-2018: Learning from the Past and Looking to the Future. *Foodborne Pathogens and Disease*, *16*(7), 480-488. https://doi.org/10.1089/fpd.2018.2582

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Chapter two – Literature review

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Chapter three – Study methodology

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Chapter four – Results, Chapter five – Discussion, Chapter six – Conclusion

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Chapter one – Introduction

1.1 Thesis aims and structure

Every year, people worldwide become sick following the consumption of food containing dangerous bacteria, viruses, chemicals and other harmful contaminants. In an increasingly globalised world, unsafe food in one country can quickly travel beyond national borders, resulting in illness and death abroad. For this reason, the International Food Safety Authorities Network (INFOSAN) was established and now operates as a global community of practice that aims to limit the negative public health impact when contaminated food reaches the international market. This is mainly done by encouraging the rapid exchange of information between contact points around the world, enabling the swift implementation of control measures to protect the public and ensure the safety of the food supply. However, until now, INFOSAN has never been fully characterised or examined as a functional community of practice, and its value, as understood from the perspective of its members, has never been determined systematically or rigorously. This thesis uses various data collected during three distinct research phases to explore and describe INFOSAN members' experiences. The research is characterised as a single overall study throughout the thesis, delineated by phase where indicated. The inquiry provides a novel understanding of the network's role in improving food safety and mitigating the burden of foodborne illness globally.

This thesis consists of six chapters plus thirteen appendices. In Chapter One, the aims of the thesis are outlined, and an overview of INFOSAN is provided. This includes a brief history and description of the general activities undertaken by the network and an orientation of INFOSAN as a community of practice (CoP), which encourages urgent international communication during food safety emergencies and functions as a platform for knowledge transfer and exchange (KTE) among its global membership. Chapter one also lays out the overall research aim, objectives and main questions of the study and describes my positionality as a researcher.

Chapter two provides a detailed review of the literature concerning the various international communication tools, networks, and systems that exist (including INFOSAN) to exchange food safety information to understand how they are being used, by whom and in what contexts. A realist approach to conduct this review was chosen as it is well suited for examining complex programmes through its focus on outcomes in real-world settings and the contextual factors that influence them. The resulting programme theory provides a helpful backdrop for understanding this study of INFOSAN vis-à-vis existing literature.

Chapter three describes the study methodology and explains how the three-phase research design has combined quantitative and qualitative methods (including website analytics in phase one, online questionnaire administration in phase two and semi-structured interviews in phase three) to elicit a broad and deep understanding of the network's operation and members' experiences. The overall study is framed through a community of practice lens and is rooted in critical realism. This philosophical perspective accepts the existence of stable and enduring features of reality independently of one's ability to perceive them, which should be measured as a sum of different perspectives, hence the mixed-methods approach employed in this study to gather quantitative indicators and qualitative narratives.

Chapter four presents the results from each research phase, including the descriptive analysis of the INFOSAN Community Website (ICW) performed in phase one, the results from the online questionnaire that INFOSAN members from 137 countries answered during phase two, and the results from ten semi-structured interviews conducted with INFOSAN members from ten countries in phase three.

Chapter five includes a discussion of the structuring characteristics of INFOSAN, how the ICW has been used to support the network activities, the main barriers to active participation in INFOSAN, the perceived impact of participation in INFOSAN on foodborne illnesses, and how participation in INFOSAN creates value for some members. Implications for practice are also discussed in this chapter and suggestions for how the INFOSAN Secretariat could

strengthen the network, support members' active participation, and create value are presented. The study limitations are also discussed here.

The sixth and final chapter concludes the thesis by summarising how the research objectives have been achieved and the main research questions answered. It includes reflections on the research conducted, including an overview of the new knowledge that has resulted. Recommendations for future work on the topic are made here.

In the appendices, readers will find additional supporting information on the published sections of this thesis (Appendix one), examples of recent large-scale food safety events (Appendix two), additional details on the conduct of the realist synthesis (Appendix three), details on the development of the questionnaire used in phase two, (Appendix four), the interview schedule used in phase three (Appendix five), the complete research proposal and ethics application (Appendix six), the ethics approval letters from Lancaster University and the World Health Organization (Appendix seven), a list of regional authorities with registered INFOSAN Focal Points (Appendix eight), a list of WHO Collaborating Centres with registered Focal Points (Appendix nine), a description of specific functions and characteristics to be included in a new INFOSAN Community Website (Appendix ten), related research posters (Appendix eleven) and research presentations (Appendix twelve), and examples of media interest in this research (Appendix thirteen).

While not a requirement for the Blended Learning PhD programme, all sections of this thesis correspond to papers (seven in total) that have been published in peer-reviewed journals. Figure 1 provides an overview of the relationship between the published components of this thesis and the corresponding chapters.

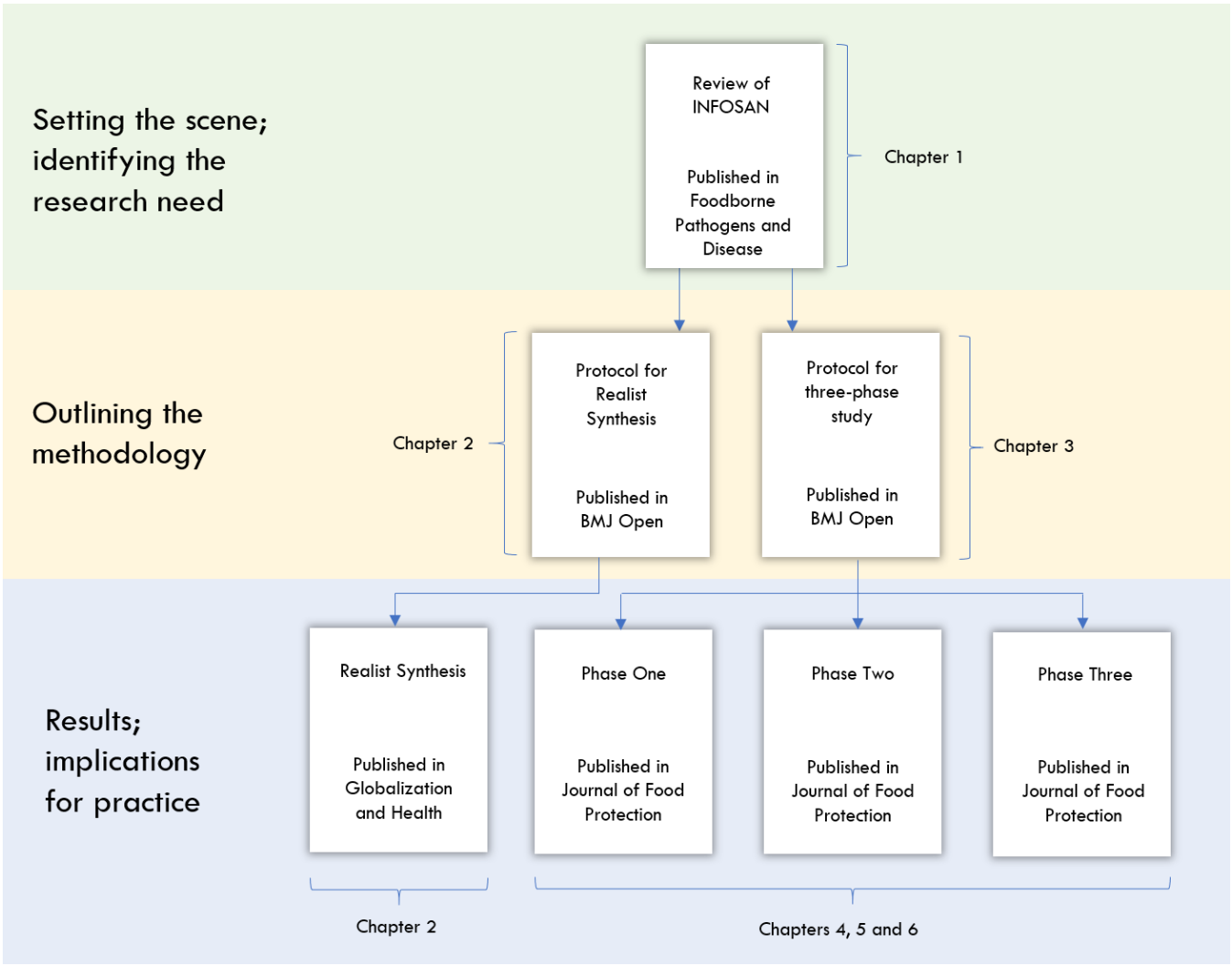


Figure 1. Relationship between published components of this thesis and corresponding chapters

1.2 Positionality

The term positionality describes an individual's worldview and the position they adopt when conducting research. Further, positionality can influence what a researcher has chosen to investigate and it can influence how the research is conducted, its outcomes and results. Positionality can be identified by orienting the researcher around the subject under investigation, the participants, and the research context and process (Holmes, 2020). My positionality is described below.

I have long had an active interest in understanding health and disease from biological and social perspectives, previously studying biomedical science and public health and starting my career at the Public Health Agency of Canada. Subsequently, moving to Switzerland to join the World Health Organization in 2010 has significantly influenced my worldview as an international civil servant who values global collaboration in pursuit of a more equitable and healthier world. As a Technical Officer in the area of food safety, I have been fortunate to visit and conduct professional activities in countries across the Americas, Europe, Africa, the Middle East, and Asia. Through these experiences, I developed a strong appreciation for opportunities to learn from others with diverse backgrounds and perspectives. I have also valued taking a participatory approach to conduct my work at WHO in order to facilitate shared ownership between stakeholders in various organisations in different countries worldwide.

As a member of the INFOSAN Secretariat at WHO, this study was borne from a desire to understand better whether a programme that I was heavily invested in was providing a valuable service to participants and making a difference in people's health, and to justify the assumption that increasing participation in network activities was a worthy endeavour.

By the time I enrolled in the PhD programme at Lancaster University in 2015, I had already been coordinating the activities of INFOSAN for five years with an aim to cultivate the network as an active and engaging community of practice for its growing global membership.

Viewing INFOSAN as a community of practice has thus been the lens through which my PhD research was conceived. This has had significant implications on several aspects of the study's design and conduct, along with my other experiences with INFOSAN beyond the context of this study. These implications are described throughout this thesis.

While my knowledge and experience with INFOSAN helped frame the research aim and objectives, it was important throughout the research process to practise reflexivity to ensure any preconceived notions did not bias the discourse used to present results or draw conclusions. Reflexivity is the concept that a researcher should acknowledge and disclose themselves while attempting to understand their potential role or influence in their research (Cohen et al., 2011). Reflexivity informs positionality and requires careful self-reflection by the researcher about their views and positions and how these could influence the design, conduct or interpretation of research findings (May & Perry, 2017).

While practising reflexivity helped me appreciate the nuances in the results and describe them accordingly, the overall focus of the inquiry has certainly been influenced by my prior experience with INFOSAN, including my relationship with INFOSAN members. In this regard, I have conducted this research as a relative insider, recognising that being involved in INFOSAN does not denote complete sameness among all others who are also involved.

In congruence with the research methodology chosen, I have embraced various aspects of being an insider researcher, which has supported the research process in many ways (e.g. ease of access to study subjects, pre-existing orientation to study setting, strong technical understanding, etc). In some instances, INFOSAN members, as the study subjects, may have been more inclined to participate, knowing that I was the one conducting the research if there was a certain rapport or level of trust that had already been established between us. However, the opposite may also be true, and some participants may have felt less comfortable participating because I was the one conducting the research (Dwyer & Buckle, 2009). Whichever may have been the case, I was uniquely positioned as a member of the INFOSAN

Secretariat to communicate with the entire study population throughout the design and conduct of the research to solicit feedback and encourage participation as the various phases of the study were launched. Overall, my position as a member of the INFOSAN Secretariat during the design and conduct of this research has undoubtedly shaped it in numerous ways. The strengths and limitations that have emerged as a result are acknowledged and described throughout this thesis.

1.3 INFOSAN in review, 2004-2018: Learning from the past and looking to the future[1]

1.3.1 Introduction to INFOSAN

Access to sufficient amounts of safe and nutritious food is an essential requirement for human health. Unfortunately, unsafe food is known to cause more than 200 acute and chronic diseases worldwide, ranging from diarrhoea to cancer (WHO, 2020a). In 2015, the WHO reported the first estimates of the global burden of foodborne diseases, indicating that 31 hazards (including bacteria, viruses, parasites, toxins and chemicals) were responsible for 600-million cases of foodborne diseases and 420,000 deaths worldwide in 2010 (WHO, 2015b). Children under five years of age were found to be disproportionately burdened, accounting for 40% of foodborne disease cases, including 125,000 deaths (WHO, 2015b). Foodborne diseases are observed worldwide; however, the African, South-East Asian, and Eastern Mediterranean regions report the highest burden (WHO, 2015b). Unsafe food presents additional consequences in such high-burden areas by impeding socio-economic development, overloading strained or fragile healthcare systems, and damaging national economies, trade, and tourism (WHO, 2014). Specifically, a 2018 study by the World Bank

[1] Section 1.3 is primarily based on a constituent paper of this research that was published in the journal, Foodborne Pathogens and Disease; the first page is included in Appendix one – publications:

- Savelli CJ, Bradshaw A, Ben Embarek P & Mateus C. (2019). The FAO/WHO International Food Safety Authorities Network in Review, 2004-2018: Learning from the Past and Looking to the Future. Foodborne Pathogens and Disease, 16(7), 480-488. https://doi.org/10.1089/fpd.2018.2582

indicated that unsafe food costs low- and middle-income economies approximately USD 100 billion in lost productivity and medical expenses each year (World Bank, 2018).

Foodborne diseases are preventable, but ensuring a safe national food supply requires a robust food control system and coordination among different government sectors responsible for human health, animal health, agriculture, trade, and others. Also, as a global commodity, contaminated food in one country can readily cause international outbreaks if distributed internationally.

Therefore, channels of communication on food safety matters must be well established within and between countries to facilitate efficient food recalls or outbreak investigations and prevent national and international food safety emergencies (WHO, 2014). For these reasons, the WHO launched the International Food Safety Authorities Network (INFOSAN) in 2004, in cooperation with the Food and Agriculture Organization of the United Nations (FAO). WHO and FAO jointly manage INFOSAN, with most operational functions led by the Secretariat staff located at WHO in Geneva, Switzerland. INFOSAN operates with an overall goal to halt the international spread of contaminated food, prevent foodborne disease outbreaks, and strengthen food safety systems globally (FAO/WHO, 2020a).

The remainder of this chapter provides an overview of INFOSAN that includes a brief history and description of the network's general activities. It also serves to orient INFOSAN as a community of practice (CoP), which encourages urgent international communication during food safety emergencies and provides a platform for knowledge transfer and exchange (KTE) among its global membership as it relates to food safety and public health. In this context, KTE is understood as referring to the dynamic and iterative process of synthesis, dissemination, exchange and application of knowledge to inform policy and practice in these sectors (Rajić & Young, 2013). In addition, an analysis of the communication activities undertaken through INFOSAN during food safety emergencies is presented to demonstrate the responsiveness of members during such events and to recognise patterns of activity. The

analysis serves to orient the reader with respect to how INFOSAN has been operating and how members have been engaging since launching in 2004.

1.3.2 History and status of INFOSAN before launching the study

The stimulus for creating a global network of food safety authorities originated directly from WHO Member States' requests. In 2000, a resolution was adopted at the WHO World Health Assembly (WHA), calling for improved communication between WHO and the Member States on matters of food safety. Specifically, the Member States requested that WHO respond immediately to international food safety emergencies and assist countries with crisis management (WHO, 2000a). Two years later, serious concerns were expressed at the WHA concerning health emergencies posed by natural, accidental, and intentional contamination of food, and the Member States again reiterated the critical need for international coordination on food safety matters (WHO, 2002a).

Later in 2002, recommendations for the establishment of a government level, international food safety network resulted from a series of international conferences, including the FAO/WHO Global Forum for Food Safety Regulators (FAO/WHO, 2002a) and the FAO/WHO Pan-European Conference on Food Safety and Quality (FAO/WHO, 2002b). Subsequently, in 2003, WHO published a report on potential terrorist threats to food, which included guidance for establishing and strengthening prevention and response systems and identified an international food safety emergency network as one of the primary measures of preparedness needed at the global level (WHO, 2003).

Following this in 2004, the Codex Alimentarius Commission (CAC) revised the "Principles and Guidelines for the Exchange of Information in Food Safety Emergency Situations (CAC/GL 19-1995)," introducing the recommendation that Member States should designate official points of contact from their respective food safety authorities to exchange information during international food safety emergencies (FAO/WHO, 2004b). The revised guidelines

also indicated that WHO should be responsible for keeping an updated list of these official contact points. In response to a clear need, expressed prominently and repeatedly in multiple global fora, the WHO officially launched INFOSAN in 2004, in cooperation with FAO, at the FAO/WHO Second Global Forum for Food Safety Regulators (FAO/WHO, 2004a).

Upon launching, members worldwide began to utilise INFOSAN to exchange information during international food safety events. It is important to note that the INFOSAN Secretariat only shares details about food safety events that INFOSAN members have validated (i.e., national government authorities) to ensure the information disseminated through the network is reliable. Within a few years, significant events such as the 2008 Melamine incident (300,000 infants and children became ill in China, six of whom died, as a result of consuming milk products contaminated with melamine) brought renewed attention to the importance of INFOSAN because contaminated products were directly exported or secondarily distributed to 47 countries around the world (Gossner et al., 2009).

Shortly after that, in 2010, a resolution on Advancing Food Safety Initiatives was adopted at the WHA, reemphasising the critical role of INFOSAN and reinforcing its global mandate. A few years later, in 2014, at the second International Conference on Nutrition, the importance of exchanging food safety information between government authorities nationally and across borders to prevent foodborne diseases was underscored. As an outcome, it was recommended that the Member States actively participate in INFOSAN, especially during food safety emergencies (FAO/WHO, 2014b).

In 2016, in recognition of the growth and development of INFOSAN, the CAC once again revised the “Principles and Guidelines for the Exchange of Information in Food Safety Emergency Situations (CAC/GL 19-1995)” by making appropriate references to INFOSAN (FAO/WHO, 2016b). This important revision, endorsed by all CAC members, has further solidified the global mandate of INFOSAN and the essential and internationally recognised

role that INFOSAN should play in the rapid exchange of information between countries during food safety emergencies.

Also, since the International Health Regulations (IHR 2005) came into force in 2007, INFOSAN has been recognised as a fundamental tool to help countries develop the core capacities required for food safety emergency preparedness and response (WHO, 2018a). In recent years, INFOSAN has demonstrated its utility during two major food safety emergencies that captured global media headlines for months in 2017 and 2018. These include an outbreak of salmonellosis in France linked to domestically produced infant formula that was exported to more than 80 countries (37 cases reported) and an outbreak of listeriosis in South Africa linked to domestically produced ready-to-eat meat products that were exported to 15 countries (1060 cases and 216 deaths reported in South Africa).

During both of these events, the INFOSAN Secretariat relied on national INFOSAN Emergency Contact Points' swift action to respond to requests for information. The INFOSAN Secretariat was subsequently able to notify INFOSAN members in importing countries rapidly of the recalled products' details to stop their distribution and allow competent authorities around the world to implement appropriate risk management measures to prevent additional cases of illness (WHO, 2018d).

When it was launched, INFOSAN included members from about 100 Member States. In 2018, that number grew to 188/194 (97%) Member States with more than 600 individual members from a range of national authorities from various sectors involved in food safety management, including, for example, health, agriculture, trade, environment and standards. To join the network, Member States have designated, by official letter to the INFOSAN Secretariat, one Emergency Contact Point from the authority responsible for national coordination of activities related to food safety emergency response. Additional Focal Points from different national authorities have also been designated in many Member States to recognise the multidisciplinary nature of food safety management.

Through membership to the network, INFOSAN members have a common identity that is defined by their shared interest in the food safety domain. By joining the network, each has committed to taking actions that contribute to a safer global food supply by engaging in joint activities and discussions to facilitate KTE among members. Common responsibilities are also shared by members, as defined by the INFOSAN Secretariat.

Combined, these common responsibilities and activities create a sense of community and are undertaken to facilitate the application of best practices to improve food safety. Also, INFOSAN members are all practitioners in their respective countries, as food regulators, risk analysts, epidemiologists, or other types of food safety or public health professionals. Although each member's focus may be different, the uniting factor is that their practice, in some respect, aims to reduce foodborne illness.

It is the shared domain, community, and practice that allows for INFOSAN to be understood as a CoP (Wenger et al., 2002). A CoP is a group of people sharing a particular concern, problem, or passion for an area and deepens their knowledge and expertise by learning from one another and regularly interacting (Wenger et al., 2002). Such interactions may occur in person or through technology-mediated means, as with INFOSAN, which utilises the INFOSAN Community Website (ICW), launched in 2012, to facilitate communication and KTE. The ICW is a secure, online portal that allows INFOSAN members from around the world to exchange information on urgent food safety events and emerging trends of potential global interest.

The ICW provides a virtual environment with a multilingual (English, French, and Spanish) user interface to share lessons learnt and allows members to pose questions to one another to exchange knowledge related to food safety (FAO/WHO, 2016a).

1.3.3 Interactions with other networks

On a biannual basis, the INFOSAN Secretariat delivers a work plan that aims to strengthen the global CoP of INFOSAN members and improve their ability to respond effectively during international food safety events. To achieve this, the work plan has most recently focused on three key areas, including emergency response activities, communication activities, and national capacity-building activities. Much of this work is carried out in close collaboration with several important regional and global partners and networks.

At the regional level, the INFOSAN Secretariat collaborates closely with colleagues from the European Commission (EC), for example, to ensure complementarity between the EC Rapid Alert System for Food and Feed (RASFF) and INFOSAN. One way in which this has been achieved is through the designation of all national RASFF Contact Points as INFOSAN members, preventing parallel and redundant communication channels during emergency communications. Updated working instructions for RASFF members detail how the INFOSAN Secretariat is notified daily of all serious risks identified through RASFF that involve countries outside Europe (European Commission, 2017). These notifications allow the INFOSAN Secretariat to follow up with INFOSAN members beyond the EU border to ensure that appropriate risk management measures are implemented worldwide.

PulseNet International is an example of a global network with which INFOSAN has forged another vital collaboration. PulseNet International is a well-established network that builds capacity for the molecular surveillance of foodborne disease, outbreak detection, and response worldwide (Nadon et al., 2017). The information generated by PulseNet International can be critical in linking international outbreaks of concern to members of INFOSAN and has been the source of such information during dozens of food safety events communicated through INFOSAN.

Strengthening partnerships with other networks and initiatives is a strategic priority for the INFOSAN Secretariat to ensure complementarity and optimise efforts to achieve common goals to mitigate the global burden of foodborne disease. There is an abundance of regional networks and initiatives at various stages of development and utility related to the exchange of food safety information during emergencies in select regions. The global food safety community would benefit from a review of such networks to understand better how they are being used, by whom, and in what contexts (See Chapter 2).

1.3.4 Emergency network activities (2011-2017)

During food safety events, the INFOSAN Secretariat supports information exchange between members, enabling risk management measures to be implemented to prevent foodborne illness. The level of engagement by the INFOSAN Secretariat in each food safety event varies depending on several factors, including the countries involved, the severity of the public health impact, and the duration of the event.

In some cases, the INFOSAN Secretariat plays a facilitating role, ensuring that affected members have access to each other's contact details. In other cases, the INFOSAN Secretariat provides technical advice or information to an INFOSAN member regarding a food safety event or issue. During complex events involving multiple countries, the INFOSAN Secretariat actively obtains and disseminates information to and from INFOSAN members regarding food safety events of international concern and enabling risk management measures to be implemented, such as recalls, public alerts, and risk communication with consumers.

During such events, the INFOSAN Secretariat also collects information about illnesses in different countries that may be linked to the same food source, as well as the results of traceback activities and root-cause analyses. This information is then summarised on the ICW. The details related to such food safety emergencies reported through INFOSAN have

been documented in a standardised and systematic way since 2011, enabling an analysis of several variables. Before this, information was not consistently collected or archived.

An average of 42 food safety events communicated through INFOSAN occurred annually in the seven years from 2011 to 2017 (total number of events, $N = 293$). For this analysis, to be considered involved in a food safety event communicated through INFOSAN, a Member State will have received communication from the INFOSAN Secretariat due to that Member States' production, export, or import of a particular food product, or because of an ongoing outbreak of foodborne disease within its borders.

Each year, an average of 74/194 (38%) Member States have been involved in food safety events communicated through INFOSAN, with a minimum of 56/194 (29%) in 2011 and a maximum of 120/194 (62%) in 2017. Before a sharp increase in 2017, the trend was relatively stable, with an average of 66/194 (34%) communicating through INFOSAN each year. Overall, 159/194 (82%) have been involved in a food safety event communicated through INFOSAN between 2011 and 2017 (Table 1) and each event has involved an average of four Member States with a minimum of one and a maximum of 73 (Figure 2). However, the majority of Member States have been involved in three events or less during this period (123/194, 63%), including 36/194 (19%) that have never been involved in an event (Figure 3). The Member States most frequently involved in a food safety event communicated through INFOSAN are given in Table 2.

Table 1. Number of Member States (MS) involved in food safety events communicated through INFOSAN, by region, 2011-2017

Region (number of MS)	2011	2012	2013	2014	2015	2016	2017	All years
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Africa (47)	2 (4%)	5 (11%)	0	5 (11%)	11 (23%)	8 (17%)	40 (85%)	41 (87%)
Americas (35)	10 (29%)	10 (29%)	13 (37%)	15 (43%)	17 (49%)	9 (26%)	13 (37%)	27 (77%)
Eastern Mediterranean (21)	5 (23%)	2 (10%)	7 (33%)	4 (19%)	11 (52%)	11 (52%)	18 (86%)	20 (95%)
Europe (53)	27 (51%)	30 (57%)	39 (74%)	28 (53%)	23 (43%)	20 (38%)	32 (60%)	46 (87%)
South East Asia (11)	3 (27%)	4 (36%)	5 (45%)	4 (36%)	5 (45%)	6 (55%)	6 (55%)	9 (82%)
Western Pacific (27)	9 (33%)	10 (37%)	11 (41%)	10 (37%)	10 (37%)	9 (33%)	11 (41%)	16 (59%)
All Regions (194)	56 (29%)	61 (31%)	75 (39%)	66 (34%)	77 (40%)	63 (32%)	120 (62%)	159 (82%)

Table 2. Top 10 Member States most frequently involved in food safety events communicated through INFOSAN, 2011-2017

Member State	Number of events MS was involved in (N = 293)
	n (%)
1. United States of America	91 (31%)
2. China (including Hong Kong and Macao)	64 (22%)
3. Canada	60 (20%)
4. Australia	48 (16%)
5. United Kingdom	48 (26%)
6. France	40 (14%)
7. Germany	40 (14%)
8. Netherlands	36 (12%)
9. New Zealand	25 (9%)
10. Italy	22 (8%)
10. Singapore	22 (8%)

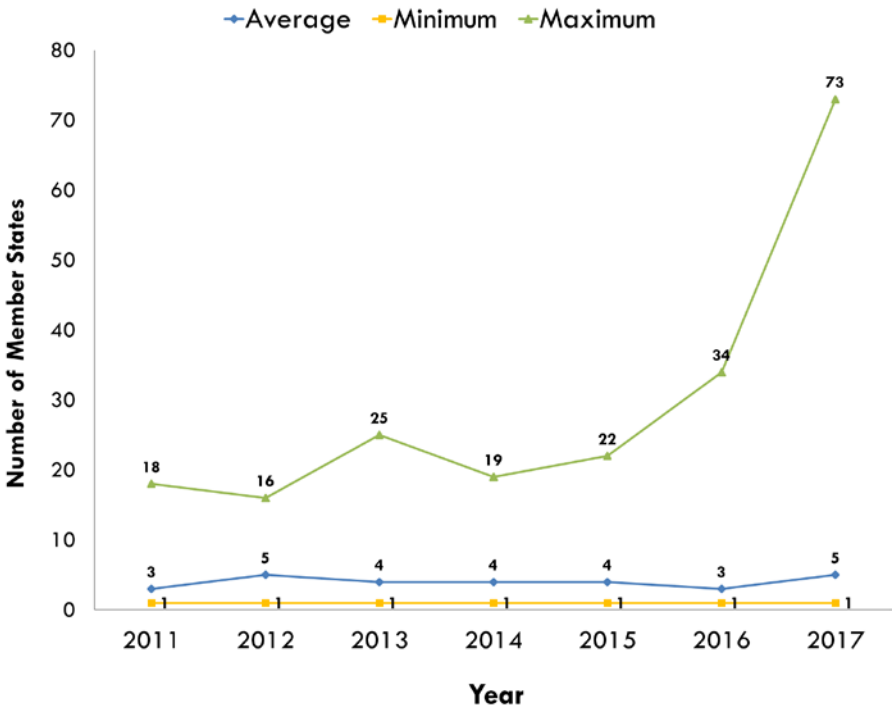


Figure 2. Average number of Member States involved in each food safety event communicated through INFOSAN, 2011–2017. Each food safety event communicated through INFOSAN between 2011 and 2017 has involved an average of four Member States with a minimum of 1 and maximum of 73.

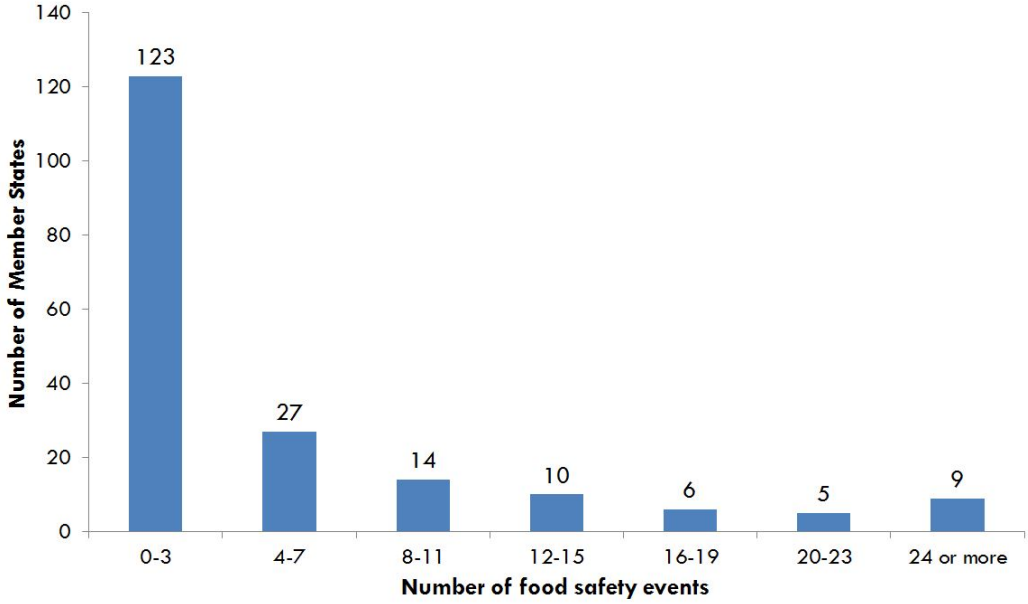


Figure 3. Member State involvement in food safety events communicated through INFOSAN, 2011–2017. Between 2011 and 2017, 293 food safety events were communicated through INFOSAN. The majority of Member States (123/194, 63%) have been involved in three INFOSAN events or less during this entire period, including 36 of 194 (19%) that have never been involved in an event.

During food safety events, the INFOSAN Secretariat will often request information from INFOSAN Emergency Contact Points after the receipt of information indicating potential international concern. Information requested may relate to the verification of the event, distribution patterns of contaminated food, details on reported cases of foodborne illness, or risk management measures implemented. Members receiving such requests are asked to acknowledge receipt within 24 hours and to respond with the requested information as soon as possible. Data from 459 requests for information relating to 192 food safety events between 2011 and 2017 have been reviewed to understand how responsive INFOSAN members have been.

Three measures of responsiveness have been examined: the first is whether or not the INFOSAN Emergency Contact Point acknowledges the request for information within 24 hours; the second is whether or not the request is acknowledged at all; and the third is whether or not the information requested was eventually provided. Figure 4 provides the overall responsiveness, including acknowledgements and provision of information. Overall responsiveness concerning acknowledgements increased relatively steadily during these seven years, from a minimum of 28% in 2011 (25% within 24 hours) to a maximum of 91% in 2017 (59% within 24 hours).

A clear trend is less apparent concerning the actual provision of the information requested by the INFOSAN Secretariat from the INFOSAN Emergency Contact Points: during the seven years, 70% (318/459) of all requests made to INFOSAN Emergency Contact Points were answered with the provision of information (with a low of 59% in 2012 and high of 78% in 2013 and 2016). The average number of days it took for information requests to be acknowledged between 2011 and 2017 is two and the average number of days it took for information to be provided following an information request between 2011 and 2017 is seven. During this period, differences in responsiveness have been observed between different regions, with members from the Americas, South-East Asia, the Western Pacific, and Europe

demonstrating more responsive behaviour than those from the Eastern Mediterranean and Africa (Table 3).

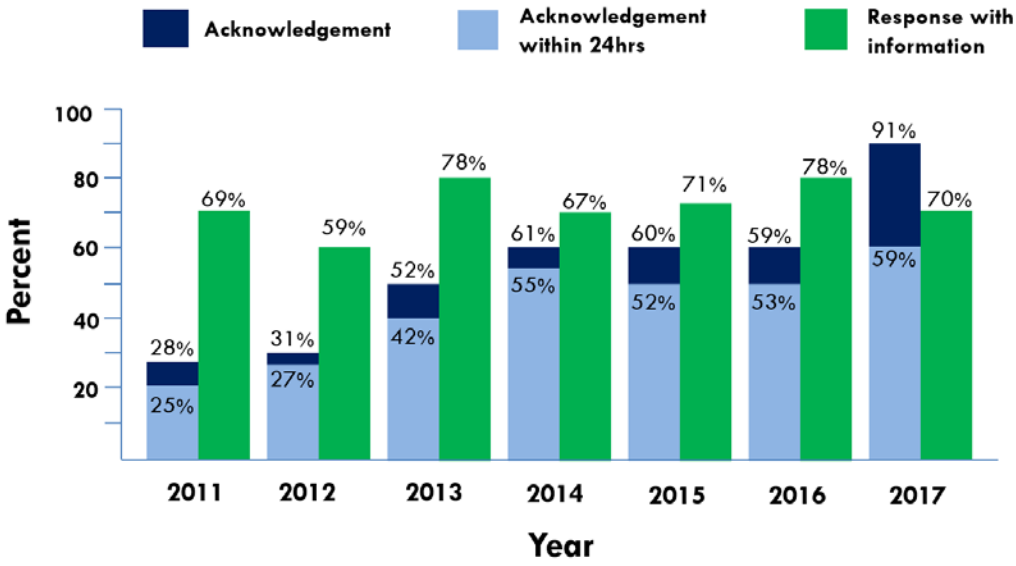


Figure 4. Overall responsiveness of INFOSAN members to requests for information from the INFOSAN Secretariat during international food safety events, 2011–2017. To understand how responsive INFOSAN members have been, data from 459 requests for information relating to 192 food safety events between 2011 and 2017 have been analysed.

Table 3. Regional differences in responsiveness (acknowledgement of requests and provision of information requested by INFOSAN Secretariat during food safety events, N =459), 2011-2017

Region (number of events from 2011-2017)	Number of events for which acknowledgement of request for information was provided at any time, (%)	Number of events for which acknowledgement of request for information was provided with 24 hours, (%)	Number of events for which requested information was provided, (%)
Africa (22)	12, (55%)	8, (36%)	7, (32%)
Americas (124)	85, (69%)	78, (63%)	97, (78%)
Eastern Mediterranean (15)	7, (47%)	3, (20%)	6, (40%)
Europe (146)	61, (42%)	45, (31%)	99, (68%)
South East Asia (27)	18, (67%)	14, (52%)	19, (70%)
Western Pacific (125)	70, (56%)	58, (46%)	90, (72%)
All Regions (459)	253, (55%)	206, (45%)	318, (69%)

1.3.5 Learning from the past: potential barriers to active participation in INFOSAN

The above analysis of emergency communication indicates that active participation in INFOSAN during food safety events was somewhat limited to a core group of Member States. It is important to note that a Member State's involvement in food safety events communicated through INFOSAN should not be equated with an unsafe national food supply. Instead, on the contrary, active participation in INFOSAN may signal those Member States that have prioritised food safety and open and transparent information exchange to facilitate recalls of contaminated products and limit the disruption to food import and export.

Active participation in INFOSAN may also indicate those well-resourced Member States with robust food control systems and sensitive and useful surveillance tools that allow for identifying foodborne illness and unsafe food and the protocols to facilitate their reporting at the international level.

For INFOSAN to reach its full potential, the entire membership should commit to timely and active engagement. The fact that information requests have, on average, taken seven days to respond to leaves much room for improvement if INFOSAN is to function efficiently to halt the international spread of illness caused by contaminated food.

Experience from practice and an applied review of evidence conducted by the INFOSAN Secretariat in collaboration with the Geneva Graduate Institute of International and Development Studies in 2014 illuminated several potential barriers to active participation in INFOSAN, and these are listed in Table 4 (Savelli, 2014). The obtainment of structured feedback from INFOSAN members on the relative importance of these barriers and potential solutions is required.

Table 4. Potential barriers to active participation

Capacity-related: Limited capacity/infrastructure dedicated to addressing food safety
Insufficient funds: human resources/expertise; national food control system underdeveloped
Training-related: Laboratory analysis; food safety risk assessment; outbreak investigation
Standardisation: No standardised information sharing at national level
Coordination: Lack of coordination among national authorities
Legal constraints: Legal implications hinder prompt information sharing; lack of food safety legislation; lack of cooperation from industry
Political constraints: Food safety not prioritised
Negative impact on economy: trade; tourism
Unclear mandate: Need better to understand role and or services of INFOSAN Secretariat
Unclear roles and responsibilities: Need to clarify expectations for members
Lack of standardisation: Data/information requests
Language: Most correspondence is only in English
Timeliness: Information reported to and from Secretariat needs to be timely
Accuracy of information: Concerns for data accuracy; precautionary vs confirmed
Trust: Lack of trust between authorities outside their own country; unknown repercussions
Confidentiality: Fears that confidentiality will not be respected

1.3.6 Conclusions and directives for this PhD study

Although INFOSAN has been operating since 2004 to facilitate the above-mentioned activities among its members, several challenges and limitations have been identified, specifically concerning INFOSAN members' responsiveness during international food safety emergencies. As the majority of members may go years between involvement in food safety events communicated through INFOSAN, efforts to engage these members and bolster preparedness should be considered to ensure that when they do become involved, they are ready to respond rapidly. Attendance to capacity-building INFOSAN workshops, meetings, webinars, and other training opportunities, including participation in simulation exercises, should be encouraged for such members.

Also, INFOSAN has never been fully characterised or examined as a functional CoP, and its value has never been determined systematically or rigorously from the perspective of its members. INFOSAN operations could be optimised if there was a clear understanding of its stage of community development (Wenger et al., 2002), taking into account its structuring characteristics (Dubé et al., 2006).

This review of INFOSAN has determined that INFOSAN would benefit from further exploration into the experiences of members concerning their participation in Network activities as a means to enhance active participation and improve global food safety and prevent foodborne illness. Specifically, this could be achieved by first examining the ICW to characterise membership and understand members' patterns of access, usage, and contribution. Also, efforts should be made to gain a broad and deep understanding of the barriers to active participation in INFOSAN to prioritise interventions by the Secretariat to improve engagement. Furthermore, members' perceptions should be elicited rigorously concerning the utility of INFOSAN as a global communication tool for KTE and the prevention of foodborne illness in each respective country. In this way, the Secretariat shall be able to determine how participation in INFOSAN might create value for members and explore the mechanisms through which this may occur.

Since 2004, INFOSAN has grown into a global network with a global mandate, endorsed by 194 Member States of the WHO. The entrenchment of INFOSAN within the IHR (2005) framework, and within important CAC guidelines, provides further acknowledgement and support for the need for such a network and its global importance. Perhaps most importantly, INFOSAN has demonstrated its utility in numerous global food safety emergencies (WHO, 2018d).

Maintaining functional links to other regional and global networks remains an essential priority for INFOSAN. In a complex global landscape, INFOSAN has emerged as the only network of its kind with a truly global mandate to connect food safety authorities around the world to exchange information during food safety emergencies. However, INFOSAN does not function without limitations. Active participation among a broader base of members and the timeliness of requests for information could be improved. Overall, this initial review of INFOSAN set the scene for the research undertaken for this PhD study, which explores members' experiences. In turn, this may help increase the value of active participation among

INFOSAN members, eliminate barriers to participation, and lead to a stronger global CoP and a robust and meaningful impact at the country level to reduce the burden of foodborne disease globally. Upon conclusion of this review of INFOSAN, the research aim, objectives and questions were set, as indicated below. This research has relied on Wenger's concept of a 'community of practice' (Wenger, 1999) as a social learning theory to provide a lens through which to focus its inquiry (see section 3.2 for theoretical perspectives underpinning this PhD study):

1.4 Research aim

The overall aim of this study is to explore and describe the experiences of INFOSAN members with respect to their participation in network activities as a means to improve global food safety and prevent foodborne illness.

1.5 Research objectives

1. Assess the functioning of INFOSAN as a CoP by obtaining systematic insights into the characteristics, performance and opinions of members.
2. Gain a broad and deep understanding of members' perceptions of the use of INFOSAN as a global communication tool for KTE and the prevention of foodborne illness.
3. Determine if participation in INFOSAN creates value for members and explore the mechanisms through which this may occur.

1.6 Main research questions

1. How is the ICW being used to support the network activities?
2. What are the barriers to active participation in INFOSAN?
3. Do members of INFOSAN believe that participation in the network has prevented foodborne illness and saved lives?
4. Does participation in INFOSAN create value for members and if so, through what mechanisms does this occur?

Chapter two – Literature review: The utilisation of tools to facilitate cross-border communication during international food safety events, 1995-2020 - A realist synthesis[2]

2.1 Rationale for the review

The study of INFOSAN is a niche subject, and research into the experiences of INFOSAN members was not published before this PhD study was conducted. Therefore, this literature review has looked more broadly than just at those publications concerning INFOSAN to investigate how other international networks facilitate cross-border communication during international food safety events, why are they used, by whom, and for what purpose. Doing so has helped to situate the PhD research and orient the reader to this field's global landscape.

An international food safety event results when unsafe food produced in one country is exported to at least one country. Even in countries with well-developed capacities related to food safety, past international food safety events have demonstrated that unsafe foods produced abroad and imported for domestic consumption have the potential to result in large-scale outbreaks of foodborne disease. Appendix two illustrates a selection of notably significant and relatively recent food safety events (Bernard et al., 2014; Gossner et al., 2009; Robert Koch Institute, 2011; Severi et al., 2015; WHO, 2018b, 2018c, 2018e). While global food safety events happen relatively infrequently, smaller-scale events occur regularly, involving a few countries each time (FAO/WHO, 2020a; Savelli et al., 2019). Such events

[2] Chapter two is primarily based on two constituent papers of this research, including the literature review protocol and the literature review; the first page of each publication is included in Appendix one – publications:

- Savelli CJ & Mateus C. (2019). Utilisation of tools to facilitate cross-border communication during international food safety events, 1995-2019: a realist synthesis protocol. BMJ Open, 9(10), e030593. http://dx.doi.org/10.1136/bmjopen-2019-030593
- Savelli CJ, Garcia Acevedo RF, Simpson J & Mateus C. (2021) The utilisation of tools to facilitate cross-border communication during international food safety events, 1995-2020: a realist synthesis. Globalization and Health, 17, 65. https://doi.org/10.1186/s12992-021-00715-2

illustrate that even the most advanced food control systems do not eliminate all foodborne hazards from reaching the public. The globalisation of our food supply means that unsafe food originating from one country can undoubtedly result in foodborne disease cases in others.

Global food trade grew almost threefold from 2005 to 2015 (FAO, 2015) and will continue to rise according to projections (International Food Policy Research Institute, 2018), even in the face of the global COVID-19 pandemic, during which time the agri-food sector has displayed more resilience to the crisis than other sectors (FAO, 2020). Thus, there is a need for international coordination to facilitate rapid and efficient communication and collaboration between public health and food safety authorities (i.e. competent authorities) worldwide to prevent, detect and respond to international food safety events when internationally traded food is considered unsafe.

Timely mechanisms to facilitate such global communication did not exist until relatively recently, as explained in Chapter One. WHO Member States recognised this gap in the early 2000s and adopted resolutions at the WHA in 2000 (WHO, 2000b) and 2002 (WHO, 2002b), calling for improved communication and coordination during international food safety events, including better tools to facilitate this. Since then, advancements in communication technology have facilitated the development or expansion of international networks and knowledge-sharing platforms to exchange molecular subtyping information on foodborne pathogens, epidemiologic information about foodborne diseases, as well as information on food contamination and related traceability details.

Throughout this review, the term ‘communication tool’ encompasses networks, knowledge-sharing platforms, technical programmes, or systems that facilitate communication related to food safety across national borders. These communication tools are complex for several reasons, including because they represent disparate systems that may or may not interface with each other, operate in different languages, are coordinated by different institutions in

different countries and are at various stages of development. Evidence from practice suggests that such tools are only effective within certain contexts, and several only target specific geographic areas (FAO/WHO, 2013, 2014a, 2016a, 2018, 2020a). Therefore, it is necessary to unpack and explore the mechanisms of how and in what context such communication tools and their components effectively facilitate international communication and coordination.

Unfortunately, limited research on the tools' attributes and effectiveness to facilitate cross-border communication during international food safety events has been conducted. As such, existing literature provides limited guidance for decision-makers (who coordinate international programmes that facilitate information exchange on food safety) to adopt best practices to achieve their objectives. Additionally, as explained in Chapter one and published by Savelli *et al*. (2019), the global food safety community would benefit from examining the characteristics of such programmes and networks to understand better how they are being used, by whom and in what contexts because this has never been done before.

Realist synthesis was therefore selected to address this gap with the following central question guiding the review: how do different tools facilitate cross-border communication during international food safety events, why are they used, by whom, and for what purpose? A realist approach to conduct this review was chosen as it is well suited for examining complex programmes through its focus on outcomes in real-world settings and the contextual factors that influence them (Pawson et al., 2005). This interpretative method is theoretically driven and allows the synthesis of evidence from various sources and study designs. The use of theory facilitates a more profound understanding concerning policy intentions and appreciates the complexity of programmes by including the context in the analysis, more so than other review methods (Pawson et al., 2005; Wong et al., 2013).

In this review, outcomes are referred to as either first- or second-level outcomes. The first-level outcome of interest is the use of different tools to communicate internationally about issues related to food safety in an efficient manner. The second-level outcomes of interest are

the outcomes or consequences of using the tools (for example, identifying the source of an outbreak, facilitating risk management actions in different countries, and preventing foodborne disease). Although important, it is beyond this review's scope to examine and measure the impact of using different tools on the global food supply's overall safety.

2.2 Objectives and focus of the review

The primary aim of this synthesis is to address the question: how do different tools facilitate cross-border communication during international food safety events, why are they used, by whom, and for what purpose? The overall objective is to refine a programme theory that explains the contexts (C) in which certain mechanisms (M) generate specific outcomes (O) by developing a C-M-O framework. This programme theory should prove useful to programme coordinators to promote and support the use of communication tools and improve their effectiveness. The specific objectives are as follows:

1) Document the different tools used to facilitate cross-border communication during international food safety events;
2) Identify the contextual factors that trigger mechanisms to influence the outcomes observed in relation to the use of different communication tools;
3) Identify and explain the mechanisms that influence the outcomes observed in relation to the use of different communication tools;
4) Examine the outcomes observed in relation to the use of different communication tools; and
5) Refine a realist programme theory that synthesises review findings and input from an expert reference committee to explain how different tools facilitate cross-border communication during international food safety events, why they are used, by whom, and for what purpose.

2.3 The realist approach

A realist approach has been chosen to conduct this review as it is well suited for the examination of complex programmes through its focus on outcomes in real-world settings and the contextual factors that influence them (Pawson et al., 2005). A realist perspective of social change underpins this approach whereby individuals' actions and their understanding of the world serve to construct social phenomena and are influenced by cultural, institutional and social structures (Gunderson & Holling, 2002; Mertens, 2008). This interpretative method is theoretically driven and allows evidence from a range of study designs to be synthesised. The use of theory facilitates a more profound understanding concerning policy intentions and appreciates the complexity of programmes by including the context in the analysis (Wong et al., 2013).

A realist review's overall intent is the development and refinement of programme theories to understand how context influences mechanisms to generate outcomes. Mechanisms can be understood as the underlying context-dependent processes, behaviours, structures, values or levers that are able to generate outcomes. The context includes the social, cultural, institutional, historical and environmental factors that form the setting in which actions are taken to trigger mechanisms. The resulting outcomes of the programme, system or intervention under examination are the products of certain mechanisms being triggered in certain contexts and may be intended or unintended (Durham & Blondell, 2014; Pawson et al., 2005; Thompson et al., 2016).

In this review, identifying mechanisms will help to explain how competent authorities use existing communication tools during international food safety events to exchange information across national borders. By taking the realist perspective, the C–M–O configuration allows the research to be abstracted and applied to multiple contexts, bolstering external validity. The process of theory building and configuring the C–M–O was iterative, enabling the

modification of the initial programme theory (Durham & Blondell, 2014; Pawson et al., 2005; Wong et al., 2013).

2.4 Preliminary work to identify initial program theory

To identify an initial programme theory, a range of sources were used, including my experiences as the secretariat of INFOSAN at WHO for more than ten years, a scoping review of published papers describing international food safety events and grey literature pertaining to various food safety communication tools currently in use and elicitation of input from an international expert reference committee including some coordinators of international communication tools currently in use.

2.5 Methods/design

This realist synthesis has followed the 2005 protocol developed by Pawson, Greenhalgh, Harvey, and Walshe for conducting realist reviews (Pawson et al., 2005), and reporting is guided by the Realist and Meta-narrative Evidence Synthesis: Evolving Standards (RAMESES) from Wong, Greenhalgh, Westhorp, Buckingham, and Pawson (Wong et al., 2013). The five steps for conducting a realist review according to Pawson *et al*. (2005) have been followed: 1) clarify scope; 2) search for evidence; 3) appraise primary studies and extract data; 4) analyse and synthesise evidence; and 5) disseminate. While presented sequentially, these steps were iterative and were revisited throughout the review process when new evidence emerged that could contribute to theory refinement (Figure 5).

The grand level development theories that provide an overarching framework for this review include the third wave of modernisation theory developed in the 1990s (Giddens, 1990, 1991) and globalisation theory as articulated by Robinson (Robinson, 2011; Robinson et al., 2004). Both theories provide a lens through which to understand that though the world is becoming ever more interconnected and interdependent, certain structures built to support development cannot be imposed in precisely the same way at the same time in different countries because

the country-specific context will influence the outcomes. Modernisation theory also helps to explain the development of systems and tools within societies. This is particularly relevant in the context of ensuring food safety as there are international food safety standards and guidelines (including guidelines for communication during international food safety events) that must be adopted in national settings to improve food safety systems and facilitate food trade. Globalisation theory helps explain that with the introduction of international food safety standards and guidelines, national governments cannot operate in isolation if they wish to engage in food trade. With these overarching theories in mind, and using the realist approach, a refined programme theory to explain a context-mechanism-outcome (C-M-O) configuration related to the use of communication tools to facilitate information exchange during international food safety events has been developed.

For information on the search strategy, study selection criteria and procedures (including the role of a second reviewer and the expert reference committee), data extraction and study appraisal (including quality appraisal), data synthesis, validity and document characteristics, see Appendix three. These details have also been published in the review protocol (Savelli & Mateus, 2019).

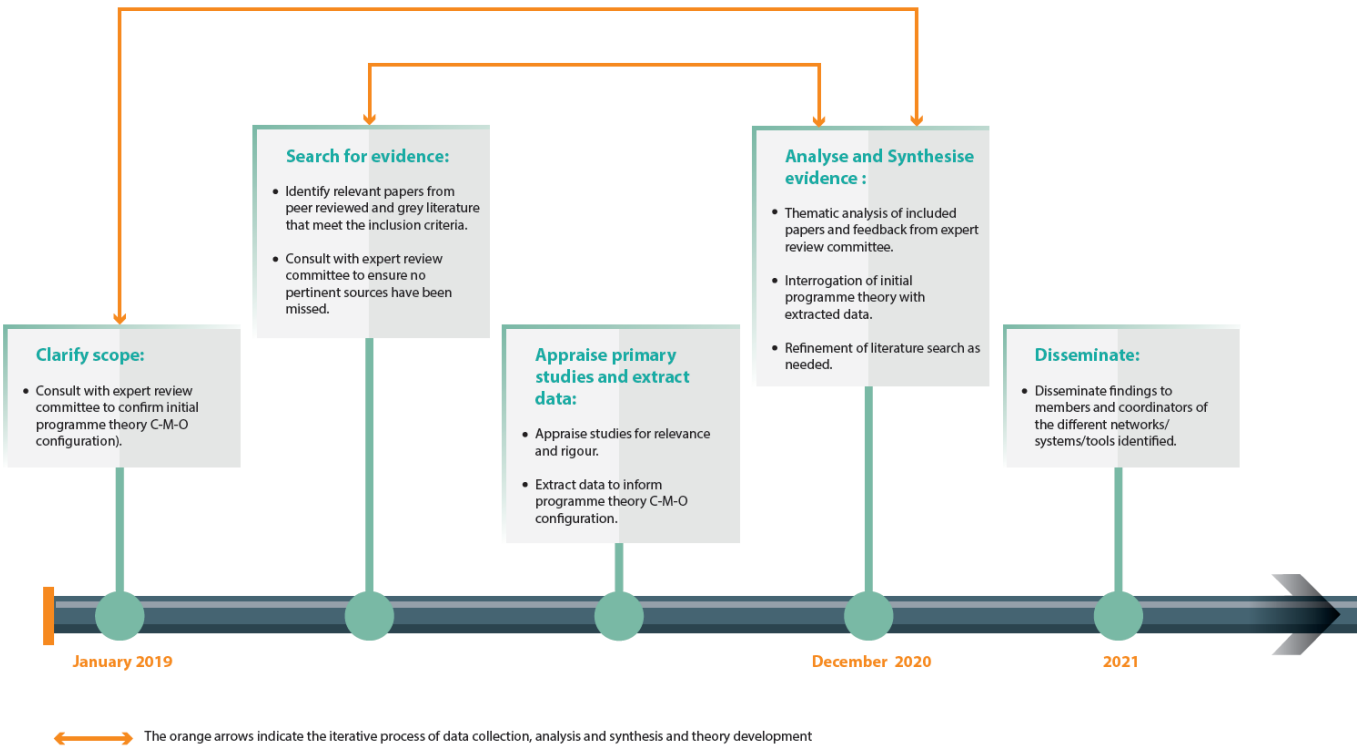


Figure 5. Overview of the stages of this review

2.6 Main findings

Given the wider focus of what constitutes relevant evidence in a realist review, a total of 4141 articles were found across the databases after duplicates were excluded. Of these articles, 55 met the inclusion criteria. Additionally, eight relevant documents were found in the grey literature search, and two relevant documents were suggested by a member of the expert reference committee resulting in a total of 65 documents included in this review. For a flow diagram of the search strategy, see Figure 6. The 65 documents retained fall under the broad categories of outbreak report (29), commentary (15), policy document (8), research article (6), review article (6) and meeting report (1).

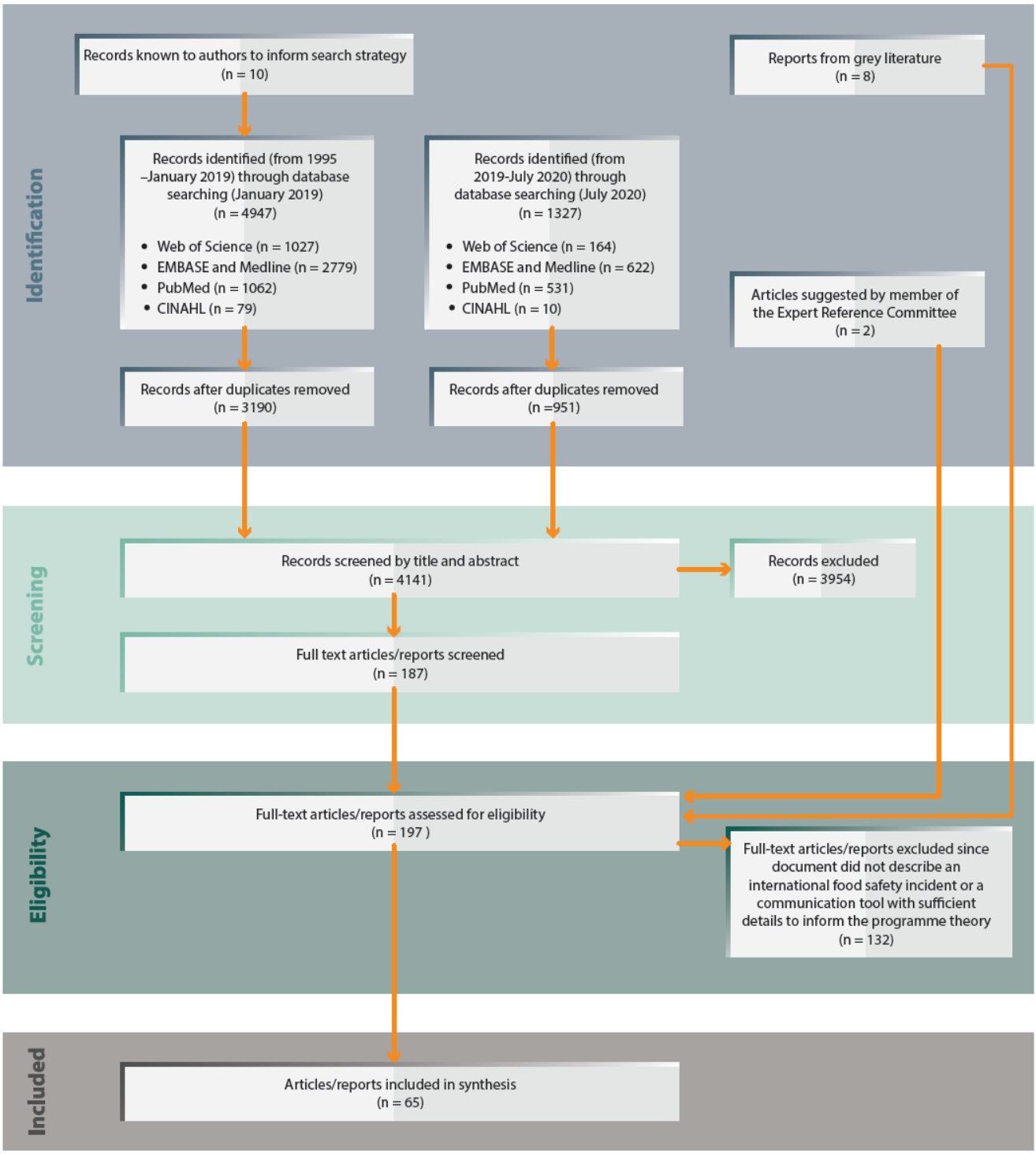


Figure 6. Flow diagram of the search strategy

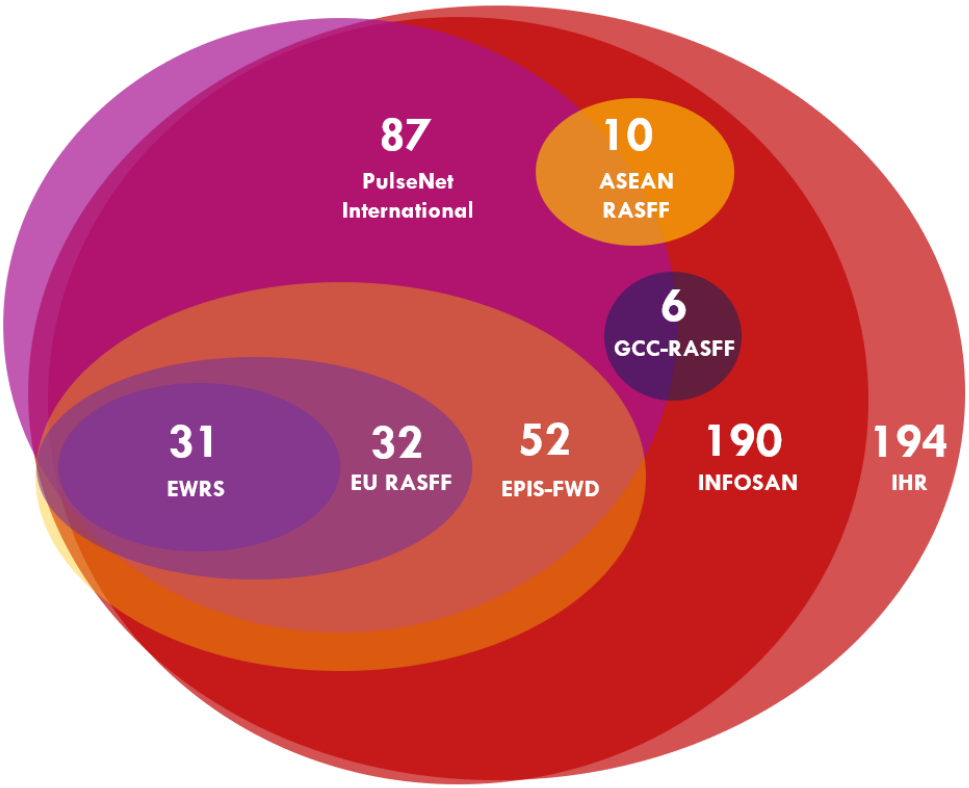
2.6.1 Communication tools to facilitate cross-border communication during international food safety events.

A total of eight different tools to facilitate cross-border communication during international food safety events had been used in the reviewed documents and are summarised in Table 5. All of these tools utilise web-based platforms to facilitate information exchange among designated participants from government authorities. Figure 7 depicts the tools currently used to facilitate cross-border communication during international food safety events and illustrates where overlaps between different networks exist from a national perspective. These overlaps do not take into consideration that different networks may include participants from the same country but different national agencies. For example, all 10 Member States from the Association of Southeast Asian Nations (ASEAN) have designated contact points as members of the International Food Safety Authorities Network (INFOSAN); however, some contact points for the ASEAN Rapid Alert System for Food and Feed (RASFF) are from national authorities that are not represented in INFOSAN.

Table 5. Communication tools to facilitate cross-border communication during international food safety events

Tool/System	Year Established	Who is using the tool?	Coordinating Authority	What is the purpose?	Key reference
European Union Rapid Alert System for Food and Feed (RASFF)	1979	EU Member State national food safety authorities, Commission, EFSA, ESA, Norway, Liechtenstein, Iceland and Switzerland	European Commission	Provide food and feed control authorities with an effective tool to exchange information about measures taken responding to serious risks detected in relation to food or feed	(European Commission, 2020b)
The International Molecular subtyping network for Foodborne Disease Surveillance (PulseNet International) Note: PulseNet International is a network of PulseNet national and regional networks	1996	National, regional and sub-regional laboratory networks of Africa, Asia Pacific, Canada, Europe, Latin America and the Caribbean, the Middle East, and the US in 86 countries	US Centers for Disease Control and Prevention (US CDC)	Implement standardised genotyping methods and share information in real-time within regional and national laboratory networks to support surveillance and outbreak response enabling the direct comparison of inter-laboratory data irrespective of geography	(Nadon et al., 2017)
Early Warning and Response System (EWRS)	1998	Public health authorities from 30 countries including 27 EU Member States and three countries of the European Economic Area (EEA), Iceland, Norway and Liechtenstein.	European Commission	A rapid alert system to communicate serious cross border threats to health according to the Decision 1082/2013/EC between EU/EEA Member States, the European Commission, other EU agencies and WHO; EWRS is the primary risk management tool for international or unexpected events in the EU/EEA	(Gossner et al., 2015)
FAO/WHO International Food Safety Authorities Network (INFOSAN)	2004	National authorities from 190 FAO/WHO Member States	FAO/WHO	Halt the international spread of contaminated food, prevent foodborne disease outbreaks, and strengthen food safety systems globally to reduce the burden of foodborne diseases	(Savelli et al., 2019)
Association of Southeast Asian Nations Rapid Alert System for Food and Feed (ASEAN RASFF)	2007	National regulatory authorities from 10 countries in south-east Asia including Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam	National Bureau of Agricultural Commodity and Food Standards (ACFS), Ministry of Agriculture and Cooperatives, Thailand	Promptly exchange information among competent authorities when food or feed safety events occur	(Lin, 2019)
International Health Regulations Network of National IHR Focal Points (IHR)	2007	National Health authorities from 194 WHO Member States	World Health Organization (WHO)	Prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade (considers all hazards, not only foodborne hazards)	(Nuttall et al., 2014)

Epidemic Intelligence Information System for food- and waterborne diseases and zoonoses (EPIS-FWD)	2010	Public health authorities from 51 countries including 27 EU Member States, three countries of the European Economic Area (EEA), Iceland, Norway and Liechtenstein plus 21 other non-EU countries	European Centre for Disease Prevention and Control (ECDC)	Detect multi-country food- and waterborne disease outbreaks and assessment of the public health risk.	(Gossner et al., 2015)
Gulf Cooperation Council Rapid Alert System for Food and Feed (GCC-RASFF)	2015	National Authorities from six GCC countries including Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain, and Oman	Secretariat General of the GCC; members of the GCC-RASFF use an electronic platform operated by the Saudi Food and Drug Authority, Kingdom of Saudi Arabia (SFDA)	Provide means for rapid exchange of information between GCC states on food alerts and food scares, flagging implicated food products to allow prompt regulatory actions.	(Faour-Klingbeil & Todd, 2020)



2.6.2 Contextual factors that trigger mechanisms to influence the outcomes observed in relation to the use of different communication tools

A country has interests in importing or exporting food commodities: Countries everywhere rely on internationally traded foods to meet consumer demands and feed growing populations (Allain, 2018). Net exporting countries have an economic interest in ensuring the food they produce is safe, and net importing countries have an interest in ensuring that food brought into the country is not contributing to their population's ill health. As such, a country's food import and export level may influence the degree to which national authorities see a need to utilise specific tools to communicate about unsafe food in an international context. Savelli *et al.* (2019) have reported a positive correlation between the value of both food product imports and exports and involvement in food safety events communicated through INFOSAN between 2011 and 2017, for example.

In the Middle East, the Gulf Cooperation Council (GCC) countries import approximately 33 million tons of foods annually, estimated as 90% of their food needs. This heavy reliance on imports has been described as one important factor driving the development and use of the GCC-RASFF by these countries (Faour-Klingbeil & Todd, 2020). The European Union (EU) is the largest global exporter of agri-food products, with a value of 151.2 billion Euros in 2019 (an increase of 10% from 2018). The EU also has a growing import agri-food product market, up 2.5% to 119.3 billion Euros in 2019 compared to 2018 (European Commission, 2020a). With so many agri-food products being traded, and because of the European single market, products easily move between countries within the EU, necessitating the use of a system such as RASFF to communicate on urgent international food safety issues (European Commission, 2020b). In other regions, countries that are net importers of food may use INFOSAN as a practical platform to support their efforts in ensuring a safe domestic food supply (Allain, 2018).

A country has the technical infrastructure to detect food safety events (including foodborne disease outbreaks or food contamination) and conduct investigations: The prevention, control and mitigation of food safety risks rely on systems to be in place (e.g. an integrated surveillance system for foodborne diseases or food contamination monitoring program) to detect signals rapidly that suggest a potential risk to health as well as communication of the appropriate information to risk managers (Marvin & Kleter, 2009). When such food safety risks are international, the currency exchanged between stakeholders includes data and information that stem from the epidemiologic, laboratory and traceability activities that are undertaken to assemble evidence during investigations. When one or more categories of evidence are deficient, then confidence in the appropriateness of subsequently applied risk management measures may be diminished. Furthermore, if the capacity to collect such evidence is limited or non-existent in one of these areas, then the ability to participate in international discussions related to such issues will also be similarly diminished.

Unfortunately, foodborne diseases are often chronically under-reported in many parts of the world and subsequently under-recognised and deprioritised in terms of allocating resources or strategies for their prevention, control and reporting (De Balogh et al., 2013). When foodborne disease outbreaks do arise, their successful management requires a well-structured food control system along with good communication, technical capacity, and access to information across all relevant sectors (Gossner et al., 2009). As articulated by Hodges and Kimball (2005), international communication networks can serve as invaluable tools for collaboration and support. However, their ultimate effectiveness is linked to individual nations' capacities for surveillance and diagnostics related to food safety and foodborne disease. Functional participation in international networks engaged in food safety information exchange is supported when national food control systems are strengthened (WHO, 2014).

A country is governed in accordance with regional and/or international laws and regulations relating to food control and global health security: Under the International

Health Regulations (IHR 2005), which came into force in 2007, all 194 Member States of the WHO have committed to a minimum set of national core capacities to protect public health and contribute to global health security (Nuttall et al., 2014). INFOSAN is recognised as a fundamental tool to help countries develop the core capacities required for food safety emergency preparedness and response under the IHR (Kirk et al., 2008). While participation in INFOSAN is voluntary (190 Member States participating), the IHR (2005) provide a legally binding framework for the coordination of events that may constitute a public health emergency of international concern and for improving the capacities of countries to manage public health risks, including those posed by unsafe food (Nuttall et al., 2014).

In 2016, in recognition of the growth and development of INFOSAN, the Codex Alimentarius Commission (CAC) revised the "Principles and Guidelines for the Exchange of Information in Food Safety Emergency Situations (CAC/GL 19-1995)" by making appropriate references to INFOSAN (FAO/WHO, 2018). This revision, endorsed by all CAC members (188 Member States), has further solidified the global mandate of INFOSAN and the critical and internationally recognised role that INFOSAN should play in the rapid exchange of information between countries during food safety emergencies. Other countries, in addition to being state parties to IHR, and members of INFOSAN and CAC, are also subject to regional legislation, as is the case of EU Member States. In the EU, food business operators (including importers) are legally required to ensure that traceability can be assured at all stages upon investigation. This requirement is outlined in EC Regulation 178/2002, which lays down the general principles and requirements of food law in the EU and outlines the legal basis of RASFF in Article 50 (Inns et al., 2017). In this way, national authorities from different countries in different regions are bound by separate agreements and legal frameworks that can mandate or encourage them to utilise different international communication tools.

2.6.3 Mechanisms that influence the outcomes observed in relation to the use of different communication tools

Trust in fellow network members to maintain confidentiality where required and to apply measures that are proportionate to risk: Ensuring trust among stakeholders is an important mechanism to facilitate international information exchange and collaboration between sectors and across borders to ensure global health security (Nuttall et al., 2014). In their 2007 review of multi-national foodborne outbreak response, Ammon and Tauxe determined that utilising tools to communicate on multi-national foodborne disease outbreaks can largely depend on the trust among foodborne disease experts in different countries and their willingness to share information (Ammon & Tauxe, 2007). More recently, during an international meeting of members of INFOSAN in 2019, trust among members was reported as an essential factor that supports information exchange between countries on matters of food safety. It was also noted that while creating a trustworthy collaborative environment takes time, it is critical to building a strong community of practice among members (FAO/WHO, 2020d).

Experience with different tools leading to institutionalisation of processes and procedures: Many of the articles included in this review that describe an international food safety event refer to the utility of RASFF, as a well-established system, in use since 1979 (longer than any of the other systems described in Table 5) (Gossner & Severi, 2014; Hachler et al., 2013). However, even with this long history, upon analysing notifications to the RASFF system from 1980 to 2017, Piglowski has noted that the activity of individual members of the RASFF can depend on members' experience with the system (Piglowski, 2019). When members have more experience with a particular communication tool and become more familiar with the requirements for engagement, then the processes and procedures can become institutionalised within their authorities, and the use of these tools becomes regular.

Following an international outbreak of *Salmonella* Enteritidis infections affecting three European countries in 2015, investigators reported that information exchange and access to

systems such as EPIS-FWD are essential for collaboration during international investigations. However, they explained that clear guidance should be provided on how, when and what data to upload to such a system, emphasising that a lack of experience with protocols and procedures can limit collaboration (Parn et al., 2017). In some cases, collaborating on an international investigation into a multi-country food safety event can provide experience to authorities in countries that are perhaps less used to doing so. With such experience comes the mindset that such collaboration is essential and needs to be maintained and reinforced (Rebolledo et al., 2014). Following an outbreak of Listeriosis in Switzerland in 2011 linked to imported cooked ham, investigators cited the critical role of RASFF to enable the rapid exchange of information between European countries. However, it was noted that even closer cross-border information sharing (e.g. sharing information on bacterial isolates) would have been helpful but observed that when such forms of international cooperation were not institutionalised, communication was dependent on the goodwill of participating authorities (Hachler et al., 2013).

Support from high-level government officials for participation in international communication activities (with clear roles and responsibilities agreed): Gaining support from high-level government officials for the participation in international communication activities, with clear roles and responsibilities agreed (including the agreement on the type of information to be shared), has been identified as a critical element required to improve international cooperation and collaboration using established systems such as INFOSAN (Nuttall et al., 2014). Food safety investigations rely on the willingness of multiple agencies involved within various countries to share information and collaborate (O'Brien et al., 2020) and without senior or management level support, technical staff may not feel empowered to share information. The investigation into a large and prolonged outbreak of hepatitis A virus (HAV) infections in several European countries in 2013 and 2014 demonstrated the importance of having strong management support and coordination capability at the national

level, noting that administrative hurdles and communication problems can lead to delays in notification of events (Scavia et al., 2017).

Following an international outbreak of *Salmonella* Enteritidis infections affecting three European countries in 2015, investigators emphasised the importance of having clear roles and responsibilities assigned and supported by senior officials during international outbreak investigations, especially because of the substantial coordination required (Parn et al., 2017). In the past, high-level political buy-in and prioritisation of food safety issues have often gained momentum in the face of large-scale food safety crises, for example, in China following the melamine event in 2008 (Gossner et al., 2009) and the United Kingdom following the announcement of the link between bovine spongiform encephalopathy (BSE) and the human form, variant Creutzfeldt-Jakob Disease (vCJD) in 1996 (Thomas & Newby, 2006). In both cases, the international implications and public concern triggered high-level government action and the development of new initiatives to improve food safety. However, national authorities need not wait for a national food safety crisis before seeking high-level support for prioritising food safety collaboration at an international level.

If not already in place, support from high-level government officials and political buy-in for participation in international communication activities is often obtained during the development or exercising of a national food safety emergency response plan (FAO/WHO, 2010). Such a plan should clearly outline the roles and responsibilities of different agencies in a food safety emergency response. High-level support from each of those agencies can help ensure efficient cross-sectoral collaboration and communication across borders if and when required (FAO/WHO, 2010).

Awareness of the needs and requirements to collaborate and communicate across borders to ensure food safety: Information sharing, including disease reporting, at an international level under the International Health Regulations (2005) requires a host of stakeholders from multiple sectors to be fully trained and aware of their roles and

responsibilities (Caceres et al., 2017). Awareness can come from sharing of expertise and experiences among stakeholders involved in international food safety events and was described as being an important and supportive factor during the international investigation into a large outbreak of HAV in Italy in 2013 and 2014 linked to imported frozen mixed berries (Scavia et al., 2017). Awareness is often improved due to the receipt of alerts that are disseminated through systems such as INFOSAN, RASFF, or EPIS-FWD, as was the case during an international outbreak of *Salmonella* Heidelberg infections associated with a meal during an international flight in 2011. Without awareness of the outbreak's multi-country dimensions, disparate authorities may have assumed that identified cases were sporadic and not part of a larger, multinational outbreak. In this case, without such awareness, officials in Tanzania (the origin of the flight) would not have been provided with multiple lines of evidence that helped facilitate their domestic investigation (Rebolledo et al., 2014).

In 2001, an outbreak of *Salmonella* Stanley infections occurred in Australia, Canada and the UK, resulting in 109 cases of illness linked to the consumption of internationally distributed peanuts from a fourth country in Asia (Kirk et al., 2004). Control of this outbreak relied on rapid communication of findings between investigators, including isolate characteristics as well as epidemiologic and traceback information. Investigators suggested that due to this outbreak investigation and international collaboration, they had a greater awareness of the benefits of sharing information through collaborative networks during subsequent investigations (Kirk et al., 2004). Multi-national food safety events emphasise the needs and requirements to collaborate and communicate across borders but also highlight the fact that food safety is sometimes a hidden and often overlooked problem except in the face of a crisis. Sustained efforts to raise awareness about the importance of food safety as a public health problem with a focus on prevention are required at all levels of society and government alike (Chan, 2014).

Understanding that open communication during international food safety events contributes to global public health: Following an investigation in 2007 of an outbreak of shigellosis in Denmark and Australia linked to imported baby corn from Thailand, investigators reflected on the crucial role of several networks to facilitate worldwide communication on various aspects of the investigation including EPIS-EWRS, RASFF, PulseNet International and INFOSAN. Investigators underscored the importance of involving international stakeholders and understood that open communication between countries worldwide could lead to timely responses, improved public health and prevention of similar outbreaks in the future (Lewis et al., 2009). In their discussion about food safety issues in the Maghreb Area, Chammem et al. (2018) explain that understanding the importance of open communication between the different actors across the food supply chain is paramount for the timely management of risks and control of hazards, especially during food safety emergencies when INFOSAN can be used for the effective sharing of information and promotion of collaboration at national and international levels.

Sense of community among fellow network members: In different parts of the world, various regional communication tools have been developed to link together national authorities from countries that share a common language (e.g. GCC-RASFF), geographic region (e.g. ASEAN RASFF) or other factors that contribute to a sense of community, such as a common legal system and similar levels of development, societal and cultural norms and industrial structure (e.g. EU RASFF). Reflecting on INFOSAN, a member of the network from Thailand described how participating in INFOSAN reduces the distance between each participating country and creates one united community for food safety that enables sharing information for action on food safety risk management promptly (FAO/WHO, 2014a). As explained by Savelli *et al.* (2019), INFOSAN members share common responsibilities and undertake activities with shared goals in mind, which creates a sense of community. Members of INFOSAN participate in network activities to exchange information across borders to

improve food safety and deepen their knowledge and expertise in the area by learning from one another and regularly interacting (Savelli et al., 2019).

Standardisation: During international foodborne disease outbreaks, there is an inherent reliance on data comparability to determine if disparate cases of illness are related. In this way, standardisation is essential concerning molecular methods for comparing foodborne bacterial strains, for example (O'Brien et al., 2020). During the investigation into cases of *Salmonella* Goldcoast in Italy and Hungary in 2009 and 2010, implementing the use of standardised protocols for *Salmonella* strain typing between human and veterinary laboratories was critical in order to generate hypotheses about a possible zoonotic connection of the outbreak cases in both countries to the pork production chain (Scavia et al., 2013).

During an outbreak investigation of *Salmonella* Enteritidis infections in several European countries in 2014 linked to eggs, investigators utilised RASFF to exchange information between countries and combined whole genome sequencing (WGS) data with information on food distribution networks to facilitate a more detailed exploration of possible sources of infections and inform risk management measures. Investigators emphasised the need for further work be undertaken to develop and standardise the methods used to compare phylogenetic and food supply network information, to enable the use of these techniques in future international outbreaks to help identify sources and guide the implementation of control measures to prevent further illness (Dallman et al., 2016). During the investigation, an important factor that enabled data to be readily exchanged and analysed between four institutions in different countries was the data's digital nature (Dallman et al., 2016).

When different typing methods are used between countries or sectors (e.g. WGS-based methods, multi-locus variable-number tandem repeat analysis (MLVA), pulsed-field gel electrophoresis analysis (PFGE), or no subtyping), it introduces challenges for investigators that hinder efficient communication related to the identity of isolates and limits the ability to link international cases together (Pijnacker et al., 2019). Two decades ago, the technology

may have been different, and there was a heavier reliance on PFGE rather than WGS, but the idea of using standard methods for PFGE and setting up compatible networks on a global scale was already being discussed, particularly as PulseNet USA had demonstrated its utility. Following an outbreak of *Salmonella* Typhimurium infections in several European countries in 2000 linked to shredded lettuce, investigators highlighted the importance of standardised protocols for molecular typing. They emphasised the need for compatible networks to exchange electronic, molecular data in real-time (Lindsay et al., 2002).

More recently, standardisation concerning protocols, validation studies, quality control programs, database development, and training materials has been highlighted as a critical element for PulseNet International in order to facilitate the sharing of data and information internationally and the implementation of WGS for global foodborne disease surveillance (Nadon et al., 2017). Additionally, the European Centre for Disease Prevention and Control (ECDC) has facilitated the standardisation of MLVA techniques for *Salmonella* Enteritidis and *Salmonella* Typhimurium, which are the most commonly reported *Salmonella* infections in EU/EEA (ECDC, 2016). The use of standard methods facilitated the detection of cross-border spread of *Salmonella* infections due to contaminated eggs from Poland, which was communicated about through RASFF, EPIS-FWD and PulseNet International (Pijnacker et al., 2019).

Intersectoral collaboration: Utilising data from epidemiological studies, laboratory investigations of food and clinical samples, as well as data and information from traceback or trace-forward activities, is an integral part of investigating food safety events and supports the use of international communication tools, as demonstrated in multiple outbreak reports (Gossner & Severi, 2014; Kinross et al., 2014; O'Brien et al., 2020; Scavia et al., 2017). For example, upon investigating three simultaneous outbreaks of HAV infections in Europe in 2013, Gossner and Severi (2014) emphasised the necessity for extensive international collaboration between countries and intersectoral collaboration between public health and

food sectors in order to identify possible vehicles of infection and implement timely control measures. Systems, including RASFF and EPIS-FWD, were utilised during these outbreaks to exchange information, distinguish cases into three distinct outbreaks and strengthen various hypotheses by pooling data and information from multiple countries. Similarly, following a multi-country outbreak of *Salmonella* Stanley infections in Europe linked to turkey meat, investigators described how intersectoral collaboration across public health, veterinary and food sectors enabled timely implementation of control measures and information sharing through EPIS-FWD and INFOSAN. Specifically, it was mentioned that involving multiple sectors in the investigation enabled the collection of robust evidence pointing towards the turkey production chain and confirmed the emergence of a new microbial clone within Europe (Kinross et al., 2014). Such intersectoral activities involve the integrated effort of multiple disciplines to attain optimal health for people, animals, and the environment, also known as One Health (Nuttall et al., 2014).

A primary challenge for effectively responding to outbreaks of foodborne zoonoses is ensuring collaboration and coordinated planning across sectors while harnessing the available technologies. Taking this kind of One Health approach calls for collaboration across disciplines, sectors, organisations, and national borders to support increasingly complex health challenges, including international food safety events (Errecaborde et al., 2019). However, processes involved in the planning and implementation of intersectoral actions are complex. Each country needs to develop or review its strategy for intersectoral action, which can support the use of international communication tools during food safety event response (Savelli et al., 2013).

2.6.4 Outcomes observed in relation to the use of different communication tools by competent authorities to relay information about international aspects of food safety events abroad

Efficient exchange of information among international stakeholders: Nearly twenty-five years ago, collaboration on international analytic studies during multi-country foodborne

disease outbreaks was in its infancy (Pebody et al., 1999), often occurring through informal networks (Nylen et al., 1999), but was nonetheless recognised as necessary for detecting related clusters of foodborne illness and identifying widely distributed contaminated foods (Lyytikäinen et al., 2000; Shane et al., 2002). In 1995, a then newly-established, international *Salmonella* surveillance network helped investigators solve an outbreak of *Salmonella* Agona infections in the UK, USA, and Israel (Killalea et al., 1996). During the response, investigators recognised the crucial role of international communication networks in facilitating efficient information exchange within Europe and beyond, which in this case led to the identification of the source of the outbreak and the swift implementation of risk management measures in multiple countries (Killalea et al., 1996; Shohat et al., 1996).

Similar outcomes were reported following an outbreak of *Salmonella* Anatum infections in France and the UK in 1997, during which rapid communication was facilitated by the same international *Salmonella* surveillance network (Threlfall et al., 1998). Since outbreak reports such as these first started to demonstrate the value of international collaboration, responses to international food safety events have continued to highlight the usefulness of establishing and maintaining information-sharing networks globally that enabled the rapid exchange of information between food regulatory agencies worldwide (Jansen et al., 2016; Le Guyader et al., 2006; O'Brien et al., 2020; Papapanagiotou, 2017; Pijnacker et al., 2019; Webby et al., 2007). For example, in 2002, an outbreak of norovirus infections in Italy and France was linked to oyster consumption, resulting in 327 cases between the two countries. Investigators credited the existence of an international foodborne virus laboratory network in Europe to facilitate information sharing rapidly and efficiently to track the international spread of the virus and lend assistance for the interpretation of results during the international investigation (Le Guyader et al., 2006).

Just over a year later, an outbreak of norovirus infections in Australia in 2003 and 2004 was linked to imported oyster meat from Japan (Webby et al., 2007). Investigators concluded that

information sharing across borders provides countries with the intelligence required to develop effective control strategies. They also noted that INFOSAN, a tool that had just launched at that time, would be helpful in disseminating such information on a global scale (Webby et al., 2007). More recently, it has been noted that utilising systems such as RASFF and INFOSAN creates a network of partnerships that enables the efficient exchange of information during international food safety events (Papapanagiotou, 2017). Jansen *et al.* (2016) have reported that because of the efficiency of RASFF, serious harm to consumers in Europe has been avoided, mitigating the negative health impact of food safety crises (Jansen et al., 2016). For example, during an international outbreak of *Salmonella* infections linked to eggs from Poland, the utilisation of RASFF, EPIS-FWD and PulseNet enabled the rapid exchange of information internationally between public health authorities (Pijnacker et al., 2019). During the investigation of a foodborne outbreak of *Shigella sonnei* infections in Ireland and Northern Ireland in 2016, cross-border information sharing using EPIS-FWD facilitated the efficient identification of the outbreak, the early generation of a hypothesis and the rapid implementation of control measures (O'Brien et al., 2020).

Timely detection, notification, investigation and response to food safety events (including the implementation of risk management measures): The utilisation of international networks including EWRS, PulseNet, RASFF and INFOSAN helped facilitate timely international communication to identify when a contaminated food enters international trade, enabling the implementation of risk management measures by competent authorities, to prevent foodborne disease (Lewis et al., 2009). For example, using EPIS-FWD allowed the early detection of the multinational nature of three distinct outbreaks of HAV infections in Europe in 2013 (Gossner & Severi, 2014). Referring to the same outbreak investigations, officials from Italy also noted the utility of EPIS-FWD and its crucial role to facilitate information exchange at a regional level to facilitate outbreak detection and investigation (Scavia et al., 2017).

Following a multi-country outbreak of *Salmonella* Bovismorbificans infections in Switzerland and Germany in 2014, investigators credited the cross-country collaboration for timely identification of the source as well as prevention of an expanded outbreak, thereby protecting public health (Knoblauch et al., 2015). Following an outbreak of *Salmonella* Typhimurium infections in Denmark, Norway and Sweden in 2008, investigators concluded that utilising international communication tools (in this case, EPIS-FWD), supported by robust and intersectoral collaboration and harmonised molecular typing tools, allowed for the practical identification and management of the outbreak in the neighbouring countries (Bruun et al., 2009). Utilising PulseNet, RASFF, EWRS, and INFOSAN allowed for information related to food surveillance, molecular microbiology and epidemiology to be gathered quickly and disseminated effectively during an international outbreak investigation in 2007 involving cases of *Salmonella* Senftenberg infections in several European countries as well as the USA linked to basil from Israel (Pezzoli et al., 2008).

During an outbreak of *Salmonella* Typhimurium DT104 infections in Denmark in 2005 linked to imported carpaccio from Italy, investigators utilised RASFF to communicate internationally about the details of contaminated batches of carpaccio, alerting other importing countries of the problem and implement timely risk management measures. In this case, investigators also emphasised how this outbreak illustrates the increasing importance of international cooperation during such events (Ethelberg et al., 2007). Widespread outbreaks caused by low-level contamination of foodborne pathogens can be challenging to identify. However, when information is readily exchanged using international tools such as PulseNet, EWRS and RASFF, such outbreaks are more quickly detected and investigated, as demonstrated during a widespread outbreak of *Salmonella* Thompson infections in Norway, Sweden and the United Kingdom linked to rocket lettuce from Italy (Nygard et al., 2008).

Robust understanding of international dimensions of a given food safety event and documentation of lessons learned: Utilising international communication tools to share

information during multi-national food safety events enabled detailed documentation by international agencies to fully understand the scope of a given food safety event. Detailed documentation can help with the recording of lessons learned and the sharing of best practices to a broad audience to prevent similar events in the future or make handling an acute event more efficient. For example, a prolonged international outbreak of *Salmonella* Enteritidis infections affected 18 European countries between 2015 and 2018 and was eventually linked to eggs from Poland (Pijnacker et al., 2019). The successful identification of the source of this outbreak and the association of cases from multiple countries to the same source was only made possible through cross-border sharing of data and information in real-time through various systems EPIS-FWD, RASFF, and PulseNet. Without international information exchange facilitated through these platforms, the outbreak's full scope would not have been known. (Pijnacker et al., 2019).

Upon review of foodborne outbreaks in the USA from 2010-2014, many of which were linked to imported foods, Crowe *et al.* (Crowe et al., 2015), have stressed the importance of collaboration between government and industry, specifically the utility of sharing lessons learned as a way to improve food safety practices and regulations and prevent future outbreaks. In 2011, a group of travellers returning to Ireland from Tanzania became ill with *Salmonella* Heidelberg infections. The authorities, investigating the Irish cases alone, could not definitively pinpoint the location of the outbreak or the source. Only through international collaboration and by including information on cases from other countries in their study were authorities able to pinpoint an in-flight meal and identify two items in particular as the likely source of infections. During the investigation, information was exchanged internationally using EPIS-FWD, EWRS and PulseNet and investigators emphasised the benefits of real-time international collaboration and the utility of these communication networks. Utilising such tools enabled the sharing of standard questionnaires, results from molecular profiling, hypotheses and other information that made the investigation more efficient and effective (Rebolledo et al., 2014).

In another example, a multi-country outbreak of *Salmonella* Stanley infections in Europe occurred over several years from 2011 to 2013, highlighting the challenges in detecting and investigating food safety events involving a contamination event early in the animal production chain resulting in multiple vehicles of infection across multiple countries. However, by sharing data, information, investigation tools (e.g. standardised questionnaire) through systems including EPIS-FWD and INFOSAN, investigators were able to identify the source as turkey meat, most likely contaminated early in the production chain (Kinross et al., 2014).

In 2008, the actions of nearly 70 countries were communicated through INFOSAN during the international response to the global distribution of milk and milk-containing products that had been deliberately contaminated with melamine in China. The rapid worldwide distribution of affected products affirmed the need for a system such as INFOSAN to coordinate communication and link together food safety authorities to promote the rapid exchange of information. The international response to this event exemplified how sharing best practices can save lives and control an outbreak. Utilising INFOSAN during this event allowed food safety authorities around the world to have access to the latest available scientific knowledge as new information became available (Gossner et al., 2009).

Reduction of food safety risks: International collaboration can reduce food safety risks in the short term by identifying unsafe products to be recalled from the market, as mentioned in previous examples already discussed. However, it can also result in longer-term changes to policies and practices that reduce food safety risks. For example, in 2009 and 2010, a large outbreak of hepatitis A virus infections was reported in Australia and linked to the consumption of imported semi-dried tomatoes. Notification of the outbreak in Australia through INFOSAN enabled identifying related hepatitis A clusters in the Netherlands and France, also linked to imported semi-dried tomatoes (Donnan et al., 2012). International cooperation through INFOSAN supported national investigations during this multi-country

outbreak (Donnan et al., 2012) and demonstrated the critical interface with European networks, including RASFF and EWRS through which information was also shared. This outbreak represents the first documented outbreak of HAV infections linked to semi-dried tomatoes and demonstrates the value of utilising networks such as INFOSAN to share surveillance data and alerts between sectors and countries (FAO/WHO, 2011). As a result of the global, coordinated action between countries, international attention was drawn to these events, which prompted industry forums to improve manufacturers' knowledge of the risks associated with products such as semi-dried tomatoes and related mitigation strategies to reduce such risks in the long-term and prevent future outbreaks (Donnan et al., 2012).

Prevention of foodborne disease around the world: Following the investigation into international food safety events, multiple reports have concluded that utilising different tools to facilitate cross-border communication has prevented foodborne illnesses and protected public health (Friesema et al., 2008; Knoblauch et al., 2015; Paine et al., 2014; Raguenaud et al., 2012). For example, in 2007, 50 cases of *E. coli* O157 H7 infections were reported in the Netherlands and Iceland and linked to the consumption of shredded, pre-packed lettuce from the Netherlands. The outbreak was first reported to other European countries by Iceland through ECDC's EPIS-FWD network, and the Netherlands responded with a report of a similar outbreak. Investigators concluded that by combining efforts, compiling and analysing data from both countries increased their ability to detect the source at an early stage and strengthened their epidemiologic evidence. Investigators also emphasised that cross-border collaboration, in this case, enabled earlier implementation of risk management measures and led to a decrease in both morbidity and mortality (Friesema et al., 2008).

In another example from 2010, investigators in France determined that a large outbreak of *Salmonella* Typhimurium 4,5,12:i:- infections affecting more than 500 people was caused by consuming beef imported from another European country. Utilising RASFF, authorities in France were able to exchange information about this event between authorities in the country

of origin who were able to quickly identify and withdraw the implicated beef, thus preventing further infections in other countries in receipt of the incriminated batch of beef (Raguenaud et al., 2012). Upon analysing notifications to the RASFF system from 1980 to 2017, Piglowski has concluded that RASFF significantly contributes to ensuring public health by preventing illnesses caused by microorganisms in food, especially on the European market (Piglowski, 2019).

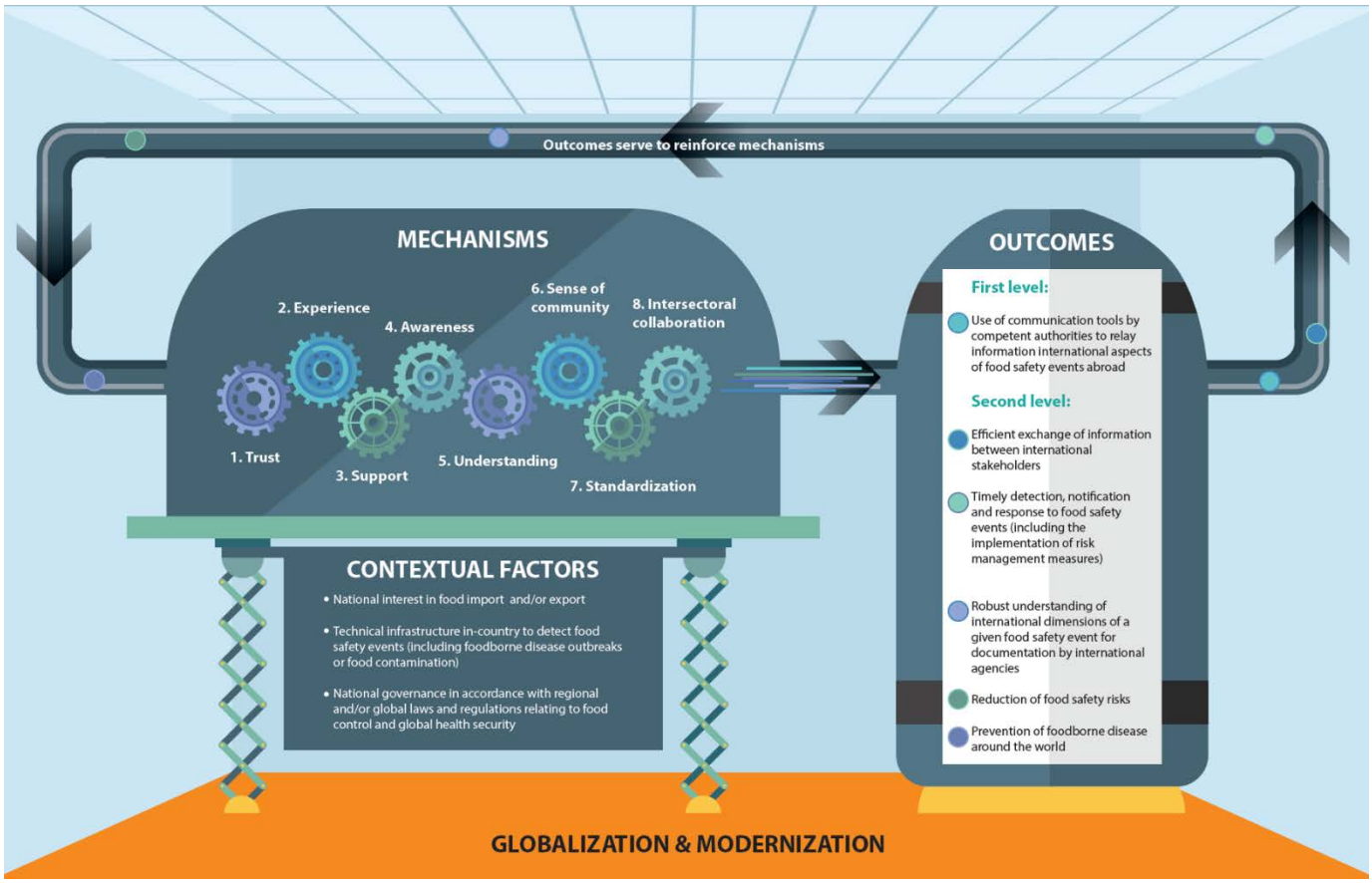
In late 2012, an outbreak of salmonellosis linked to the consumption of tahini from Turkey was investigated in New Zealand. A few months later, cases of *Salmonella* infections were identified in the USA with strains indistinguishable from the New Zealand cases, confirmed through information exchange using PulseNet (Paine et al., 2014). A global alert was subsequently shared through INFOSAN, and authorities in Turkey were able to determine that the implicated tahini products were also distributed to 13 additional countries. Information shared through INFOSAN enabled competent authorities in recipient countries to recall products, prevent further outbreaks, and protect public health. Without INFOSAN, the international scope of this event would not have been realised, and information required by national authorities to take risk management actions to protect public health would not have been disseminated (FAO/WHO, 2014a). Following this investigation, a former INFOSAN member from New Zealand described INFOSAN as a valuable platform that operates efficiently and reliably to enable flexible communication arrangements that can be tailored to the needs of members to address food safety risks (FAO/WHO, 2014a).

2.6.5 Realist programme theory

The programme theory developed indicates that when a country has interests in importing or exporting food, has the technical infrastructure to detect food safety events, and is governed in accordance with regional and/or global laws and regulations relating to food control and global health security, then certain mechanisms lead to specific outcomes. These mechanisms, including trust, experience, support, awareness, understanding, a sense of community,

standardisation and intersectoral collaboration, facilitate the first-level outcome of using communication tools to relay information abroad and a potential range of second-level outcomes, including the prevention of foodborne diseases, among others as described in Figure 8.

The programme theory developed includes a feedback loop whereby the act of using a communication tool can itself serve to reinforce each mechanism. For example, awareness of the tools facilitates their use, but using the tools also raises awareness about them. Likewise, trust among stakeholders can facilitate the use of communication tools, but using the tools can also build trust over time. A similar pattern for other mechanisms can be seen. The refined programme theory is underpinned by modernisation theory (Giddens, 1990, 1991) and globalisation theory (Robinson, 2011), reminding us that efforts to modernise society occur at vastly different paces in different places and globalisation is not a linear process. Engaging with these theories provides us with an understanding that while the world is becoming ever more interconnected and interdependent, specific structures built to support development cannot be imposed in precisely the same way and at the same time in different countries since the country-specific context will influence the outcomes.



1. **Trust** in fellow network members to maintain confidentiality where required and to apply measures proportionate to risk.

2. **Experience** with different tools and familiarity with processes and procedures.

3. **Support** from high-level government officials for participation in international communication activities (with clear roles and responsibilities agreed).

4. **Awareness** of the needs and requirements to collaborate and communicate across borders.

5. **Understanding** that open communication during an international food safety events contributes to global public health.

6. **Sense of community** among fellow network members or users of tools/systems.

7. **Standardization** of methods, protocols and procedures for collecting and sharing data and information.

8. **Intersectoral collaboration** to integrate epidemiological data, data from food and human laboratory investigations and data from trace-back activities.

Figure 8. Realist programme theory to explain how different tools facilitate cross-border communication during international food safety events

2.7 Discussion

This review's findings have illuminated a variety of communication tools that are currently in use around the world by various stakeholders to exchange information during international food safety events. However, there is an evident absence of published event reports which describe the use of some of the tools included in Table 5, namely the GCC RASFF and ASEAN RASFF. The absence of articles may be partially explained by the limit of this review to English publications and the fact that these three tools are relatively new. However, the possibility remains that these networks have not matured to the point at which their utilisation has resulted in many successful collaborations during international food safety events.

To understand regional network proliferation and potential underutilisation better, considering the context is essential. The EU RASFF system and other European tools work so well, in part, because there is a shared legal system and similar levels of development, societal and cultural norms and industrial structure, which is not the case for ASEAN countries, for example (Lin, 2019). Interestingly, a study of the challenges for international data sharing among countries in the Greater Mekong subregion (Cambodia, Lao People's Democratic Republic, Myanmar, and Vietnam) found that differences in language, culture, surveillance systems and political engagement have all been reported as potential challenges to harmonising surveillance data between countries. Such differences can lead to variations in the quality of data reported, difficulty in data integration and comparison and interpretation (Lawpoolsri et al., 2018).

A plan of action to improve ASEAN RASFF was adopted at the ASEAN ministerial meeting on agriculture and forestry in 2018, which runs through 2023 (Schlundt et al., 2020). Such efforts to improve this and other regional networks and tools would benefit from also considering the programme theory developed in this review and addressing issues related to the national context and the status of the various mechanisms identified to facilitate their use.

As various regional networks and tools develop and are operationalised, it will be of paramount importance to link these tools to global systems to avoid parallel communication tracks or duplication of efforts by national authorities with limited resources. This can be avoided by ensuring common contact points between regional and global networks and formalising relationships through memorandums of understanding to ensure functional interfaces are in place. For example, the formal working instructions of the European RASFF dictate when and how the INFOSAN Secretariat at WHO is informed of issues involving countries outside the EU (European Commission, 2017). This arrangement enables the INFOSAN Secretariat to follow up accordingly. Additionally, all RASFF members are also INFOSAN members. The functional interface between the two networks should be encouraged and replicated with other regional systems and tools in place or under development in other parts of the world to avoid resources from being allocated to disparate and disjointed tools that could hinder international food safety event coordination.

Following multiple international outbreak investigations in Europe, investigators have emphasised that strong collaboration with existing international networks should be ensured (Gossner & Severi, 2014). The need for such functional links between INFOSAN and regional networks and systems, including with ASEAN RASFF and GCC-RASFF were discussed at the second global meeting of INFOSAN members in 2019, and there was a clear recognition of the need to coordinate between systems and the critical role that INFOSAN can play in this regard (FAO/WHO, 2020d).

Finally, it should be noted that the utility of any of these tools is dependent on the quality of the data and information supplied to them, and the speed at which users do this. In this regard, future systems and tools may benefit from introducing automation and validation to improve data quality and increasing the timeliness of the information exchanged to help identify potential international food safety events before they grow into large-scale crises.

2.7.1 Strengths, limitations and future directions

Increasingly, the globalisation of our food supply necessitates international communication and coordination among food safety and public health professionals to prevent, detect, and respond to foodborne disease outbreaks and instances of food contamination that affect more than one country. This review contributes to understanding how the various tools used to facilitate communication are working and in what contexts. The knowledge gained from this review has provided valuable insight into how different tools facilitate cross-border communication during international food safety events, why they are used, by whom, and for what purpose.

One limitation of this review is that it was only conducted in English and may have introduced an element of language bias. Additionally, the formulation of the context-mechanism-outcome programme theory relies heavily on published literature and may be subject to publication bias. Review findings are, therefore, context-specific and must be considered within the context of this research. While conducting this review and assessing the quality of research, it became clear that most published evidence in the area is anecdotal, with subjective accounts from investigators involved in using various communication tools being the source of most of the evidence for utility. Also, much of the literature included in this review is Eurocentric, even when the origin or distribution of implicated products in a given event was beyond European borders.

In the future, more effort to include the perspective of all countries involved in international food safety events, including those from which contaminated food originated, should be made when writing and publishing event reports. Including these perspectives would contribute to a gap in the literature and amplify the voices of those currently underrepresented but who would undoubtedly have valuable lessons to share with the global food safety community.

Globally, there is a need to establish or strengthen functional links with current and future regional networks and tools to ensure complementarity between global and regional systems

to prevent duplication or the creation of parallel communication tracks to the detriment of timely and coordinated global response efforts. Despite the gaps in the literature, this review draws strength from the engagement with an expert reference committee, whose members hail from a multitude of geographically diverse countries who provided oversight, guidance and rigour to the review process.

2.7.2 Comparison with existing literature

Although broader in scope, a review of early identification systems for emerging foodborne hazards in 2009 concluded that little information had been published on the performance of operational food safety early warning or emerging risk systems (Marvin et al., 2009). Having searched for similar information, the same deficiency has been observed in the literature more than ten years later, with few empirical studies reporting on the impact of such systems. This deficiency may be partially explained by the difficulty in quantifying the impact of preventing severe food safety events without knowing what would happen if those systems or tools were not used.

2.7.3 Conclusion and recommendations

Responding to international food safety events is complex for several reasons, including the globalised nature of our food supply, the involvement of numerous international and national stakeholders, and the dependence on functioning national integrated surveillance systems and national food control systems broadly. In this realist synthesis, a programme theory has been presented to explain how tools are utilised to facilitate cross-border communication during international food safety events, which has important implications for global efforts to mitigate the significant burden of foodborne illness resulting from internationally distributed food. Overall, the results have shown that the various tools examined facilitate cross-border communication during food safety events by making functional connections between national regulatory authorities in different countries, supported by several specific mechanisms. The various tools are used because they facilitate, streamline or expedite national response efforts

during food safety events, ensuring timely information exchange by those using them. The literature indicates that while nearly all countries around the world are members to one or more of the networks/systems/tools discussed, the European tools are very well used, while others in Asia and the Middle East are still maturing. The ultimate goal of all of the tools identified is to reduce foodborne risks and prevent foodborne diseases.

The programme theory will be useful to policymakers and those coordinating the operation of communication tools currently in use, who may adapt components of the tools according to different contextual factors to promote, support and improve their use. In addition, the programme theory would be useful to inform future studies of other networks and tools that have yet to be undertaken. All relevant national food safety authorities should be encouraged to make active use of the various international tools available to them to openly exchange information and strengthen the global community of food safety practitioners. In doing so, national authorities will contribute to the strengthening of core capacities for food safety required under the IHR (2005), thereby improving global health security. The global burden of foodborne disease can be mitigated by improving international coordination and communication during international food safety events.

As it pertains to the overall exploration into the experiences of members of INFOSAN, an important result from this review has been the support lent to the underlying assumption of this PhD study that exploring member experiences, with a view to increase participation in the network, is a worthy endeavour given the range of potential positive outcomes that can result from utilising cross-border communication tools during food safety events.

Chapter three – Study methodology[3]

3.1 Knowledge Transfer and Exchange in Communities of Practice

As explained in Chapter One, it is the shared domain, community, and practice that allows for INFOSAN to be understood as a community of practice that aims to facilitate communication and KTE on food safety matters. A growing body of research suggests that KTE can be effectively fostered within CoPs, leading to the uptake and application of best practices by individuals and teams in various sectors, including health, business and beyond (Ho et al., 2010). In addition, multiple systematic reviews (Barbour et al., 2018; Kothari et al., 2011; Mairs et al., 2013; Quinn et al., 2014) suggest that fostering a virtual or electronic CoP among professionals in public health helps encourage KTE, which translates into the adoption of evidence-based best practices and, by extension, improved public health. Rajić et al. (2013) have described the benefits of facilitating KTE among food safety professionals working at the intersection of agriculture and health.

Together, the literature suggests that a CoP such as INFOSAN, connecting food safety and public health professionals from around the world, is an appropriate tool to facilitate KTE in this area. However, while INFOSAN has been operating for more than 15 years to facilitate the aforementioned activities among its members, it has never been fully characterised or examined as a functional CoP, and its value, as understood from the perspective of its members, has never been determined in a systematic or rigorous way. Furthermore, a paucity of research has been conducted to investigate the attributes and effectiveness of specific tools or CoPs such as INFOSAN to facilitate cross-border communication during international food safety events.

[3] Chapter three is primarily based on a constituent paper of this research that was published in BMJ Open; the first page of this publication is included in Appendix one – publications:

- Savelli CJ & Mateus C. (2019). A mixed-method exploration into the experience of members of the FAO/WHO International Food Safety Authorities Network (INFOSAN): study protocol. BMJ Open, 9(5), e027091. https://doi.org/10.1136/bmjopen-2018-027091

As evidenced in Chapter Two, most of the publications mentioning such tools focus on summarising a particular incident response rather than explicitly examining the tools that were used. However, such reports of international food safety events commonly conclude with recommendations to use existing international networks and communication tools to improve and expedite information exchange better (Einoder-Moreno et al., 2016; Guzman-Herrador et al., 2013; Inns et al., 2017; Knoblauch et al., 2015; Nygard et al., 2008; Pezzoli et al., 2008; Rebolledo et al., 2014). In addition, several published studies have specified the important role that INFOSAN has played in facilitating rapid international communication between government officials that has led to the timely implementation of risk management measures during a food safety emergency (Acciari et al., 2016; Gossner et al., 2009; Khardori, 2012). This PhD study is the first ever to position INFOSAN members and their experiences at the centre of the inquiry. This is significant because of the broad policy implications that could result from better understanding INFOSAN in order to facilitate prevention, detection and response to international food safety emergencies.

3.2 Theoretical perspectives underpinning this PhD study

As the title of this thesis suggests, this PhD study is about exploring INFOSAN members' experiences. It has the overall aim of assessing the functioning of INFOSAN as a CoP by obtaining systematic insights into the characteristics, performance and opinions of members. This research has relied on Wenger's concept of a 'community of practice' (Wenger, 1999) as a social learning theory to provide a lens through which to focus its inquiry. This theoretical perspective positions learning as a social process leading to the acquisition of knowledge which includes four important assumptions for this research. First, individuals are social beings, and this is considered a central aspect of learning. Second, knowledge is a matter of competence with respect to valued enterprises, such as knowing how to respond to a food safety emergency. Third, knowing is a matter of participating in the pursuit of such enterprises, that is, of actively engaging in response to food safety emergencies, for example. Fourth, the production of meaningful experiences is an ultimate outcome of learning. To this

end, a significant focus of this PhD study is on establishing a robust understanding based on value creation among INFOSAN members (if such value exists).

Value creation is an evaluation concept discussed by Wenger et al. (2011), which emphasises the importance of utilising quantitative indicators and value creation stories as two complementary types of data that, when combined, can establish a robust understanding of value creation within communities and networks. Indicators are relatively easy to obtain by looking at things such as the number of times members log in to an online portal over time, the number of times a particular document is downloaded or the number of responses to a particular discussion thread. However, Wenger et al. (2011) suggest that indicators alone depend too much on assumptions as a direct measure of value creation and thus only provide a point of reference to search for value creation stories in order for members to provide a more robust picture. Conversely, only looking at value creation stories misses out on opportunities to cross-reference the information with existing indicators to see if and how actions and perceptions correspond. Looking at both sets of information and analysing discrepancies between them becomes possible by describing grounded narratives versus aspirational narratives where grounded narratives are representative of those value creation stories supported by indicator-based data and where aspirational narratives are not. This approach allowed me to examine reality from the INFOSAN members' perspectives and the INFOSAN Secretariat’s.

Stepping back from the focus on experiences within a community of practice, this research is also framed by an understanding of the development theories already described in Chapter Two, namely the third wave of modernisation theory developed in the 1990s (Giddens, 1990, 1991) and globalisation theory as articulated by Robinson (2011). Both theories provide a broader lens through which to understand where INFOSAN as a community of practice sits in the world as it becomes ever more interconnected and interdependent. Specifically, these theories suggest that certain structures built to support development cannot be imposed in

precisely the same way at the same time in different countries because the country-specific context will influence the outcomes. Modernisation theory helps explain the development of systems and tools within societies. This is particularly relevant in the context of ensuring food safety as there are international food safety standards and guidelines (including guidelines for communication during international food safety events) that must be adopted in national settings to improve food safety systems and facilitate food trade. Globalisation theory helps explain that with the introduction of international food safety standards and guidelines, national governments cannot operate in isolation if they wish to engage in food trade.

Underpinning these theoretical lenses is the philosophical perspective of critical realism. Although many descriptions, interpretations and definitions exist, critical realism as described by Maxwell (2012) resonates most with my ontological and epistemological orientation. Maxwell (2012) explains that critical realism denies the possibility of objective or certain knowledge of the world, and accepts alternative accounts of any phenomena as valid depending on one's perspective. This is explained through the notion that theories about the way the world are seen and understood are rooted in one's particular perspective and therefore all knowledge is partial, incomplete and fallible.

While positivists may claim there is a reality that is knowable and exists outside an individual's construction, realists may assume that the world and everything in it exist in reality but there can be more than one correct way to understand reality in terms of conceptual schemes made up of different objects, properties and relations. In short, critical realism can be understood as a philosophical perspective that accepts the existence of stable and enduring features of reality independently of one's ability to perceive them and, therefore, is best measured as a sum of different perspectives using different methods (Maxwell, 2012). This concept represents critical realism's ontological perspective (where ontology should be understood as the philosophical study of being). Furthermore, critical realism asserts that social phenomena and their meanings are continually being created by social actors (i.e. the

philosophical concept of constructivism) and may differ depending on one's perspective (i.e. the philosophical concept of relativism). Constructivism and relativism can therefore represent critical realism's epistemic orientation (where epistemology is the philosophical study of knowledge and how one knows)(Maxwell, 2012) and have underpinned the design of this PhD study, drawing from multiple perspectives and using different data types and methods of collection.

As already described, the importance of using quantitative indicators, together with qualitative narratives from different perspectives in a community, is a concept described by Wenger et al. (2011) to understand what kind of experiences create value within CoPs. It is this acknowledgement of multiple perspectives of reality that demonstrates congruence with critical realism. With an understanding of INFOSAN as a functional CoP, and with an appreciation for the critical realist perspective that underpins its examination, it was prudent to take a mixed-method approach in order to strengthen the credibility of the findings and to provide a more complete view and deeper understanding of the experiences of members.

Furthermore, Tashakkori and Teddlie (2010) suggest that critical realism provides a perspective that validates and supports critical aspects of qualitative and quantitative approaches and represents a valuable stance for integration and a mixed-method approach. Additional confidence in this approach was obtained from the discussion about critical realism in the Encyclopaedia of Communities of Practice in Information and Knowledge Management (Coakes & Clarke, 2006), in which it is explained that communities of practice theory implicitly incorporates a critical realism perspective, precisely for the reasons previously discussed. The community exists because of members' actions, which can be observed and quantified, but the value associated with those actions can only be understood through each participant's value creation stories. This idea is further elaborated in the discussion about evaluating communities of practice from Ranmuthugala et al. (2011). In their article, the authors explain that applying a critical realist approach to evaluation is well

suited for examining scenarios where the outcomes are determined through stakeholder action and interaction, which is in turn likely to be influenced by social and cultural norms. They suggest that the realist evaluation goes beyond focussing on inputs and outputs and instead explores and identifies the actual mechanisms through which inputs create value and become outputs, and recognise the need to understand the supportive structures or domain that must be in place for this to happen.

The use of a mixed-method approach to investigate online community members' experiences is also strongly supported by a growing body of literature (De Laat & Lally, 2003; Guldberg & Mackness, 2009; Roberts, 2015). Figure 9 presents the theoretical perspectives underpinning this PhD study. Figure 10 presents a schematic overview of the mixed-method approach taken.

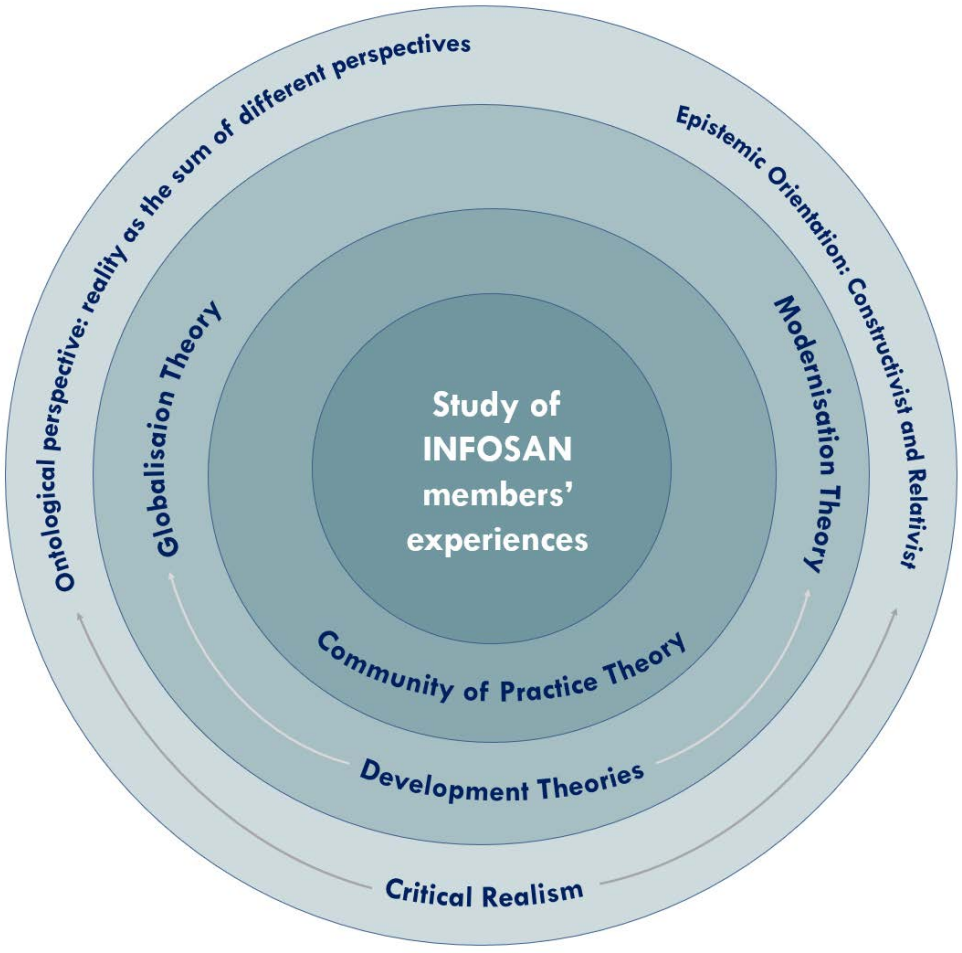


Figure 9. Theoretical perspectives underpinning this PhD study

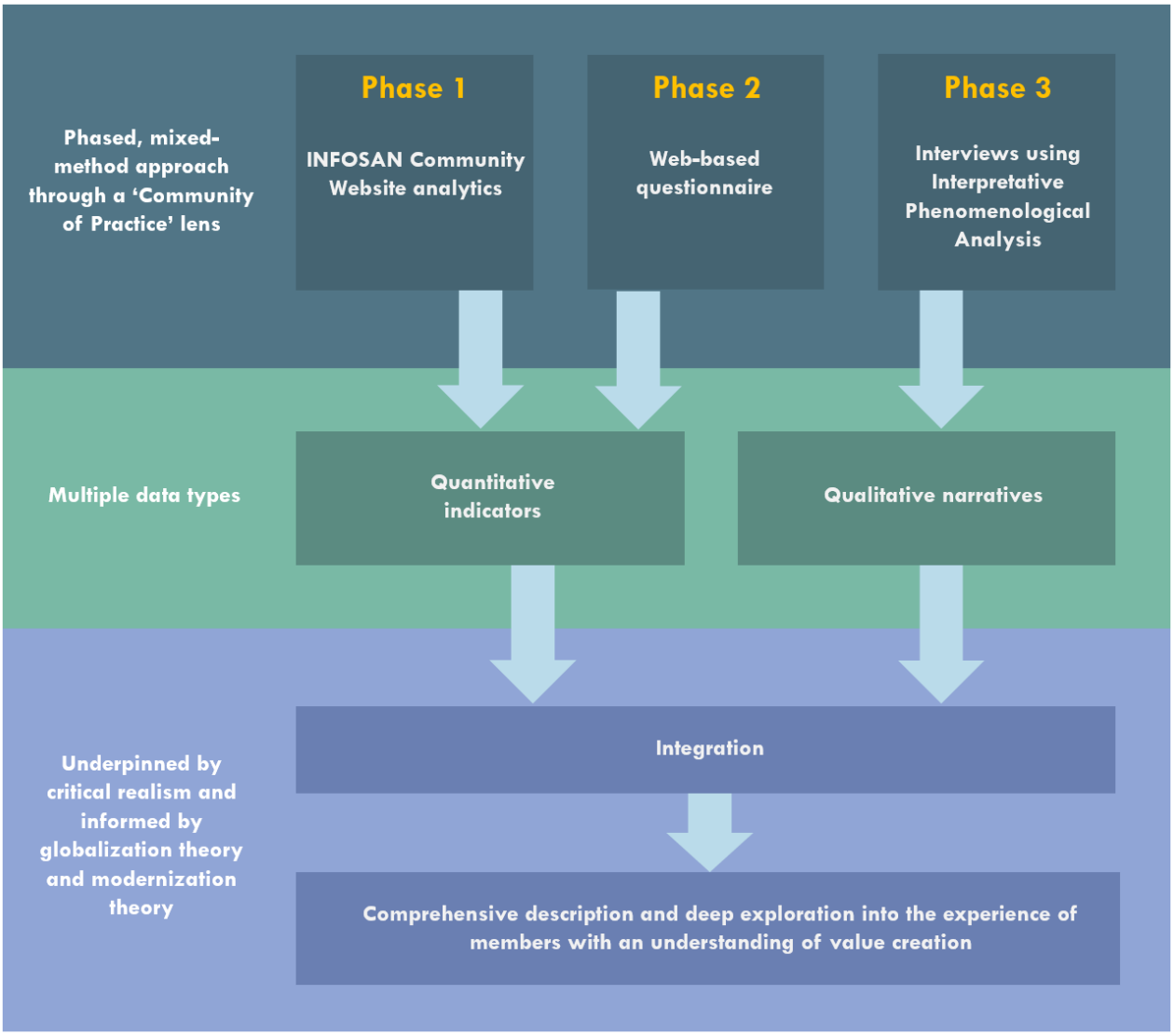


Figure 10. Schematic overview of the mixed-method approach taken to conduct this PhD study

3.3 Setting

The study was conducted from within the Department of Food Safety and Zoonoses; renamed the Department of Nutrition and Food Safety in January 2020) at the headquarters of the WHO in Geneva, Switzerland (where the INFOSAN Secretariat is based); however, the actual setting is global since INFOSAN membership spans 190 countries.

3.4 General comments on sampling

For each phase of the research, participants included registered INFOSAN members only. These individuals have been officially designated by their national government and are all registered on the ICW. INFOSAN membership includes both men and women in approximately equal proportions.

3.5 General comments on recruitment

To announce the launch of the study, all members of INFOSAN received introductory information by email about the proposed research, including an invitation to attend an online seminar (i.e., webinar), delivered by me, to find out more information about the overall study and ask any questions or seek clarification.

3.6 General comments on the analysis

An important aspect of the overall analysis is the integration of the information collected from each phase, including quantitative indicators and qualitative value stories. Anonymised information and quotations from participant interviews have been reported, representing the limits to confidentiality. The combined strengths of quantitative and qualitative methods have contributed to improved study validity, credibility and overall integrity and have provided a broad and deep understanding of members' experiences. (Allsop & Saks, 2007; Bryman, 2016; Creswell & Creswell, 2017).

3.7 Phase one (website analysis) – recruitment and consent

In January 2019, all national INFOSAN members who were registered on the ICW (N = 525) received an informational e-mail explaining the three different phases of the study of INFOSAN and reminding INFOSAN members that data analysed in phase one of the study would be extracted from the ICW in accordance with the terms and conditions of use that each member consented to when he or she registered online. The informational e-mail and a

subsequent online seminar ensured that INFOSAN members understood that anyone not agreeing to have their website access and use data used for this study had two weeks to make this indication by e-mail to me. After this time, opting out was no longer possible due to the data's aggregation and anonymisation. Only one member expressed a desire to be excluded. With 524 INFOSAN members included, nearly the entire network was recruited for phase one of the study.

3.8 Phase one (website analysis) – data collection and analysis

Access to the ICW was granted to me as a staff member at WHO, and approval for use in this research was granted by the director of the Department of Food Safety and Zoonoses, WHO (renamed the Department of Nutrition and Food Safety in January 2020). ICW data concerning INFOSAN members and their contributions were collected retrospectively between February 2012 (when the website was launched) and December 2018. Information from all recruited members concerning the following variables was downloaded in January 2019 from the website, anonymised, and exported into Microsoft Excel for analysis: type of member (i.e., Emergency Contact Point or Focal Point), sex, languages spoken, country (aggregated to regional level), government sector, primary function (i.e., risk assessment, risk communication, or risk management), and areas of scientific expertise. These data have all been automatically collected and stored in the internal ICW database at the time of each member's registration.

Additional data about the length of membership, last access to the website, and discussion thread initiations, responses, and views were also exported for analysis. Once collected, all anonymised data were analysed using descriptive summary statistics, allowing for stratification by variables including type of member and geographical region and evaluation of member activity level. For this study, active membership is conceptualised as regularly logging on to the ICW and sharing content in the discussion forum. Information regarding

international food safety events was also extracted for analysis, including details on hazards and food categories.

3.9 Phase two (administration of online survey) – recruitment and consent

In August 2019, all members of INFOSAN received an informational email which provided indicative results from phase one of this study and an invitation to attend an online seminar (i.e. webinar), delivered by me, to learn more about the results from phase one and to provide further details about phase two. Following the webinar, all INFOSAN members received another informational email which included an invitation to participate in phase two of the study and a link to the online questionnaire. Only those who expressed consent were recruited as participants for phase two. By clicking on the questionnaire link embedded in the informational email, the participants confirmed having read the introductory information and understood what would be expected of them as participants in phase two of the study (see Appendix six for consent forms and recruitment emails).

3.10 Phase two (administration of online survey) – data collection (including questionnaire development and adaptation from English into Spanish and French) and analysis

The questionnaire consisted of questions from the Community Assessment Toolkit (CAT) (Verburg & Andriessen, 2006) and an additional set of questions tailored specifically to INFOSAN members. The CAT was developed to support research efforts aiming to obtain systematic insights into the characteristics and performance of CoPs and opinions of CoP-members. Using the CAT in this study enables future comparative research between communities of practice that have been assessed with the same tool. However, given the unique nature of INFOSAN and the specific objectives of this study, it was also necessary to develop a set of supplemental questions to examine the experiences of INFOSAN members that are unique to this particular community of practice.

A preliminary set of supplemental questions was therefore inserted into the appropriate sections of the CAT questionnaire. These supplemental questions were reviewed for content validity by a panel of six experts consisting of the INFOSAN Secretariat and INFOSAN Advisory Group members since they are familiar with the constructs that the supplemental questions are designed to measure. The expert panel judged whether the supplemental questions appropriately related to the construct they intended to assess and whether these supplemental questions were indeed sufficient to measure the domain of interest. A Content Validity Index (CVI) was computed for each supplementary item. The CVI is an index of inter-rater agreement that constitutes one method of providing evidence of content validity for instruments which is based on experts' ratings of items relevance. This method was chosen because of its relative ease of computation, understandability, and focus on agreement of relevance. As per the appraisal of the CVI and recommendations from Polit et al. (2007), items with a CVI of 0.78 or higher were considered evidence of good content validity and therefore retained. Supplementary items that did not receive a CVI of 0.78 or higher were removed. In practice, this meant that if more than one of the six expert panellists did not rate a supplemental item as relevant, it was removed. The first draft of the English questionnaire was then finalised and referred to as CAT+.

Phase one of this study indicated that 98% of INFOSAN members spoke English, French or Spanish. It was, therefore, important to ensure that the questionnaire was adapted into these languages to encourage a higher response rate from the global membership. The aim of the adaptation process was to achieve different language versions of the English instrument that are conceptually equivalent in both French and Spanish. The instrument needed to be equally natural and acceptable and practically perform in the same way, with a focus on cross-cultural and conceptual equivalence, rather than on linguistic or literal equivalence. A well-established method to achieve this goal is to use forward translations and back translations (WHO, 2018f). This method has been refined over the course of several WHO studies and was used to adapt the questionnaires into French and Spanish. The detailed process of expanding and

adapting the questionnaire into French and Spanish is summarised in Appendix four. Anonymised, one-time-use links to the questionnaire were generated for each INFOSAN member in Qualtrics and I sent out individual emails to 479 INFOSAN members[4] in 181 countries.

Results were collected for a 10-week period between August and October 2019. Members were sent reminders three times during this period to indicate how many members had completed the questionnaire so far and to encourage others to do so. Only submitted questionnaires were analysed.

3.11 Phase three (semi-structured interviews) – Interpretative Phenomenological Analysis

Interpretative Phenomenological Analysis (IPA) is a qualitative research methodology used to examine how people make sense of their lived experiences. IPA has three primary theoretical underpinnings, including phenomenology, hermeneutics, and ideography. Firstly, phenomenology aims to develop an account of lived experience in its own terms rather than one prescribed within the bounds of predefined or overly abstract categories. Secondly, hermeneutics, as the theory of interpretation, underpins IPA since participants' accounts of their experiences represent their attempts to make sense of those experiences, and then requires the researcher to interpret those accounts to understand them. Thirdly, IPA is ideographic in its commitment to the detailed examination of each individual case under study (Smith et al., 2009).

Since the focus of this inquiry was on INFOSAN members' experiences as participants in network activities, the use of IPA allowed for exploration into how participants expressed their unique, idiosyncratic experiences and also shared some higher-order qualities. IPA as a methodology also embraces the role of the researcher, recognizing that one's prior

[4] Note the number of INFOSAN members decreased from 525 in phase one to 479 in phase two because the Secretariat, outside of the context of this research, engaged in a process to remove accounts of individuals who were no longer functional (e.g. emails bounced back from these accounts).

knowledge, experience, and understanding are assumed to affect the research process, including analyses and interpretations (Smith et al., 2009). This approach was congruent with my conduct of the overall study as a relative insider and involved the important practice of reflexivity as earlier introduced and elaborated below.

In contrast to thematic analysis, for example, IPA represents an overall methodology rather than simply a method of data analysis. As such, using IPA has influenced the decisions related to sampling, recruitment, data collection and analysis as described in the subsequent sections. Overall, IPA was chosen due to its ability to offer both an individual and group level analysis, to present INFOSAN members' phenomenological understanding of their experiences and the meaning they ascribe to these, and to embrace my position as an insider researcher to provide an additional level of interpretation.

3.12 Phase three (semi-structured interviews) – sampling, recruitment and consent

After conducting a preliminary analysis of the questionnaire results from phase two, all members of INFOSAN received an informational email in November 2019, which included preliminary results from phase two and an invitation to attend a webinar to learn more about the results as well as the details about phase three. I also presented results from the first two phases of the study at the global meeting of INFOSAN members in Abu Dhabi, the United Arab Emirates, in December 2019, and members were encouraged to participate in phase 3 when the call for volunteers was announced. In October 2020, an informational email was sent to all INFOSAN members to inform them that the results from the first two phases of the study were published (Appendix one) and announce that phase three recruitment was open for volunteers to express their interest within two weeks.

As phase three of the study was qualitative in nature, sampling needed to be theoretically consistent with the qualitative paradigm in general and with the chosen methodology of IPA in particular. As explained by Smith et al. (2009), samples for IPA studies are selected

purposively so that selected participants can offer insight into a specific experience. Further, IPA studies are conducted on relatively small and reasonably homogenous samples. The goal of recruitment in phase three was, therefore, to include a minimum of six and a maximum of twelve participants in the study sample. A sample size within this range allowed for the examination of similarities and differences between individuals without producing an overwhelmingly large amount of qualitative data that could not be managed within the confines of the study timeline.

In addition, the intention was to select participants from different geographic regions since INFOSAN is global and including participants from different regions was thought prudent to reveal a richer pool of experience than if all members were selected from a single region. In addition, this sample of participants was restricted to those INFOSAN members who were registered members for a minimum of two years at the time of their interview to ensure they would have a reasonable level of experience with the network from which to draw. Setting a minimum duration of membership also contributed to the homogeneity of the sample (e.g. INFOSAN members for more than two years, national government employees, working in the field of food safety, etc.). The sample was limited to those who spoke English due to limited funding for research conduct (including translation and interpretation) and limited time for collecting and analysing data in other languages. Following the two weeks during which time members volunteered for phase three, ten participants were selected (Table 6).

Table 6. Characteristics of participants recruited for study phase three

Pseudonym	**Geographic area**	**Length of membership (years)**
Amanda	North America	2.7
Brianna	Caribbean	4.0
Carlos	South America	5.5
Dina	Europe	7.3
Elias	Middle-East (Mediterranean)	10.8
Fatima	Middle-East (Gulf)	4.2
Gabriel	Africa	2.7
Hana	South-Asia	6.3
Izzy	East-Asia	5.8
Jessica	Pacific	6.8

In instances when more than one person volunteered from the same country or geographic region, the person who had been an INFOSAN member longer was selected. Eight individuals who volunteered for phase three but who were not selected were emailed individually and provided with an explanation about how the selection was made. They were also informed that if they wanted to discuss their experiences about INFOSAN with the WHO Secretariat, they were most welcome to do so at any time outside of the context of this study. Before commencing their interview, recruited participants read, signed and returned their consent form by email. Immediately before each interview, participants were informed that they could choose to withdraw from the study at any time, for any reason, before or during their interview and withdraw their data up to two weeks after their interview.

3.13 Phase three (semi-structured interviews) – data collection and analysis

Recruited participants were requested to participate in a semi-structured interview conducted online using the secure tool WebEx because participants were located in various countries around the world. The interviews were scheduled between October and November 2020. Various dimensions of members were explored during the interviews, but the discussion focused on answering the related questions of ‘how?’ and ‘why?’ instead of just ‘what?’ as elaborated in Appendix five. The qualitative research approach of IPA, used to explore and examine personal lived experiences (Smith et al., 2009), was utilised to engage in a dialogue with study participants to explore and interpret their understandings of lived experiences regarding participation in activities related to INFOSAN. Such a method required a flexible data collection instrument (Smith et al., 2009). Therefore, the semi-structured format of the interviews was conversational in style and allowed the participants and I to engage in a dialogue where questions were sometimes modified depending on individual responses. This format also enabled prompting and follow-up for further elaboration in certain areas of interest identified by participants, allowing for more flexibility than a structured interview (Bryman, 2016).

The interviews were audio-recorded and then transcribed by me. Audio recordings were made using WebEx and immediately downloaded on a password-protected laptop. Audio-recorded data was anonymised as far as is possible (given the nature of audio data) by saving the file with a de-identified tag (e.g., participant 1, region X). Before recording, the participants were reminded that they could refrain from using names of people and places to the extent possible when answering questions to assist with anonymisation.

Once recording started, participant's names were not used during the interview. Transcripts were anonymised by replacing identifying names of people or places with a de-identified tag (e.g., participant 1, region X, country A, etc.). The interviews were analysed following the procedures described by (Smith et al., 2009). Transcripts were read and re-read multiple times, sometimes while simultaneously listening to the audio recordings. Initial descriptive, linguistic and conceptual notations were then added to the right margin. This process was repeated several times for individual transcripts, with the focus shifting to various aspects each time before emergent themes were developed and noted in the left margin.

Connections across interviews were subsequently searched for after all individual interviews had been analysed. This process resulted in some emergent themes being revised and others being merged. All interviews were reanalysed in light of the final conceptualisations. Figure 11 depicts a sample interview transcript extract from one of the participants which includes exploratory comments and themes written in the margins.

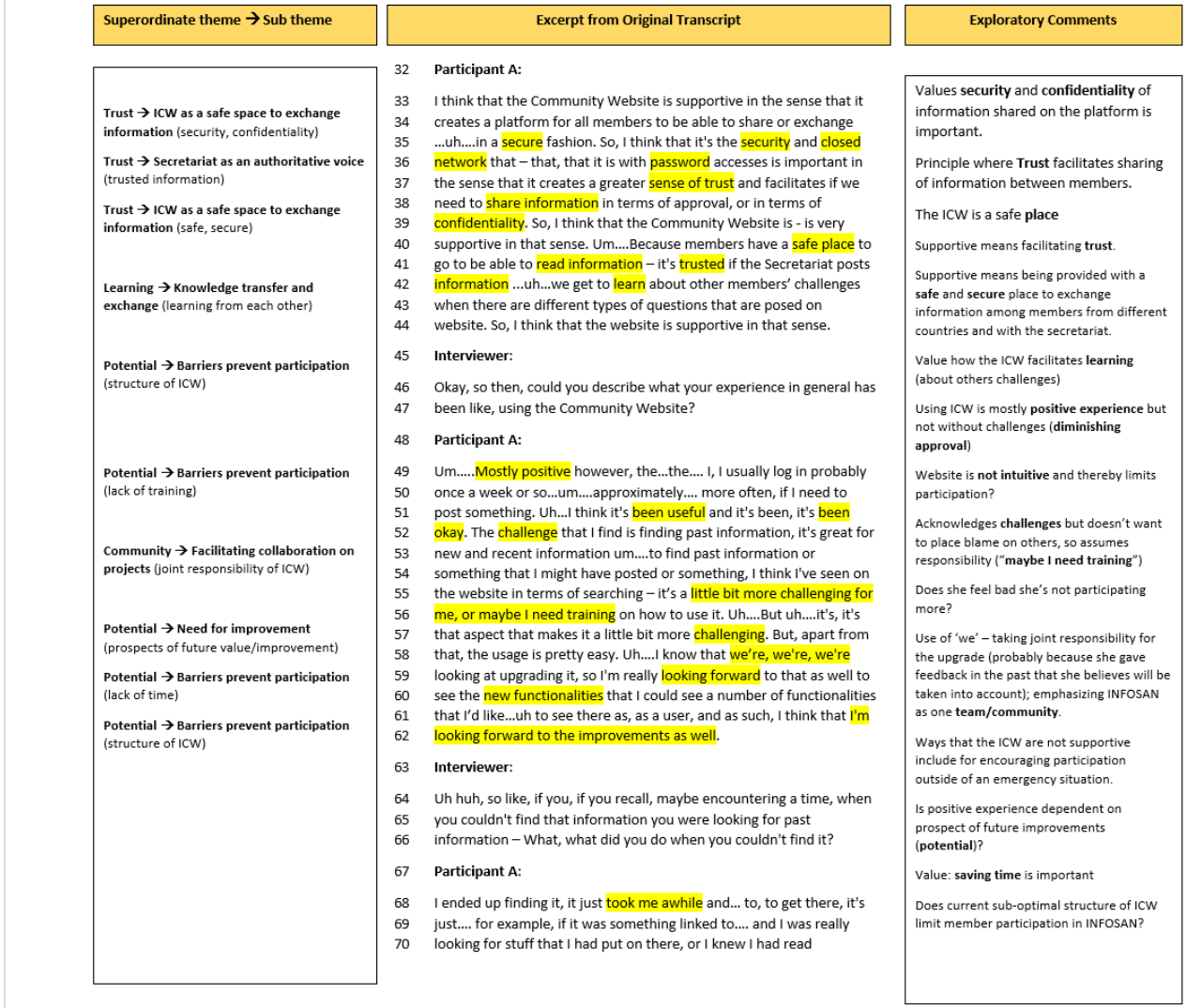


Figure 11. Sample interview transcript extract with exploratory comments and themes

A researcher's prior knowledge, experience, and understanding are assumed to affect IPA studies' research process, including analyses and interpretations (Smith et al., 2009). As such, my background as a member of the INFOSAN Secretariat at WHO for more than ten years will have certainly influenced how themes and interpretations were developed. Regarding my positionality, I embarked on this study with a view to understand better whether a programme that I was heavily invested in was providing a valuable service to participants and making a difference in people's health, and to justify the assumption that increasing participation in network activities was a worthy endeavour. In that respect, it was necessary to ensure that,

despite having access to additional data or information, only those data collected with the expressed consent of participants were used and reported on for the purposes of this study and practising reflexivity became critically important. Ahead of the study, my experience with INFOSAN may have led me to believe certain truths about its operation, but I needed to remain guided by the data collected to ensure participants' voices were represented in the findings presented and conclusions drawn. At the same time, I also acknowledged that my prior experiences with INFOSAN were assets that supported my understanding of the phenomena under investigation.

Potential preconceptions were countered by my rigorous adherence to the analytic process principles and by providing transcript extracts to substantiate interpretations. Specifically, interpretations were inspired by and arose from attending to the participants' own words rather than being imported from outside the study context. A master table of themes with extracts from all interviews was created to enhance the validity of the findings. All sub-themes included in the final conceptualisations occurred in at least four of the interviews, and superordinate themes occurred in all ten of the interviews.

3.14 Ethical considerations

Participant involvement in study design. Several conversations were had with INFOSAN members in finalising this study design. These conversations followed a presentation of the research design at a regional meeting of INFOSAN members in Miami, USA, in November 2017, where INFOSAN members from approximately 30 countries were present. In addition, a more detailed presentation of the study design was delivered at a meeting of eight INFOSAN members in Geneva, Switzerland, in December 2017, where a further discussion contributed to the finalisation of the study design, including the overall aim, objectives and research questions. The questionnaire was also vetted by several target participants (selected because they are also part of the INFOSAN Advisory Group) as

described above. Each phase of the study's results was communicated to study participants via email and through webinars.

Conducting insider research. By the nature of this work-based research project, I was an insider, investigating an issue that examines, in broad terms, the operation of an organisational programme. Therefore, I was an agent of my organisation as a technical officer at WHO and an agent of Lancaster University as a PhD student. As such, the ethical considerations for the design of this research project have been carefully made from the insider researcher perspective.

In addition to approval being granted by the director of the Department of Food Safety and Zoonoses to conduct this research, the overall study has been subject to scrutiny and approval by the Faculty of Health and Medicine Research Ethics Committee (FHMREC) at Lancaster University and the WHO Ethics Review Committee (WHOERC) before it could commence. The complete ethics application is contained in Appendix six and the ethics approval letters from FHMREC and WHOERC are contained in Appendix seven. This process to obtain ethics approval involved technical review by an external scientific committee of experts. In addition, the conduct of the research was governed by the WHO Code of Ethics and Professional Conduct and the WHO Code of Conduct for Responsible Research, both of which emphasise the need for all research to be conducted with integrity, accountability, independence, impartiality, respect and professional commitment.

Acknowledging one's role as an insider is congruent with the methodology used to conduct this research on INFOSAN through a CoP lens. As already explained, IPA as a research methodology is concerned with carefully detailing the lived experience of individuals (Smith et al., 2009). Guldberg and Mackness (2009) explain that using IPA to understand experience aligns with a CoP lens since the focus of analysis is on the interpretations of members and the values they attribute to them. In addition, IPA acknowledges and embraces the role of a researcher's interpretation, and understanding of members' lived experiences. Through my

insider role on the INFOSAN Secretariat, I played an important part in connecting, communicating and facilitating interaction among members. Therefore, my familiarity with the participants and the ability to provide expertise in the interpretation and understanding of members' experiences should be considered assets.

While there are several positive aspects to being an insider researcher (e.g., informed perspective and ability to implement study recommendations directly), the potential conflicts of interest or challenges have been carefully considered, acknowledged and addressed. For example, some challenges presented by conducting insider research include being seen more as an advocate than a researcher, being biased towards findings or interpretations, focusing too much on extremes and less on nuance, and experiencing role conflicts (Bonner & Tolhurst, 2002).

In addition, as some members of INFOSAN were familiar with me in my role at WHO, I needed to ensure transparency and clarity that the research being conducted was part of this PhD study. INFOSAN members were assured that neither their participation nor abstention would impact their future treatment as an INFOSAN member or the technical support provided to them or their agency by the WHO. Despite these potential challenges, transparency in the process, due permissions from senior WHO staff and assurances given to INFOSAN members have ensured this research was conducted to the highest ethical standard in a manner that was faithful to the methodological approaches chosen. Furthermore, several techniques well known to insider researchers were employed to understand and document the experiences of INFOSAN members accurately, including the practice of reflexivity. The practice of reflexivity involved active engagement of the self and questioning my own perceptions to expose their contextualised nature (Greene, 2014). I made use of a diary during data collection and analysis to document reflexivity, including predictions and reflections on outcomes for each phase of the study and how they related to one another.

Chapter four – Results

Chapter four presents the results from each research phase in three sub-sections, including the descriptive analysis of the INFOSAN Community Website performed in phase one, the results from the online questionnaire that INFOSAN members from 137 countries answered during phase two, and the results from ten semi-structured interviews conducted with INFOSAN members from ten countries in phase three.

4.1 Results from phase one: Analysis of the INFOSAN Community Website[5]

The results presented with respect to phase one of the study serve to orient the reader to the types of individuals who comprise the INFOSAN membership and the ways in which INFOSAN members have used the INFOSAN Community Website in the past. In this sense, it provides an objective, foundational layer of understanding about the network.

4.1.1 Types of INFOSAN members

Among INFOSAN members (524), 186 were Emergency Contact Points from 168 countries, and 338 were Focal Points from 144 countries. Emergency Contact Points have been designated from a national authority responsible for coordinating food safety emergency response activities and Focal Points have been designated by other national authorities with a stake in food safety activities. Since the ICW was launched, the number of registered members has increased annually (Figure 12). Among the Focal Points, 15 members were registered from eight different regional authorities (Appendix seven), and five members were registered from five different WHO Collaborating Centres (Appendix eight). WHO Collaborating Centres are research institutes, divisions of universities, or academies that the

[5] Section 4.1 is primarily based on a constituent paper of this research that has been published in the Journal of Food Protection and the first page is included in Appendix one – publications:

- Savelli CJ & Mateus C. (2020) Looking Inside the International Food Safety Authorities Network Community Website. Journal of Food Protection, 83(11), 1889-1899. https://doi.org/10.4315/JFP-20-193

WHO Director-General designates to carry out activities in support of WHO programs. Five hundred and seven members reported sex, of which 266 (52%) were male, and 241 (48%) were female. Information about languages spoken was provided by 431 of 524 INFOSAN members at the time of registration on the ICW. Three hundred forty-eight (81%) members reportedly spoke English, 88 (20%) spoke Spanish, and 86 (20%) spoke French. Only 10 (2%) did not report speaking English, French, or Spanish. Of those ten members, 6 of them reported speaking only Russian, and four of them reported speaking only Portuguese. Eighty-one (19%) members reported speaking one of more than 50 different languages.

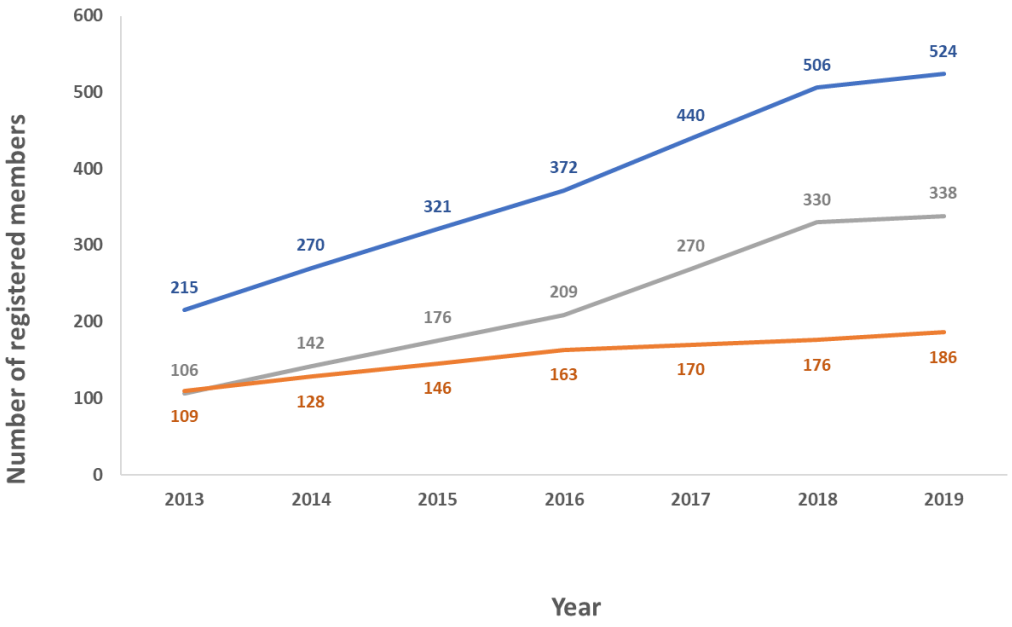


Figure 12. INFOSAN members registered on the INFOSAN Community Website, January 2013- January 2019 including all members (ALL –), Focal Points (FP –), and Emergency Contact Points (ECP –).

4.1.2 Geographical representation

INFOSAN members have been designated from nearly all WHO Member States (182/194, 93%; Table 7). However, the Americas was the only region in which all Member States had registered INFOSAN members on the ICW. The Americas was also the only region where the Member States had registered, on average, four INFOSAN members each (including one

Emergency Contact Point and three additional Focal Points from different national agencies). Member States from Africa, Asia, and the Eastern Mediterranean regions had registered an average of three members each, and the Member States from Europe and the Pacific had registered an average of two members each.

Table 7. Geographical representation of INFOSAN members registered on the INFOSAN Community Website, by region[6], January 2019.

Region	Registered Members (N)	Member States represented (N)	Total Number of Member States per region (N)	Average number of members per Member State (N)	Regional Member State coverage (%)
Africa	120	43	47	3	91%
Americas	147	35	35	4	100%
Asia	64	21	22	3	95%
Eastern Mediterranean	52	18	21	3	86%
Europe	112	50	53	2	94%
Pacific	29	15	16	2	94%
Global	524	182	194	3	93%

4.1.3 Government sector represented by members.

The government sector most commonly represented by INFOSAN members was food safety (337, 64%), followed by public health (199, 38%), agriculture (83, 16%), animal health (76, 15%), trade and commerce (35, 7%), and other sectors (30, 6%) including, for example, consumer affairs, education, and environment.

4.1.4 Primary function of members

Upon registration, INFOSAN members were asked to indicate their primary function as either risk management, risk communication, or risk assessment. INFOSAN members most

[6] Regional divisions of Member States in Africa, the Americas, the Eastern Mediterranean and Europe are based on coverage provided by the WHO regional offices. Asia includes the MS from the WHO South-East Asia region plus 11 Asian countries from the WHO Western Pacific region including Brunei Darussalam, Cambodia, China, Japan, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, Republic of Korea, Singapore, and Viet Nam.) The Pacific group includes the remaining pacific island countries from the WHO Western Pacific region. These regional divisions were recommended by the INFOSAN Advisory Group because of differences in the ways that INFOSAN activities have been historically organised and current practices in regional food safety management.

commonly reported risk management as their primary function (302, 58%), followed by risk communication (264, 50%) and risk assessment (232, 44%). One hundred thirty-eight (26%) members reported other primary functions, including surveillance, research, and standard-setting.

4.1.5 Scientific expertise of members

INFOSAN members reported a wide range of scientific expertise, including (in descending order) food safety (365, 70%), public health (237, 45%), foodborne disease surveillance (151, 29%), food science and technology (142, 27%), microbiology (139, 27%), outbreak investigation (134, 26%), epidemiology (116, 22%), emergency management (106, 20%), animal health (88, 17%), chemistry (68, 13%), toxicology (51, 10%), biotechnology (33, 6%), and other (33, 6%) including, for example, nutrition, plant protection, management, and administration.

4.1.6 Length of membership

The average INFOSAN member had been registered on the ICW for 3 years 10 months. For Emergency Contact Points, the average was 4 years 5 months, and for Focal Points, the average was 3 years 6 months. INFOSAN members who registered on the INFOSAN Community Website in 2012 when it launched represent the largest group (136, 26%).

4.1.7 Access to the ICW

As of January 2019, just over half of INFOSAN members had logged on to the ICW within the preceding six months (270, 52%). However, 194 (37%) members had not accessed the ICW in more than a year, including 70 (13%) members who had not accessed the site in three or more years (Table 8). Across regions, the majority of members from the Americas (92, 63%), Asia (39, 61%), and the Eastern Mediterranean (38, 73%) accessed the ICW during the preceding six months. In contrast, the majority of members from Africa (75, 63%), Europe (63, 56%), and the Pacific (22, 76%) had not accessed the website during the preceding six months (Table 9).

Table 8. Last access to the INFOSAN Community Website by INFOSAN members, stratified by type of member (Emergency Contact Point or Focal Point), January 2019

Last access	All Members N (%)	Emergency Contact Points N (%)	Focal Points N (%)
<1 month	77 (15%)	40 (22%)	37 (11%)
1-3 months	64 (12%)	24 (13%)	40 (12%)
3-6 months	129 (25%)	39 (21%)	90 (27%)
6-12 months	60 (11%)	26(14%)	34 (10%)
1-2 years	96 (18%)	27 (15%)	69 (20%)
2-3 years	28 (5%)	8 (4%)	20 (6%)
3+ years	70 (13%)	22 (12%)	48 (14%)
Total	524 (100%)	186 (100%)	338 (100%)

Table 9. Last access to the INFOSAN Community Website by INFOSAN members, stratified by geographic region, January 2019

Last access	All Members N (%)	Africa N (%)	Americas N (%)	Asia N (%)	Eastern Mediterranean N (%)	Europe N (%)	Pacific N (%)
<1 month	77 (15%)	14 (12%)	25 (17%)	11 (17%)	10 (19%)	13 (12%)	4 (14%)
1-3 months	64 (12%)	8 (7%)	22 (15%)	9 (14%)	10 (19%)	14 (13%)	1 (3%)
3-6 months	129 (25%)	23 (19%)	45 (31%)	19 (30%)	18 (35%)	22 (20%)	2 (7%)
6-12 months	60 (11%)	13 (11%)	15 (10%)	0 (0%)	8 (15%)	17 (15%)	7 (24%)
1-2 years	96 (18%)	30 (25%)	26 (18%)	10 (16%)	5 (10%)	18 (16%)	7 (24%)
2-3 years	28 (5%)	13 (11%)	6 (4%)	4 (6%)	0 (0%)	4 (4%)	1 (3%)
3+ years	70 (13%)	19 (16%)	8(5%)	11 (17%)	1 (2%)	24 (21%)	7 (24%)
Total	524 (100%)	120 (100%)	147 (100%)	64 (100%)	52 (100%)	112 (100%)	29 (100%)

4.1.8 Use of the discussion forum

The INFOSAN discussion forum provided an environment for asynchronous conversations to occur among members and the INFOSAN Secretariat. These discussions were visible to all registered INFOSAN members, and any member could have read and responded to the threads. For summary purposes, the discussion threads have been assigned to one of four topic categories based on the most accruing themes: (i) food safety events, (ii) training, (iii) announcements, and (iv) feedback.

From 2012 to 2018, a total of 136 discussion threads were initiated in the forum. This excludes discussions held within subgroups on the website that were private and only visible to group members. Members made sixty-seven member-initiated threads from 26 different countries; however, two-thirds of these threads (45, 67%) were started by just ten members from 10 different countries. Members from the Pacific were responsible for initiating the most threads (18, 27%), followed by members from Asia (17, 25%), the Eastern Mediterranean (12, 18%), Africa (8, 12%), the Americas (8, 12%), and Europe (4, 6%).

Overall, 578 replies were made across the 136 discussion threads. Sixty-six (11%) of those replies came from the Secretariat or someone else at FAO or WHO. The remaining 512 (89%) replies were made by 177 members from 116 countries. Twenty members from 19 countries were responsible for 216 replies (42%). Members from the Americas were responsible for the most replies (186, 36%), followed by members from Africa (109, 21%), Asia (85, 17%), the Eastern Mediterranean (62, 12%), the Pacific (40, 8%), and Europe (30, 6%).

Fifty-seven (42%) of 136 of the discussion threads consisted of only a single post (i.e., no one replied to the original message). Among those threads with no replies, they were viewed an average of 53 times (maximum, 228; minimum, 8). Overall, the minimum number of views of any thread was eight, and the maximum was 879. On average, each discussion included three replies (Table 10).

Table 10. INFOSAN Community Website Discussion Forum Activity, 2012-2018

	2012	2013	2014	2015	2016	2017	2018	Overall
Registered members	215	250	311	372	439	506	524	524
Discussion forum threads	14	17	8	14	15	35	33	136
Secretariat initiated threads	3	4	3	3	9	28	19	69
Member-initiated threads	11	13	5	11	6	7	14	67
Average number of views per thread	80	64	172	144	134	111	116	113
Min number of views per thread	12	9	18	21	10	8	17	8
Max number of views per thread	189	292	597	740	313	879	660	879
Average number of replies per thread	2	2	6	6	4	3	3	3
Min number of replies per thread	0	0	0	0	0	0	0	0
Max number of replies per thread	6	9	21	21	20	34	20	34
Mode replies per thread	0	0	4	0	0	0	0	0

Discussions about food safety events represented nearly half of all topics (61, 45%) and typically included responses from INFOSAN members detailing national risk management measures implemented in response to a specific food safety event. Discussions about training opportunities represented about a quarter of all topics (33, 24%). Many of these posts included details about upcoming opportunities offered by the INFOSAN Secretariat or members' institutions or otherwise referred members to Web-based training resources (e.g., recorded technical webinars on various food safety topics). Announcements about upcoming events (e.g., World Health Day, publication of new food safety guidance or resources) accounted for 27 (20%) of the discussion topics. Requests for feedback (e.g., comments on draft documents, ideas for future publications) were the topics of 15 (11%) of the discussion threads.

4.1.9 Number of food safety events on the ICW

The ICW contained information about 482 food safety events dating back to 2005. Events dating from 2005 to 2011 were added retrospectively when the ICW was launched in 2012 (Table 11). The majority of incidents were caused by contamination with bacteria (268, 56%) followed by chemicals (81, 17%), physical hazards (42, 9%), viruses (35, 7%), undeclared allergens (22, 5%), unknown hazards (17, 4%), parasites (8, 2%), other hazards (7, 1%), or fungi (2, 0.4%; Table 12). Ten hazards most frequently responsible for food safety events accounted for 59% of all those documented on the ICW. Nearly a quarter of those involved

Salmonella enterica (110, 23%) followed by *Listeria monocytogenes* (49, 10%), enterohemorrhagic *Escherichia coli* (38, 8%), *Clostridium botulinum* (35, 7%), hepatitis A virus (16, 3%), norovirus (13, 3%), peanut (allergen; 9, 2%), methanol (adulterant; 6, 1%), *Vibrio* spp. (6, 1%), and *Cronobacter sakazaki* (6, 1%; Table 13). Foods from 10 categories most frequently responsible for food safety events accounted for 78% of all those documented on the ICW. Fish and other seafood topped the list (63, 13%), followed by milk and dairy products (57, 12%); meat and meat products (54, 11%); vegetables and vegetable products (42, 9%); fruit and fruit products (41, 9%); herbs, spices, and condiments (37, 8%); snacks, desserts, and other foods (34, 7%); nuts and oilseeds (27, 6%); products for special nutritional use (21, 4%); and cereals and cereal-based products (17, 4%; Table 14).

Table 11. Number of Food Safety Events documented on the INFOSAN Community Website, 2005-2019

Year	Number of food safety events
2005	2
2006	3
2007	8
2008	12
2009	5
2010	2
2011	46
2012	42
2013	44
2014	39
2015	37
2016	37
2017	43
2018	78
2019	84
Total	482

Table 12. Frequency of hazards involved in food safety events (482) documented on the INFOSAN Community Website, 2005-2019

Hazard category	Number of food safety events, N (%)
Bacteria	268 (56%)
Chemicals	81 (17%)
Physical hazards	42 (9%)
Viruses	35 (7%)
Undeclared Allergens	22 (5%)
Unknown	17 (4%)
Parasites	8 (2%)
Other	7 (1%)
Fungi	2 (0.4%)
Total	482 (100%)

Table 13. Top 10 specific hazards involved in food safety events documented on the INFOSAN Community Website, 2005-2019

Specific hazard	Number of food safety events, N (%)
1. *Salmonella enterica*	110 (23%)
2. *Listeria monocytogenes*	49 (10%)
3. Enterohemorrhagic *Escherichia coli* (EHEC)	38 (8%)
4. *Clostridium botulinum*	35 (7%)
5. Hepatitis A virus	16 (3%)
6. Norovirus	13 (3%)
7. Peanut (allergen)	9 (2%)
8. Methanol (adulterant)	6 (1%)
9. *Vibrio spp*.	6 (1%)
10. *Cronobacter sakazaki*	6 (1%)
Top 10	282 (59%)

Table 14. Top 10 foods involved in food safety events documented on the INFOSAN Community Website, 2005-2019

Food categories	Number of food safety events, N (%)
1. Fish and other seafood	63 (13%)
2. Milk and dairy products	57 (12%)
3. Meat and meat products	54 (11%)
4. Vegetables and vegetable products	42 (9%)
5. Fruit and fruit products	41 (9%)
6. Herbs, spices and condiments	37 (8%)
7. Snacks, desserts, and other foods	34 (7%)
8. Nuts and oilseeds	27 (6%)
9. Products for special nutritional use	21 (4%)
10. Cereals and cereal-based products	17 (4%)
Top 10	376 (78%)

4.2 Results from phase two: global survey of INFOSAN members[7]

4.2.1 Demographics

Overall, 239/479 (50%) members responded to the questionnaire and 123/239 (51%) respondents were female. Females were, therefore, slightly over-represented among respondents compared to the overall membership, of which 219/479, 46% were female. The response rate differed across regions, with some being overrepresented and some being underrepresented (Table 15). The response rate was highest among members from the Americas (60%), followed by Africa (57%), the Eastern Mediterranean (44%), Europe (41%), the Pacific (38%) and finally Asia (37%). Respondents included members from 137/181 (76%) countries where INFOSAN members were registered. The average length of membership of respondents was 4.3 years (minimum = 2 weeks, maximum = 15 years).

[7] Section 4.2 is primarily based on a constituent paper of this research that was published in the Journal of Food Protection and the first page is included in Appendix one – publications:

- Savelli CJ & Mateus C. (2021). Exploring the International Food Safety Authorities Network as a Community of Practice: Results from a Global Survey of Network Members. Journal of Food Protection. 84(2), 262–274. https://doi.org/10.4315/JFP-20-313

Table 15. Regional representation of respondents

Region	INFOSAN Members who received the questionnaire, N (%)	Respondents, N (%)	Response rate by individual, %	Countries where members received the questionnaire, N (%)	Countries represented by respondents, N (%)	Response rate by country, %
Africa	112 (23%)	64 (27%)	57%	44 (24%)	38 (28%)	86%
Americas	135 (28%)	81 (34%)	60%	35 (19%)	32 (23%)	91%
Asia	57 (12%)	21 (9%)	37%	20 (11%)	14 (10%)	70%
Eastern Mediterranean	50 (10%)	22 (9%)	44%	19 (11%)	14 (10%)	74%
Europe	99 (21%)	41 (17%)	41%	48 (27%)	31 (23%)	65%
Pacific	26 (5%)	10 (4%)	38%	15 (8%)	8 (6%)	53%
Total	479 (100%)	239 (100%)	50%	181 (100%)	137 (100%)	76%

4.2.2 INFOSAN aims and objective

INFOSAN aims to prevent the international spread of contaminated food and foodborne disease and strengthen food safety systems globally. The main objectives are to: 1) promote the rapid exchange of information during food safety events and emergencies; 2) share information on important food safety issues of global interest; 3) promote partnership and collaboration between countries; and 4) help countries strengthen their capacity to manage food safety emergencies. Respondent perceptions on the aims and objectives of INFOSAN are shown in Figure 13. Notably, 230/237 (97%) of respondents agreed or strongly agreed that the objectives of INFOSAN were still valid. However, when considering the statement, "*Because of INFOSAN, illnesses have been prevented*", just over two-thirds of respondents agreed or strongly agreed (161/236, 68%). Most of the remaining respondents (representing more than a quarter of respondents) answered with some kind of ambivalence (40/236, 17% neither agreed nor disagreed; 23/236, 10% did not know; 5/236, 2% preferred not to answer) and a small group expressed disagreement (6/236, 3% disagreed; 1/236, 0.4% strongly disagreed).

Similarly, when considering the statement, "*Because of INFOSAN, lives have been saved*", agreement or strong agreement was expressed by just over two-thirds of respondents (158/236, 67%). Again, most of the remaining respondents answered with some kind of ambivalence (46/236, 19% neither agreed nor disagreed; 23/236, 10% did not know; 6/236, 3% preferred not to answer) and a small group expressed disagreement (3/236, 1% disagreed). Sixty-two percent (146/235) agreed or strongly agreed that INFOSAN had improved the safety of the global food supply and 59% (138/233) agreed or strongly agreed that INFOSAN had reduced the burden of foodborne illness globally. When considering both of these ideas, a large group of respondents (totalling more than one third) expressed ambivalence in their answers.

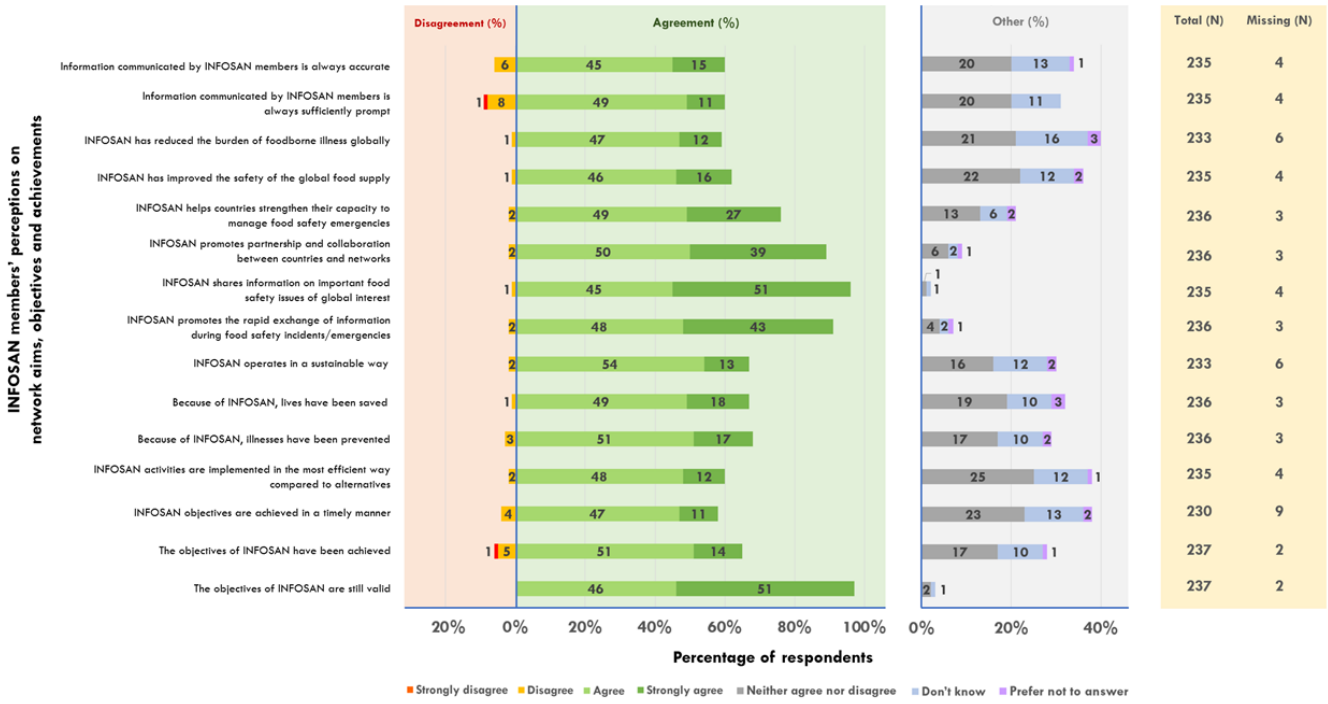


Figure 13. INFOSAN member perceptions on network aims and objectives

4.2.3 Barriers to active participation in INFOSAN activities

When indicating factors that create barriers to active participation in INFOSAN, those which were reported by more than half of all respondents included: 1) the need for a simpler and more standardised way to share information between national authorities within their country (60%); 2) challenges in conducting food safety risk assessments within their country (59%); 3) insufficient funds dedicated to monitoring and/or responding to food safety events within their country (55%); and 4) limited capacity and/or infrastructure dedicated to addressing food safety events within their country (54%). Respondents' perceptions of potential barriers are shown in Figure 14. Perceptions of barriers vary across regions, with members from Africa having perceived the most barriers, followed by those from the Americas, then Asia, the Eastern Mediterranean, the Pacific and finally Europe. Details on the barriers reported by region are published with the related manuscript (Savelli & Mateus, 2021).

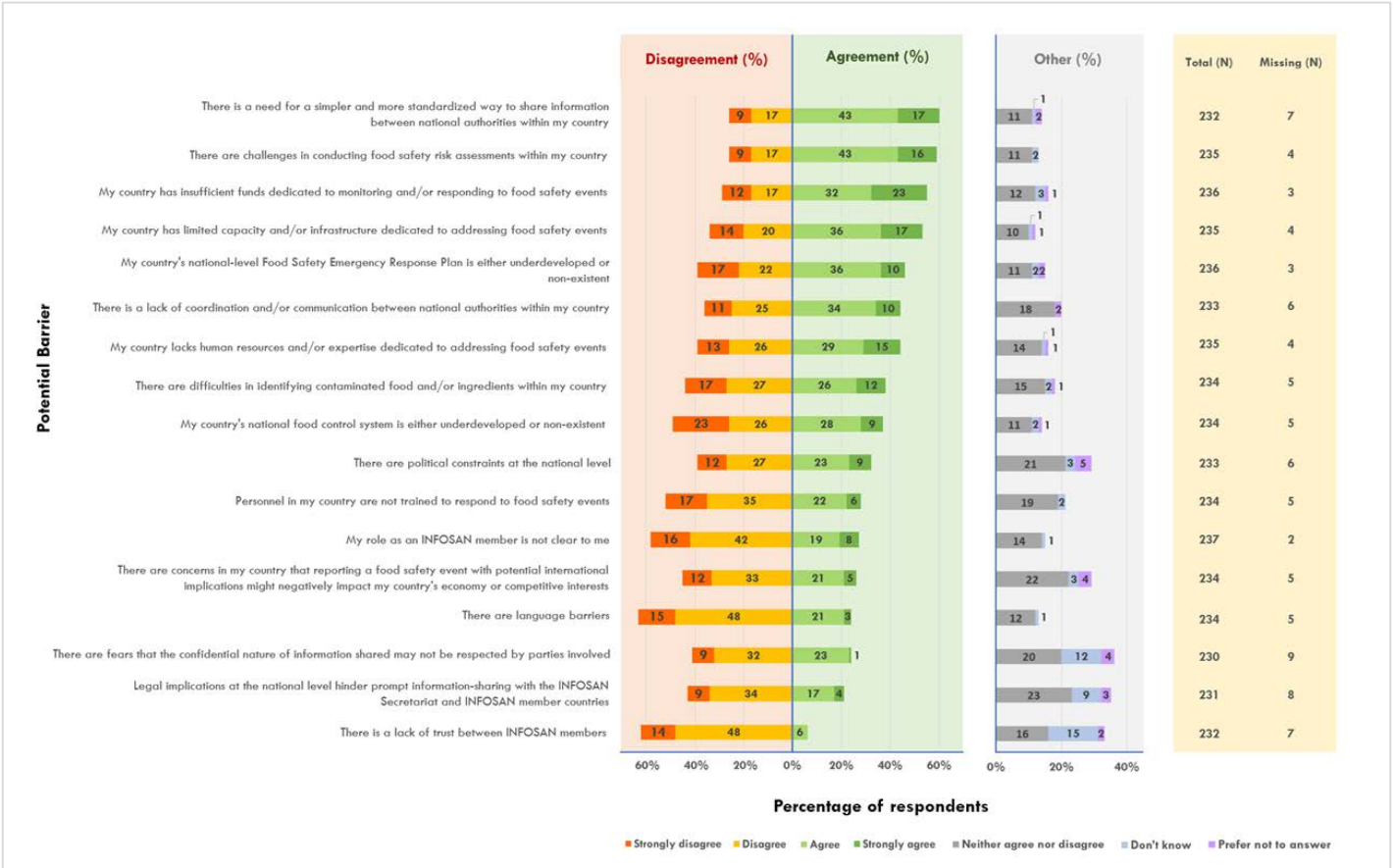


Figure 14. Global ranking of potential barriers to active participation in INFOSAN activities

4.2.4 Information and communication technology support

The INFOSAN Community Website (ICW) was launched in 2012 as an online portal through which all members could communicate with each other and with the INFOSAN Secretariat. Ninety-four percent (216/229) of respondents agreed or strongly agreed that the ICW was an important and supportive tool for the network and 79% (185/233) agreed or strongly agreed that it facilitated information sharing and provided collaborative features that helped foster the community of practice among INFOSAN members. Figure 15 presents INFOSAN members' perceptions of the utility of the ICW.

Only 6% of respondents reportedly accessed the ICW daily (14/236), 21% (40/236) accessed the ICW weekly, 26% (61/236) accessed the ICW monthly, 29% (68/236) accessed the ICW every few months, 8% (19/236) never accessed the ICW, 4% (10/236) do not know how often they accessed the ICW and 6% (14/236) preferred not to answer this question.

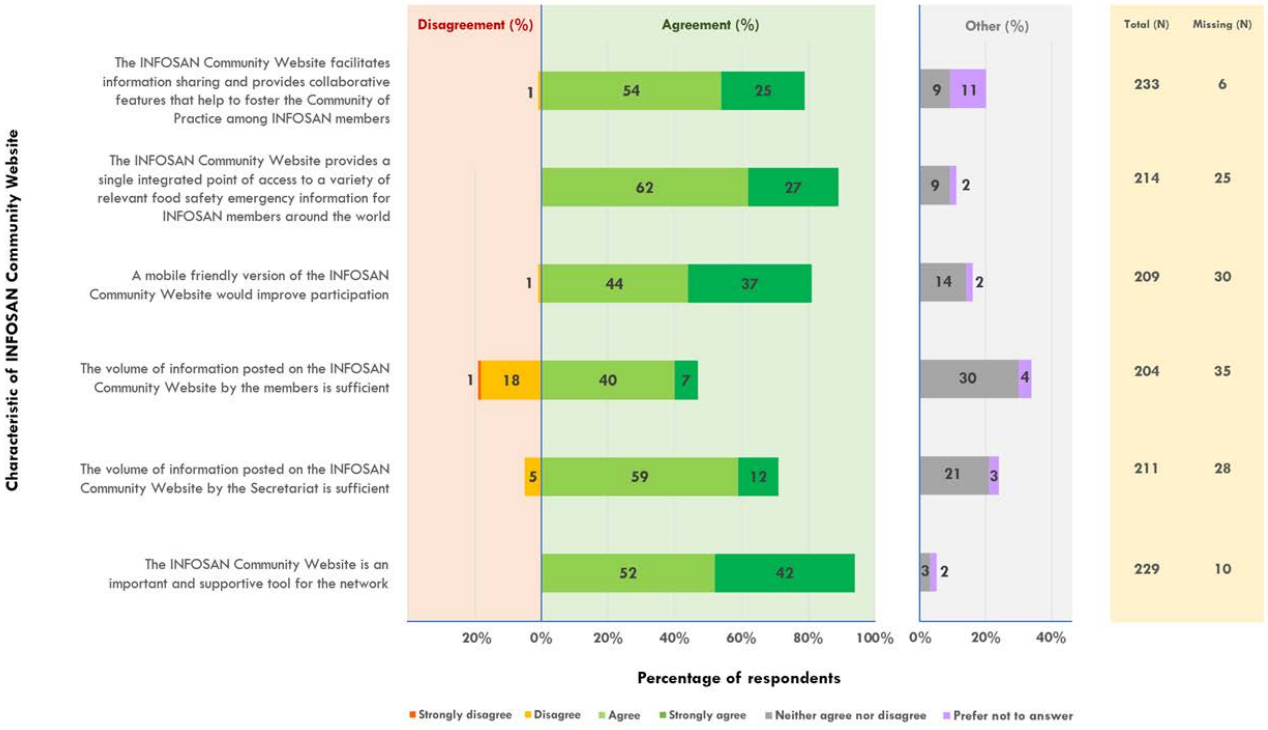


Figure 15. INFOSAN members' perceptions of the utility of the INFOSAN Community Website

Among 219 respondents who do reportedly accessed the ICW, a range of reasons for doing so have been indicated and are displayed in Figure 16. Nearly all users of the ICW accessed it to read about alerts issued by the INFOSAN Secretariat (97%, 212/219). The majority of ICW users also accessed the site to read INFOSAN documents (69%, 152/219) and to read publications and newsletters from FAO and WHO (65%, 142/219). Additional reasons for accessing the ICW reported by respondents included: to find the information provided in discussion posts; to read about INFOSAN activities; to ask for help managing food safety events; and to seek partnerships and international cooperation.

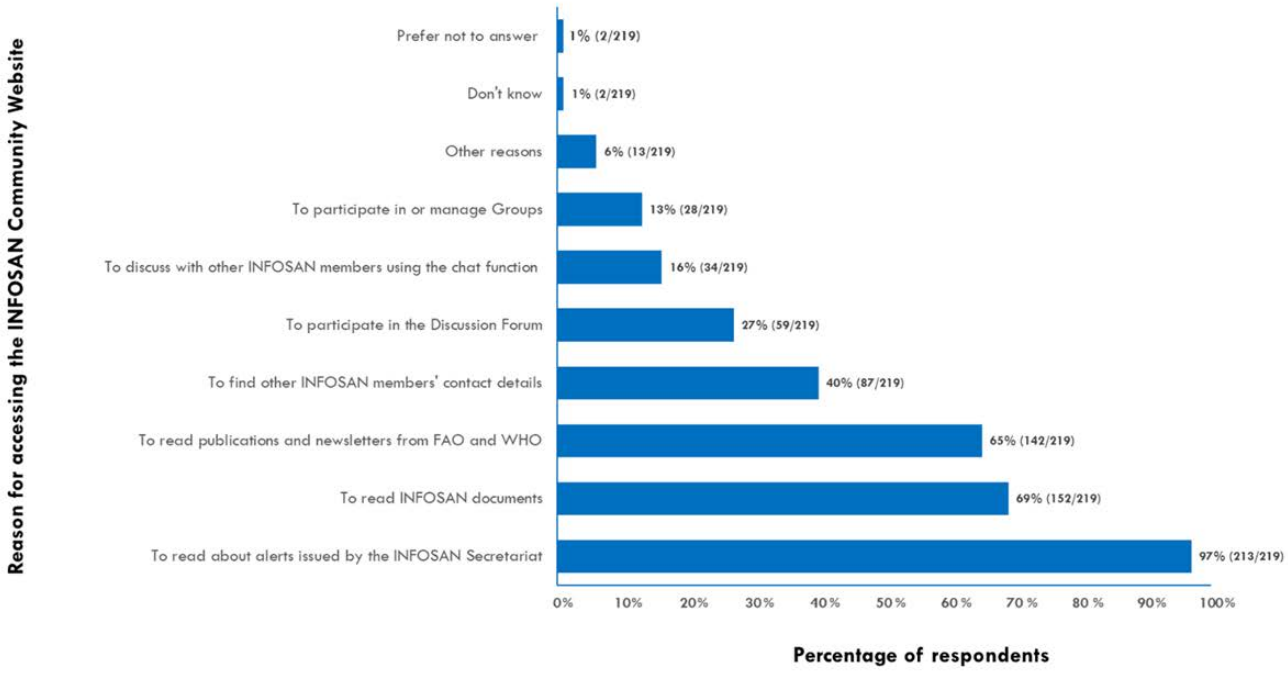


Figure 16. Reported reasons for INFOSAN members to access the INFOSAN Community Website

4.2.5 Goals

Respondents have indicated that the most important goals they are trying to achieve by participating in INFOSAN included preventing foodborne diseases and improving the safety of the food supply, which were rated as extremely important factors for participation by 68% (163/238) and 59% (139/236) of members respectively. Table 16 presents a range of reasons

for participating in INFOSAN ranked by their relative importance. The ranking was calculated by assigning numeric values to each possible response and then calculating the sum (score) for each reason according to responses, where extremely important = 4, very important = 3, moderately important = 2, slightly important = 1 and not important at all = 0.

Table 16. Ranking of reasons for participating in INFOSAN by relative importance according to respondents

Rank	Score	Reason for participating	Extremely important	Very important	Moderately important	Slightly important	Not important at all	Don't know	Prefer not to answer	Total	Missing
			N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N	N
1.	860	Preventing foodborne diseases	163 (68%)	65 (27%)	6 (3%)	1 (0%)	0 (0%)	2 (1%)	1 (0%)	238	1
2.	829	Improving the safety of the food supply	139 (59%)	86 (36%)	7 (3%)	1 (0%)	1 (0%)	2 (1%)	0 (0%)	236	3
3.	788	Staying up to date on food safety issues	119 (51%)	93 (40%)	14 (6%)	5 (2%)	1 (0%)	2 (1%)	1 (0%)	235	4
4.	723	Hearing about new knowledge and experiences from other INFOSAN members	61 (26%)	139 (59%)	28 (12%)	6 (3%)	0 (0%)	2 (1%)	0 (0%)	236	3
5.	719	Developing standards, methods and best practices	81 (34%)	109 (46%)	28 (12%)	12 (5%)	1 (0%)	4 (2%)	1 (0%)	236	3
6.	691	Making useful contacts/ networking	57 (24%)	130 (55%)	31 (13%)	11 (5%)	2 (1%)	2 (1%)	3 (1%)	236	3
7.	674	Saving time in finding information	63 (27%)	118 (51%)	26 (11%)	16 (7%)	4 (2%)	5 (2%)	0 (0%)	232	7
8.	672	Improving the level of expertise of other members	66 (28%)	110 (47%)	35 (15%)	8 (3%)	3 (1%)	10 (4%)	1 (0%)	233	6
9.	633	Developing new ideas for INFOSAN together with other members	48 (21%)	109 (47%)	52 (22%)	10 (4%)	1 (0%)	11 (5%)	3 (1%)	234	5
10.	602	Helping new INFOSAN members	46 (20%)	110 (47%)	38 (16%)	12 (5%)	5 (2%)	16 (7%)	5 (2%)	232	7
11.	526	Advancing in my career	50 (22%)	76 (33%)	34 (15%)	30 (13%)	27 (12%)	7 (3%)	7 (3%)	231	8
12.	333	Having nice meetings, fun and non-work related activities	17 (7%)	45 (19%)	43 (18%)	44 (19%)	65 (28%)	11 (5%)	8 (3%)	233	6

4.2.6 Organisational support

Many respondents (70%, 165/236) indicated that their organisation allocated time for their participation in INFOSAN. Twenty percent (47/237) were not allocated time for participation in INFOSAN, 3% (7/236) did not know if they were allocated time, and 7% (17/236)

preferred not to answer. Many respondents felt encouraged (43%, 102/236) or strongly encouraged (17%, 39/236) by their organisation to participate actively in INFOSAN, while 28% (65/236) felt neither encouraged nor discouraged, 4% (10/236) felt discouraged, and 1% felt strongly discouraged. Three percent did not know how encouraged they felt by their organisation to participate actively in INFOSAN, and 5% (12/236) preferred not to answer. Most respondents (77%, 183/237) would have liked to have more time available for activities concerning INFOSAN, (11%, 25/237) would not have liked to have more time available for activities concerning INFOSAN, 5% (13/237) did not know if they would have liked to have more time and 7% (16/237) preferred not to answer.

4.2.7 Impact of INFOSAN as a Community of Practice

Just over two-thirds of respondents agreed (49%, 114/232) or strongly agreed (18%, 41/232) that INFOSAN members felt a sense of belonging to INFOSAN, while 11% (25/232) neither agreed nor disagreed, 3% (6/232) disagreed, 18% (42/232) did not know and 2% (4/232) preferred not to answer. Many respondents also agreed (45%, 103/230) or strongly agreed (17%, 39/230) that INFOSAN members felt a sense of loyalty to INFOSAN, while 13% (30/230) neither agreed nor disagreed, 1% (3/230) disagreed, 0.4% (1/230) strongly disagreed, 20% (47/230) did not know and 3% (7/230) preferred not to answer.

In addition, slightly more than half of the respondents (118/231, 51%) agreed or strongly agreed that INFOSAN members trusted each other, 16% (37/231) neither agreed nor disagreed; 2% (4/231) disagreed; 0.4% (1/231) strongly disagreed and 1% (2/231) preferred not to answer. Notably, 30% (69/231) did not know if INFOSAN members trusted each other. In terms of using INFOSAN to find new information to solve problems, advance projects or keep updated on new developments related to food safety, 33% (76/230) respondents indicated that using INFOSAN was absolutely essential. Thirty-two percent (75/230) reported that using INFOSAN for such purposes was very important, 23% (53/230) reported that it was important, 8% (18/230) reported that it was slightly important, while 2% (4/230) reported that it was not important at all and 2% (4/230) preferred not to answer.

Other important ways of finding new information related to food safety included asking individual colleagues, using the internet, or reading publications or reports, as displayed in Table 19. In addition, respondents identified meetings and conferences, scientific articles and books, and podcasts as other important resources for finding food safety information. Knowledge transfer and exchange is an important characteristic of any community of practice and such activities were commonly occurring among INFOSAN members. Figure 17 shows the perceptions of members on various aspects of knowledge transfer and exchange among INFOSAN members.

Participation in INFOSAN was shown to have numerous positive impacts on members' organisations. For example, about a third of respondents strongly agreed (7%, 16/230) or agreed (25%, 58/230) that INFOSAN had contributed to their organisation's cost savings. Also, nearly half of respondents agreed (40%, 91/230) or strongly agreed (8%, 18/230) that INFOSAN had made a real contribution to their organisation's effectiveness. Furthermore, more than half of respondents agreed (45%, 104/230) or strongly agreed (10%, 22/230) that participation had contributed new ideas to their organisation. Additional impacts of INFOSAN on members' organisations are shown in Figure 18.

Finally, through membership to INFOSAN, many members reported making new contacts, working more efficiently, and being kept up to date in the field of food safety. The extent of these and other personal achievements due to membership in INFOSAN is displayed in Table 20. Overall, 97% (226/234) of members responded that they liked being a part of INFOSAN (2%, 4/234, did not know and 2%, 4/234 preferred not to answer).

Table 17. Important ways of finding new information related to food safety

Modality for finding information	Absolutely essential	Very important	Important	Slightly important	Not important at all	Don't know	Prefer not to answer	Total	Missing
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N	N
Through INFOSAN	76 (33%)	75 (33%)	53 (23%)	18 (8%)	4 (2%)	0 (0%)	4 (2%)	230	9
Through individual colleagues	22 (10%)	87 (39%)	83 (37%)	24 (11%)	3 (1%)	0 (0%)	4 (2%)	223	16
Via the internet	63 (28%)	76 (34%)	64 (28%)	18 (8%)	3 (1%)	0 (0%)	2 (1%)	226	13
Asking an expert	46 (21%)	94 (42%)	69 (31%)	10 (5%)	1 (0%)	0 (0%)	2 (1%)	222	17
Reading publications or reports	60 (27%)	98 (44%)	56 (25%)	6 (3%)	0 (0%)	0 (0%)	5 (2%)	225	14

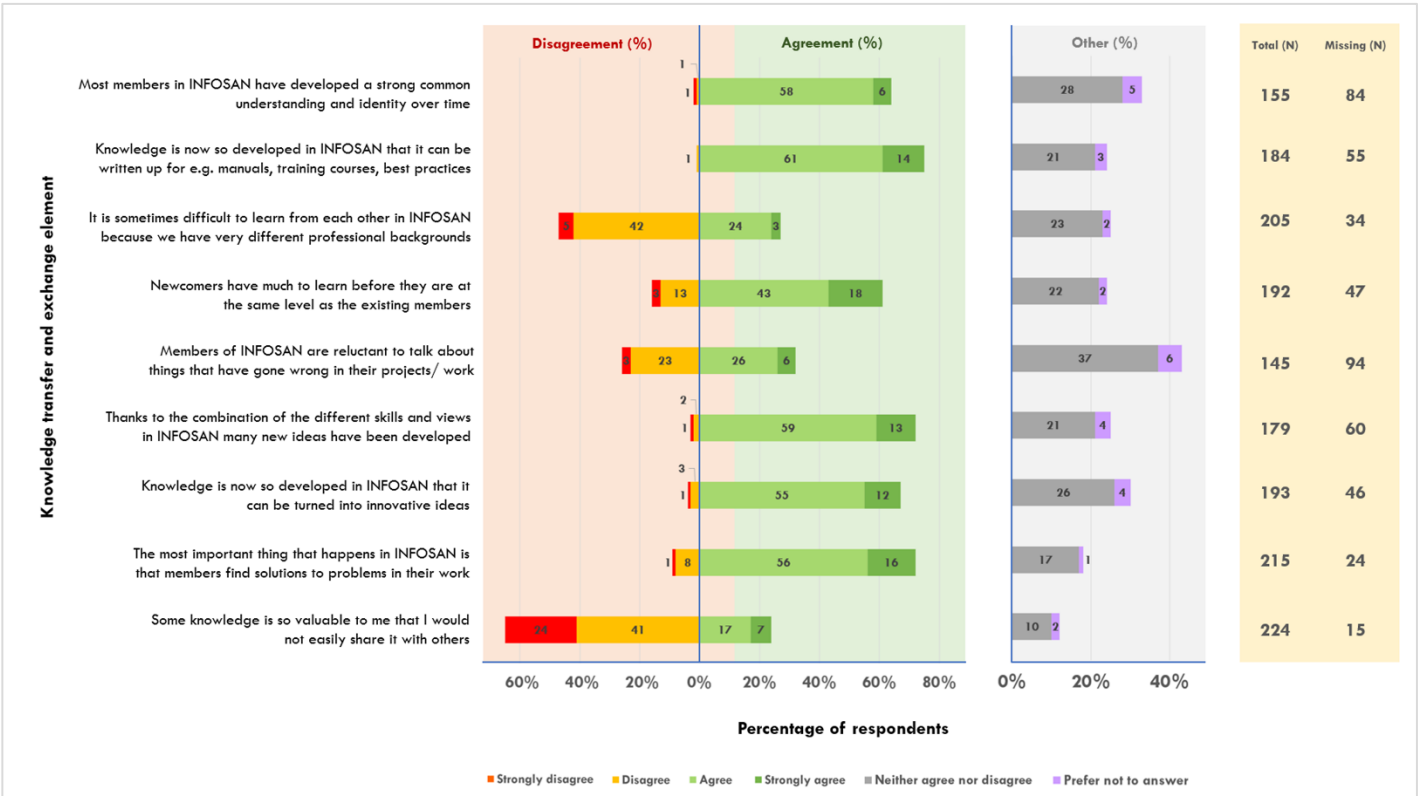


Figure 17. Knowledge transfer and exchange among INFOSAN

Table 18. Extent of personal achievements due to membership in INFOSAN

Personal achievement	To a great extent	To a moderate extent	Somewhat	To a slight extent	Not at all	Don't know	Prefer not to answer	Total	Missing
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N	N
Learned a lot about my subject area	38 (17%)	88 (39%)	54 (24%)	30 (13%)	9 (4%)	4 (2%)	4 (2%)	227	12
Made useful new contacts	21 (9%)	60 (27%)	48 (21%)	49 (22%)	34 (15%)	7 (3%)	5 (2%)	224	15
Been able to solve problems at work	27 (12%)	68 (30%)	61 (27%)	38 (17%)	17 (7%)	9 (4%)	7 (3%)	227	12
Improved my career prospects	21 (9%)	49 (22%)	47 (21%)	28 (12%)	47 (21%)	20 (9%)	13 (6%)	225	14
Worked more efficiently	20 (9%)	72 (32%)	55 (24%)	44 (20%)	16 (7%)	11 (5%)	7 (3%)	225	14
Been kept up to date in the field of food safety	38 (17%)	73 (32%)	54 (24%)	32 (14%)	12 (5%)	10 (4%)	7 (3%)	226	13
Improved my reputation and visibility within my organisation	26 (12%)	60 (27%)	34 (15%)	33 (15%)	31 (14%)	27 (12%)	14 (6%)	225	14
Transferred information from INFOSAN to my team or department	61 (27%)	76 (34%)	32 (14%)	29 (13%)	13 (6%)	6 (3%)	8 (4%)	225	14

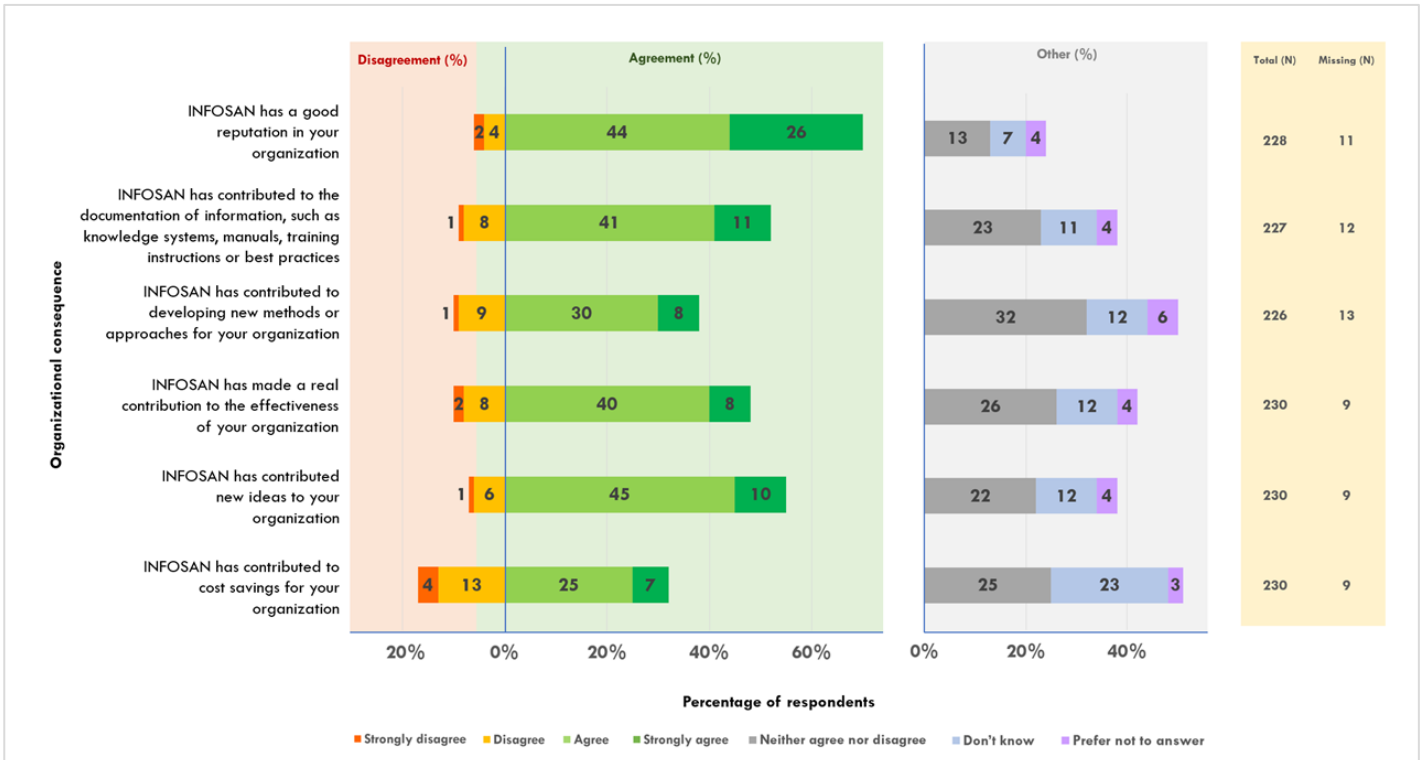


Figure 18. Organizational consequences of participation in INFOSAN

4.3 Results from phase three: an IPA study of INFOSAN member experiences[8]

The process of data analysis generated five superordinate themes and 14 sub-themes that offered an understanding of INFOSAN members' experiences in this study in the context of what participation in this global network means to them. The themes are presented in Table 21 and supported by original quotes, with all participants represented by at least one quote. Symbols used within participants' quotes have the following meaning: Three ellipsis points (…) indicate that some text has been omitted, and square brackets [ ] contain my own words aimed to clarify/contextualise the content. Pseudonyms have replaced all real names and were chosen by me.

[8] Section 4.3 is primarily based on a constituent paper of this research that has been published in the Journal of Food Protection; the first page is included in Appendix one – publications:

- Savelli CJ, Mateus C & Simpson, J. (2021). Exploring the Experiences of Members of the International Food Safety Authorities Network: An Interpretative Phenomenological Analysis. Journal of Food Protection. https://doi.org/10.4315/JFP-21-171

Table 19. Final themes identified in the analysis with brief illustrative quotes

Superordinate themes	Subthemes	Illustrative quotes	Source
Trust: Authenticity and reputation are drivers for the acceptance of information from the network	Secretariat as an authoritative voice	"INFOSAN, what it does, it offers messages at the right time. And the best thing about it, is that **we know that when we get information from INFOSAN, that it is authentic information**. So we don't have to worry about thinking that it may not be true or something like that. […] You get information first hand. That is the most important thing, because now I think we are living in a world where there is so much information and half of it is all wrong, and half of it we don't know – you can't simply distinguish the right information from the wrong information."	Hana, South Asia
	Members as gatekeepers to privileged information	"They know exactly why I'm asking the question, and **they will share their information instantly** and they'll give us, you know, analytical reports and there are no barriers there. And, you know, **they save us days of work** and that, that's just such a shining example of how things should work!"	Jessica, Pacific
	ICW as a safe space to exchange information	"It provides a **safe place for communicating**, sharing, asking questions and getting information."	Carlos, South America
Learning: International collaborations create valued opportunities for professional development and knowledge exchange among members	Knowledge transfer and exchange	"So we can **share our experience** and say – *You don't need to go through these steps, but these steps, and you can easily do this because we've tried that and it worked* – so, we can help them to help themselves, you know? To **prevent the mistakes** we made or **overcome the challenges** we faced."	Fatima, Middle East (Gulf)
	Professional development	"You start getting invited to the board meetings, the meetings you never could have gotten into before. Alright? You're like invisible and then all of a sudden, **everybody sees you as important**: *Oh, yes! We must have INFOSAN there. Yes!*"	Brianna, Caribbean
Health protection: Collective actions to safeguard the global food supply are seen as noble endeavours and worthy investments by members	Preventing foodborne illness	"Because of INFOSAN, we found the products and everything was destroyed for health reasons. […] You feel like the job is done, like you did your job, you know? And **you are protecting the people**. You are **protecting the consumers**."	Gabriel, Africa
	Improving food safety	"I feel very proud of this INFOSAN to help me, **improving food safety** in the country."	Izzy, East Asia
Sense of community: shared ownership for INFOSAN creates feelings of mutual respect and opportunities for collaboration within the network	Making global connections	"We are bridging with [a country in Europe], we are bridging with others – and this is a really important part that INFOSAN is doing – by harmonisation and **building more relationships between the members**. I think this is really one of the really excellent added values from having the INFOSAN meetings and from the INFOSAN network."	Elias, Middle East (Mediterranean)
	Membership as a multi-layered identity	"So in that way it has benefited in terms of **my experience**, or **our experience, country experience**. So I thought that was the most benefit thing: connecting people and gathering information"	Hana, South Asia
	Facilitating collaboration on projects	"INFOSAN is a critical part of how we operate and it's certainly a part of my job I love because I do get to talk to different people with different – from different countries and try to **resolve issues together**."	Jessica, Pacific
	Unifying a globally disparate group	"I love to be a member of INFOSAN. I feel that I belong – that I am a citizen of the world […] I like this idea of being a **citizen of the world** and INFOSAN gives me this – this feeling that I can discuss, if I have a problem, I can discuss it with someone else all over the world and find the answer for my question."	Dina, Europe
Potential: recognition of untapped potential is a significant motivating factor that leads members to lend time and energy to network activities	Barriers limit participation	"The most **important barrier** for me, it's our **food safety system**. Because I want to give INFOSAN more, but I can't do it because of our system – it's a **poor system**, you know?"	Gabriel, Africa
	Members as drivers of activities	"**More work has to come from the members**, because it's, it is a community for them and, it's not really relying on the Secretariat that, that will get us there. So I, I really do think that the members should have a larger role"	Amanda, North America
	Need for improvement	"I get the feeling that INFOSAN **has a lot of potential** that has not been fulfilled – that it's working below its potential."	Carlos, South America

4.3.1 Trust: Authenticity and reputation are drivers for the acceptance of information from the network

The INFOSAN Secretariat's reputation as a trustworthy provider of authentic information to network members was a significant driver for their acceptance of such information. As food safety regulators, many members were responsible for taking risk management decisions to protect public health and thus, acting on unambiguous, factual information was of the utmost importance. Participants' accounts of their experiences suggested a hierarchy of needs concerning food safety information with accuracy at the top, followed by other characteristics, including timeliness and completeness. Underpinning these needs was the inherent trust that members place in the INFOSAN Secretariat. There was also a recognition of the critical role that other trusted members played in information exchange as gatekeepers to privileged information, who could either allow or deny access based on a range of factors. Finally, the online INFOSAN Community Website's characterisation as a safe space to exchange information between members indicated the value members placed on security and a focus on getting messages right before taking them public. Overall, the concept of trust was a prominent theme mentioned in various ways by several participants across three sub-themes, as discussed below.

Firstly, many participants expressed how their experiences had led them to see the INFOSAN Secretariat as an authoritative voice, especially during situations when accurate information was needed urgently to communicate an acute food safety risk to the public. Hana from South-Asia expressed this sentiment in the following way: *"INFOSAN, what it does, it offers messages at the right time. And the best thing about it, is that we know that when we get information from INFOSAN, that it is authentic information. So we don't have to worry about thinking that it may not be true or something like that. […] You get information first hand. That is the most important thing, because now I think we are living in a world where there is so much information and half of it is all wrong, and half of it we don't know – you can't simply distinguish the right information from the wrong information".* Here, Hana revealed

that utilising information from the Secretariat could have alleviated some pressure that she may have faced when making risk management decisions in her own country. Jessica from the Pacific shared a similar view on the Secretariat's trusted reputation and said, *"the value is getting that information out there quickly, but on top of that, it's that, it's from the authority. For us to be able to say that, 'We've got this from INFOSAN which is a WHO/FAO network', is, is like gold because it means that we can demonstrate we're linking in correctly and we've got the global body of this involved and we're getting information from you".* Together, these accounts from Hana and Jessica exemplified an inherent trust of the INFOSAN Secretariat to provide accurate information that is justified because of the Secretariat's reputation.

Jessica elaborated further and explained that, *"it's about managing things in the most efficient way and as well, like, it's that rapid exchange for public health reasons but also these other drivers: that getting information from INFOSAN means that it's reputable and we can quote it, and it builds trust in what we're doing."* Carlos from South America shared similar sentiments with Hana and Jessica about the quality and trustworthiness of the INFOSAN Secretariat's information but suggested that the timeliness of information provided could be improved: *"I would rely on INFOSAN for good information, not necessarily being the first – you usually hear about it in the press – but the official information, the best quality information I've seen comes from INFOSAN."* He elaborated further and explained, "*Whenever I have a question that requires official information, I use that network to get that information".*

On the issue of timeliness, Jessica from the Pacific provided her understanding of why information sharing was sometimes "*a little bit slow*" when she said, *"I know it's because you [the INFOSAN Secretariat] are consulting with other countries so you're trying to get the message right before it comes out to us"*. Others expressed their trust in the INFOSAN Secretariat as an authoritative voice for issues beyond the context of food safety emergencies. For example, Amanda from North America stated, *"I will often go to the Secretariat if I have*

a big picture question of, of something that I don't know how it works in the world." She further shared her experience asking the Secretariat for advice on antimicrobial resistance as a food safety risk and using the response to broaden her perspective and validate her information, guiding policy decisions. Reflections from members have unveiled a hierarchy of information needs, whereby accuracy was of the utmost importance, followed by timeliness and completeness. Across nearly all the interviews, participants expressed their respect for the INFOSAN Secretariat as an authoritative voice that provided accurate information and emphasised the importance of trust in that experience.

Secondly, many participants explained how they saw other INFOSAN contact points in different agencies and countries as gatekeepers to privileged information that required sharing to inform risk management decisions by different agencies and in different countries. In such instances, these other network members were seen as trusted partners because of their shared membership in INFOSAN. For example, Hana from South Asia explained that *"gathering of information through the contact points which – I mean, food safety experts which we all have identified as well as WHO has identified – those are the things that helps us also to get the authentic information to help us with our work in our field. So in that way it has been helpful."* Here, Hana alluded to the value she placed in the time-saving that she experienced when sharing resources and other assets by reaching out to other network members.

Other participants also explained the necessity of relying on INFOSAN members to do their jobs and explained that building trust facilitated information sharing. For example, Fatima from the Middle East (Gulf) explained that *"certain information is really not available with me, in my organisation, so this is when I need to have other focal points, INFOSAN Focal Points, who are known to me in my country, so we can easily get the information and exchange it".* Fatima recognised the need for collaboration to address the multidisciplinary food safety issues, and suggested that only by engaging with other members to obtain required information, will response efforts be possible. Jessica from the Pacific shared her

experience of dealing with another trusted INFOSAN member, which meant saving precious time when trying to implement risk management measures to protect the public from unsafe food: *"They know exactly why I'm asking the question, and they will share their information instantly and they'll give us, you know, analytical reports and there are no barriers there. And, you know, they save us days of work and that, that's just such a shining example of how things should work!"*. In her reflection, Jessica suggested the consequences of interactions where communication is not open and easy, including potential time delays in implementing risk management measures to protect public health.

Thirdly, nearly all participants described past experiences using the ICW as a safe space to exchange information with other trusted members and the Secretariat. Their stories highlighted the value in getting messages right before taking them public and the benefit of discussing such messages in a secure environment before doing so. When he spoke about the ICW, Carlos from South America expressed this idea succinctly when he said, *"It provides a safe place for communicating, sharing, asking questions and getting information"*.

Other participants elaborated on this idea, explaining why using the ICW has been meaningful for them by enabling them to get their questions answered by either the Secretariat or other members alike. Gabriel from Africa appreciated the ICW because *"it's a mechanism that allowed all the Focal Points to be together and to work – and to use this website – work together. Yeah, everyone's in their country, but we can still work together, because of the website*. Here, Gabriel emphasised the value in gaining outside perspectives from his colleagues in other countries and pooling information from experts worldwide to solve problems. Izzy from East Asia shared this sentiment and said, *"you just go to the discussion forum and you put your issue and then you will be there right away and then you can get the answer or information will be given to you"*.

Other members had similar experiences and emphasised the practical use of the various tools on the ICW (such as the synchronous chat function) to communicate directly with other

members or the Secretariat in real-time to get information about a food safety issue of concern. For example, Gabriel from Africa explained that *"If you go to the website, you will see all these new notifications, everything is updated, and, and when you have to receive notification, we receive it. So for me, I think it's here – the most important thing is that you can talk with them anytime, because you have this chat window."* In these reflections, members alluded to the importance of the human connection despite virtual connectivity and the value in direct access to support, which may all contribute to strengthening relationships and building trust.

Brianna from the Caribbean emphasised the importance of the ICW as a repository of resources that good-intentioned members from around the world have shared: *"I can go on my INFOSAN Community Website, I can check to see if there's an alert or notification about various food items, because these organisations, they come from all over the globe! They're coming to help you! […] On the website you are also provided with the topics that are in the discussions that are needed to get your own national emergency food plan in place, your own authorities in place. There's excellent guidance"*.

Overall, all participants expressed the importance of trust as a factor to facilitate information exchange between members and the Secretariat, and the critical role of the ICW as a safe, trusted and practical tool for sharing important food safety information. This is so important because, in practical terms, it meant members felt confident in carrying out their national responsibilities using authentically sourced information.

4.3.2 Learning: International collaborations create valued opportunities for professional development and knowledge exchange among members

The opportunities for learning that existed for collaborating INFOSAN members were valued aspects of participation in network activities. Because members hailed from all parts of the world, representing countries from the least to the most developed, each brought with them a unique range of experiences from which others could have learned. As a result, many

participants alluded to the value in transferring and exchanging knowledge related to food safety and public health between INFOSAN members. In this way, participants also suggested the importance of mapping knowledge, identifying gaps and filling them through the pooling of assets and resources. In addition, participants explained how participation in INFOSAN had enabled their professional development and suggested that certain experiences had been responsible for a range of workplace benefits, including increased visibility and respect. Overall, the idea that INFOSAN served as a learning device in different ways was a prominent theme that numerous participants expressed across two subthemes, as discussed below.

Firstly, the stories shared by participants illuminated several different ways in which they value interacting with and learning from other network members, specifically in the context of knowledge transfer and exchange (KTE) as it relates to food safety and public health. In this context, KTE is understood as referring to the dynamic and iterative process of synthesis, dissemination, exchange and application of knowledge to inform policy and practice in these sectors (Rajić & Young, 2013). Elias from the Middle East (Mediterranean) expressed this succinctly when he said, *"There is value in contacting the other members from the other countries. And learning from them. And exchanging with them, their expertise and experience. This is very important."* In this sense, many members found value in understanding how other members, often in other countries, solved a problem or addressed a specific food safety issue so that lessons learned elsewhere could be applied in a local context. Izzy from East Asia expressed this clearly when she said, *"When they have done a very good practice in another country, we can share experiences and then we can learn from them – especially because the same case may happen here and people do things differently and maybe things can be done more effectively and then less costly, for example."* Here, Izzy suggested that pooling knowledge and expertise can be an effective strategy to save and money and eventually save lives.

There was a clear sense of importance articulated by participants concerning communicating shared experiences with one another. Fatima from the Middle East (Gulf) expressed this sentiment and emphasised that exchanging knowledge between members resulted in learning that can be applied to solve problems: *"we can share our experience and say – 'You don't need to go through these steps, but these steps, and you can easily do this because we've tried that and it worked' – so, we can help them to help themselves, you know? To prevent the mistakes we made or overcome the challenges we faced."* In her account, Fatima expressed a kind of altruism that seemed to be a common characteristic of many participants who had a desire to learn and a willingness to help others.

Secondly, several participants explained how participating in INFOSAN had enabled them to learn and grow in ways that contributed to their professional development, such as training, new job assignments, increased duties and responsibilities and improved job performance. As such, many members revealed how they had professional experiences because of INFOSAN that they would not have otherwise had if they were not network members. Gabriel from Africa explained how he had been learning and developing professionally since joining the network: *"I was selected to be the Focal Point and then I participated in the Listeria food alert management activities, and then [the Secretariat] sent the invitation for the second global meeting, and I got all this training, these training opportunities, and received all the documents, as well, about food safety. So I think it's allowed me to grow professionally"*. Here, Gabriel demonstrated how he valued the opportunities that participation in the network brought him that he would not have otherwise experienced.

Brianna from the Caribbean explained that being designated as a member of INFOSAN in her country was a great source of pride for her and significantly raised her professional profile among her colleagues: *"You start getting invited to the board meetings, the meetings you never could have gotten into before. Alright? You're like invisible and then all of a sudden, everybody sees you as important, 'Oh, yes! We must have INFOSAN there. Yes!'"*. In this

case, Brianna saw INFOSAN as a kind of badge of honour that, when worn, denoted a certain status among her peers and colleagues.

Dina from Europe recounted some inspiring interactions with other INFOSAN members that had impacted her ways of thinking and helped her develop a new perspective to address existing problems in her work, including during her participation in the second global meeting of INFOSAN members in 2019. In this context, she explained that "*the meeting was really interesting, and it made us, you know, open a little bit our minds and think in a different way."* She elaborated and exclaimed, "*Oh, I learned a lot! For me as a person, I learned a lot! It's great because you have all these top experts that completely made inputs inside my head."* For Dina, participation in INFOSAN activities was valuable because it provided an opportunity for departure from ordinary daily tasks and the chance to become stimulated by external ideas. This held importance because it could have meant being able to solve problems or address challenges in ways that had not previously been tried.

Other members also expressed how participation in INFOSAN had inspired professional development. For example, Elias in the Middle East (Mediterranean) explained that, *"Honestly speaking, this is an enriching experience, and it is an area where we can develop and I really believe this experience makes you more enthusiastic to do more in the global, or in the regional, level. This is excellent in fact, this is a good experience!"* Here, Elias alluded to the notion that members' actions locally can significantly impact on a larger scale and with a multiplying effect. For Amanda in North America, participation in INFOSAN helped her professional development by enabling her to do her job "*better, faster and in a more efficient way*" and was an idea shared by others, including Jessica from the Pacific who emphatically stated, "*I would hate to be doing this job without INFOSAN*". For both Amanda and Jessica, participation in INFOSAN became a kind of supporting apparatus that had improved the ways they did their jobs and revealed the importance they placed on efficiency in a professional context.

Overall, participants' stories about their experiences with INFOSAN leading to KTE and professional development indicated that learning from one another was a valuable part of their participation that was meaningful to many of them.

4.3.3 Health protection: Collective actions to safeguard the global food supply are seen as noble endeavours and worthy investments by members

For many participants, engagement with INFOSAN was understood as a principled way to contribute to the safety of their national food supply. In addition, participants expressed the pride they felt as network members, believing that membership represented an investment to protect their fellow citizens' health. Furthermore, the recognition of INFOSAN as a mechanism that enabled collective actions to bolster the global food supply appeared to be a significant motivating factor for participants to engage in network activities. As such, the utilisation of INFOSAN as a health protection tool to enhance various aspects of food safety and prevent outbreaks of foodborne illness was a theme that was expressed clearly by all participants and considered to fall within two subthemes, described below.

Firstly, all participants recounted various stories about how their engagement with INFOSAN had improved food safety. Several participants recounted how they applied various technical information received through INFOSAN to improve their national food safety systems or other processes and procedures to enhance coordination efforts related to food safety event response. For example, when speaking about various guidance documents shared through INFOSAN, Gabriel from Africa explained that *"all these documents support us to build a lot of tools that we need right now. So, it, it's very important – important to create food safety tools, to manage food alerts, for example."* For Gabriel, INFOSAN was supplying him with the building blocks to bolster a food safety system that was still under development in his country. As such, participating in INFOSAN to improve food safety appeared to be a primary motivating factor for many participants. This motivation was also articulated clearly by Elias from the Middle East (Mediterranean), who explained, *"My motivation, you know, is always*

that we need to enhance the food safety level in the area. This is the major goal for everybody: we need the food safety to be better. Every time – for the Middle East countries – it's hard, you know? You don't want always to be at the end of the line". Here, Elias also suggested that an essential factor for participating in INFOSAN was to improve certain aspects of development for his country and region where others lagged behind amidst a range of complex challenges. In addition, he revealed his sense of responsibility to make a difference within and beyond his community by improving food safety.

Fatima from the Middle East (Gulf) explained the significance of her participation in INFOSAN as a way to ensure that her national food supply was safe: *"being a country importing more than 90% of its food, receiving certain notifications to help me make sure that food entering my country is safe – I mean, it's a necessity to me. So it has a great impact"*. Fatima's engagement with INFOSAN represented a professional investment in bolstering the safety of her national food supply. Other participants expressed a sense of pride over the fact that they had some responsibility for improving food safety in their respective countries and had been doing so with the support of INFOSAN. For example, Brianna from the Caribbean received support from the INFOSAN Secretariat to address various food safety concerns in her country and was emphatic when she exclaimed that *"to be able to work during this time* [during the COVID19 pandemic] *and still hold down food safety concerns, with INFOSAN guiding me and holding my hand, I can't fail at it"*. For Brianna, she credited her status as an INFOSAN member for enabling her to carry on her duties related to food safety when other colleagues have been deployed to pandemic response teams. Furthermore, she revealed the high degree of faith she placed in the INFOSAN Secretariat as a guiding hand that supported her efforts to ensure food safety in her country.

Izzy from East Asia succinctly expressed the meaningful impact that participating in INFOSAN had made when she said, *"I feel very proud of this INFOSAN to help me, improving food safety in the country"*. For Izzy, her motivation for engagement in network

activities was rooted in her understanding that participation would lead to a safer food supply in her country.

Secondly, all participants described how participation in INFOSAN had prevented foodborne illness cases in their respective countries. It logically follows that by improving the safety of the food supply, foodborne illnesses would be prevented, but the degree to which this happens is often challenging to measure, and several participants expressed this conundrum. Amanda from North America articulated this point clearly when explaining the difficulty in quantifying the reduction in national foodborne illness cases due to the implementation of risk management measures during an outbreak (e.g. removing contaminated food from the market): *"It's very difficult to prove the negative like that. And, and I think that it's probably the same thing for INFOSAN: How many lives have we saved? For sure some. Can I quantify it? No. But I think that we can take faster actions and just by the fact that we're doing something quicker, in terms of risk management action or decision, I think that ultimately that saves – that saves something in terms of public health![…] It's faster information and faster reaction. It allows us to make risk management decisions faster."* In her explanation, Amanda suggests that while difficult to measure, there is a public health benefit to participation in INFOSAN and alludes to the value of prevention and proactivity rather than reactivity.

The idea of being able to implement risk management measures quickly because of information received through INFOSAN was echoed by other participants, including Gabriel from Africa, who explained his actions during an international outbreak of listeriosis: *"Because of INFOSAN, we found the products and everything was destroyed for health reasons"*. He continued and explained his feelings at the time: *"You feel like the job is done, like you did your job, you know? And you are protecting the people. You are protecting the consumers."* Here, Gabriel revealed his sense of duty to protect his fellow citizens and his appreciation for INFOSAN as a source of information to help him do so.

Similarly, Jessica from the Pacific explained the impact that engagement with INFOSAN had on her ability to protect consumers in her country: *"We can action recalls more promptly and it's fair to say we're probably actioning more recalls because of the information we're seeing, knowing that we have tools available to us to get the information in a prompt manner. So, at the end of the day, we are managing to get unsafe food away from consumers more often and more, more rapidly."* In her reflections, Jessica emphasised the importance of timeliness with respect to food safety decision-making. Food moves quickly from one country to another, and she recognised that communication between countries should move faster in situations where unsafe food needs to be kept away from consumers. Jessica further elaborated and emphasised an important perspective shared by other participants about being able to rely on INFOSAN for scientific information, free from political influence: *"I don't know how else we'd be able to operate without INFOSAN on those things [*international food safety events*]. It would be a very long process and very political process without INFOSAN. So I think that's part of the value, it's, you know, it's removing the politics and it's just purely keeping it about food safety information from a reputable source"*. Here, Jessica referred to the necessity for independent, science-based decision making and the importance of neutrality when conducting risk assessments and implementing risk management decisions. Food safety emergencies can have significant financial and reputational consequences, and Jessica alluded to the need for decisions to be apolitical to remain health-focused.

Overall, participants' experiences relying on INFOSAN as a health protection tool to improve food safety and prevent foodborne illness were articulated clearly by all participants and indicated as significant motivating factors for participation in this international network.

4.3.4 Sense of community: shared ownership for INFOSAN creates feelings of mutual respect and opportunities for collaboration within the network

Participants' accounts suggested several ways the network operated to build a sense of community by fostering mutual respect among members and facilitating collaboration

opportunities to reach common goals. An important aspect of community revealed by many participants related to the global connectivity afforded by network membership. In addition, many participants revealed ways in which membership formed a part of their identity as professionals, spokespersons of their national agencies, and representatives of their respective countries, which had implications for how they engaged in network activities. Because of a shared domain of interest, collaborating on projects was a valued membership outcome that many participants articulated. In addition, several participants revealed how the network functioned to unify a globally disparate group and the positive outcomes that resulted. The idea that INFOSAN worked to strengthen the sense of community among members worldwide and facilitated collaboration between them was thus another theme that was powerfully conveyed through participants' experiences and expressed across four subthemes, described below.

Firstly, nearly all participants talked about making global connections with other members as a valuable experience. The idea of connectedness was discussed by several participants in the context of quickly identifying points of contact when urgent information related to a food safety emergency was required from regulatory authorities abroad. The aspect of time-saving was echoed by several participants and articulated by Carlos from South America when he said, *"The value I've seen – and I've seen it, I've used it – it's the ability to easily connect, worldwide, to a network of experts in the food safety arena that is predetermined. I mean, I don't have to set up my network based on my contacts. It's all in there in the network"*. Brianna also expressed her appreciation for the ease with which she had made global connections through INFOSAN: *"The connections that INFOSAN has is – wow! You know? I mean, you get in contact with Focal Points around the globe in record time, and to me, that is remarkable!"*. In the reflections from Carlos and Brianna, both alluded to the value they placed in the network because of the time-saving component; when they needed information, they knew where to get it because of INFOSAN, even if it required communicating with someone on another continent.

Several participants expressed the critical role that INFOSAN played in making international connections, and in several cases, between countries that would have never otherwise been in touch. Elias from the Middle East (Mediterranean) explained that he had connected with multiple members from different countries outside of his region, and "*this is a really important part that INFOSAN is doing – by harmonisation and building more relationships between the members. I think this is really one of the really excellent added values from having the INFOSAN meetings and from the INFOSAN network"*. Here, Elias emphasised the value he placed on learning from others with different perspectives and the respect for and value in diversity that existed among the INFOSAN membership.

Secondly, participants articulated their experiences as members of INFOSAN in a way that highlighted membership as a shared identity. For Gabriel from Africa, INFOSAN membership made him feel as though he was *"a part of something important to the world"*, and other members expressed a similar sentiment. Here, Gabriel also revealed his altruistic motivations for participation and commitment to making positive contributions to society to improve food safety. Interestingly, many members shared their experiences in a way that uncovered membership as not just a personal identity but one with multiple layers. For example, when talking about how she had used INFOSAN to obtain microbial test kits, Hana from South Asia said that engaging through INFOSAN *"has benefited in terms of my experience, or our experience, country experience. So I thought that was the most benefit thing: connecting people and gathering information"*. Here she spoke about her experience from the personal level, the organisational level and the national level. This kind of response was typical of many participants who saw themselves as a personal representative to the network and also as a representative of their organisation and their entire country.

The idea of identity across these multiple levels was also revealed by Fatima from the Middle East (Gulf) when she explained that, *"as an organisation, I'm working with INFOSAN to prevent any food safety incidents that will challenge the food safety in my country. So to me, it*

gives a greater value to my organisation. I'm a safeguard for my country as I work with and collaborate with INFOSAN. To me I'm protecting my country, my fellow citizens and making sure that nothing harmful happens to them which I'm aware of or I'm supposed to be aware of in regards to food safety. So to me it's a very noble contribution personally and at the level of my organisation". Here, Fatima expressed the sense of responsibility she felt for protecting the health of fellow citizens at a personal level as well as on behalf of her organisation.

Thirdly, many participants explained that membership to INFOSAN had facilitated essential collaboration during incident response activities or on projects with members from other agencies or countries. These reflections demonstrated the value that members ascribed to international engagement and consideration of outside perspectives to solve work-related problems. For example, Jessica from the Pacific explained that *"INFOSAN is a critical part of how we operate and it's certainly a part of my job I love because I do get to talk to different people with different – from different countries and try to resolve issues together."* Her perspective of enjoying and finding it a valuable experience to collaborate with members from other countries to solve problems was shared by other participants and something that appeared to grow stronger over time when members got to know each other better. Brianna from the Caribbean explained this clearly when she said, *"Through all of the recalls, the alerts and notifications, the online sessions, the face-to-face meetings, we really have created that level of communication that is beyond just the basics: we now can share information and feel comfortable and confident when we're sharing that information"*. Here, Brianna alluded to the idea that building the community takes time and investment, but that eventually, the investment paid off in the form of easy and effective communication between members. This comfort level often appeared to grow out of interactions during international food safety event responses, which built trust and facilitated collaborative work in different contexts.

Amanda from North America explained that after liaising with INFOSAN members during an international food safety event, it *"led to joint publications between countries"* and also for

two organisations to *"jointly plan surveillance"* activities which proved greatly valuable to manage the specific risk under consideration and save time on conducting preliminary research. Amanda from North America also credited INFOSAN with connecting her to colleagues in Europe to discuss emerging food safety issues. This connection then "*led to further collaboration on methodologies, collaborations on sharing results, on the design and best practices, and it made it more productive for us in the end, and this is still ongoing as we're still exchanging with additional countries every year"*. Amanda's reflections revealed that collaboration with other network members were highly valued and evolve over time.

Fourthly, many members provided examples of experiences that suggested the network had a significant role in unifying the globally disparate membership. This unifying influence was undoubtedly facilitated by the shared identity and collaboration on projects. However, members also indicated that INFOSAN membership created a sense of equality between all members that was not always present in other settings, yet greatly appreciated. This sense of equality was most colourfully articulated with a metaphor from Brianna, who explained her delight when meeting other INFOSAN members: *"We get to sit down around the round table – we're like Knights of the Round Table – and we're able to have that discussion face-to-face. It makes it more personal."*

The idea that everyone was coming together, united and working towards a common goal was expressed by others, including Gabriel from Africa, who said that INFOSAN is *"a very important network because you are bringing all the countries together for the same cause. And, I think it's important as well to harmonise, you know? Harmonise knowledge and share experiences. It's very important"*. In his reflection, Gabriel suggested that knowledge was a public good that holds great benefits when shared. Dina from Europe said something similar: *"I love to be a member of INFOSAN. I feel that I belong – that I am a citizen of the world"* She later continued and explained, *"I like this idea of being a citizen of the world and INFOSAN gives me this – this feeling that I can discuss, if I have a problem, I can discuss it*

with someone else all over the world and find the answer for my question". Here, Dina revealed that finding a sense of belonging was a motivating factor for participation in INFOSAN that facilitated knowledge exchange with other members.

Overall, the sense of community that members have been building with each other was a crucial and valuable membership component. Initial connections have grown into long-lasting relationships and respected professional collaborations that have united members to achieve common goals that safeguard the global food supply and prevent foodborne illness.

4.3.5 Potential: recognition of untapped potential is a significant motivating factor that leads members to lend time and energy to network activities

For many participants, different barriers existed that limited their participation in INFOSAN activities or prevented their engagement from increasing to personally desired levels. Participants' accounts revealed how barriers can be overcome, suggesting certain enabling factors at the individual, organisational and national levels. Through their reflections, many participants recognised the need for members to take a more active role in driving activities and seemed to embody a sense of ownership for INFOSAN successes and failures. A desire to cultivate the untapped potential of the network appeared to be a significant motivating factor that leads members to invest their time in INFOSAN activities. Overall, all members shared experiences that unveiled the vast potential of INFOSAN that had yet to be cultivated or fully exploited and related to three subthemes described below.

Firstly, all members described a range of situations that previously created barriers that limited active participation and engagement in INFOSAN activities. Lack of coordination between agencies at the national level within one's own country was a barrier that several participants discussed as one of the main problems. Dina from Europe explained that *"the coordination between the agencies within the country: it's the worst possible thing. It's so easy to coordinate with others outside, but is not really easy at all to coordinate within the country, so this really sometimes is one thing that blocks it [participation in INFOSAN]."*

Carlos from South America also expressed frustration as he described his failed attempts to coordinate with other INFOSAN members in his own country despite his best efforts: *"I would like as a country to be more coordinated, I've tried to do it, but I have not been successful. I don't get answers to my questions. I don't get replies to my emails. I don't get reactions to my comments"*. The exasperation expressed by Carlos and Dina illustrated the frustration each felt as they attempted to tap into the potential benefits of INFOSAN that others in their respective countries had perhaps not seen yet.

Lack of prioritisation of INFOSAN activities in the face of limited time was another barrier that was mentioned by multiple members and articulated by Hana from South Asia: *"We are all tied up! Tied up with our own work, no? We hardly have time to go to log in – too much information online, I mean, so many emails, so many group chats, so many – I mean, groups, and all, no? So, overload of information"*. Here, Hana suggested that despite her best intentions, she was restrained and could only offer so much in the face of competing priorities.

Other participants discussed the lack of food safety technical capacities as a significant barrier to participation, despite their willingness to participate. For example, Gabriel from Africa explained that "*the most important barrier for me, it's our food safety system. Because I want to give INFOSAN more, but I can't do it because of our system – it's a poor system, you know?"*. Another barrier described by several participants was the lack of individual members' authority to provide information outside of their organisation. As Elias from the Middle East (Mediterranean) explained, *"the main challenge is authority: Not every organisation has the authority to tell information. They need, maybe, approvals from other players in the government. And this is really something that can interfere with the way of approval"*. Here Elias alluded to the consequences that could arise when high-level government buy-in has not been obtained, thus leaving members without the autonomy to make their own decisions regarding information-sharing.

Some participants felt they had succeeded in overcoming many of the barriers that previously existed by improving national coordination, embedding engagement with INFOSAN into standard operating procedures, and doing so with the high-level political buy-in from organisational authority figures. For example, Jessica from the Pacific explained that engagement in INFOSAN came from *"building confidence and making INFOSAN the norm, rather than only for the big events, you know? […] I think all of those things have led to that, and just making it day-to-day, rather than doing it once a year."* Here, Jessica revealed the importance of normalising the use of INFOSAN in order to embed it within organisational procedures to ensure sustainable use and gain high-level support. Similarly, Brianna from the Caribbean emphasised the importance of getting high-level support to enable participation in INFOSAN and explained that her *"country depends on the, the political buy-in, so if the politicians are not buying in, we don't have the support – we have the support!*

For Amanda from North America, she acknowledged the absence of certain barriers on account of such enabling factors already being in place: *"I'm lucky I'm from one of the countries that is privileged and we have a good food safety system, and I have support from around me, and we have good communications among the country to use it [INFOSAN]. So, for me, or for the members in my country, I think that it's much easier than it might be for others. I also don't have challenges with technology and getting Internet access or things like that"*. In her case, Amanda's level of engagement with INFOSAN had become a matter of personal interest since other barriers at the organisational or national level did not exist.

Secondly, many participants acknowledged their potential to improve engagement in INFOSAN and the critical role of members as drivers of these activities. Speaking about her experience interacting with other members, Amanda from North America explained that, "*More work has to come from the members, because it's a community for them and, it's not really relying on the Secretariat that will get us there. So I really do think that the members should have a larger role"*. Carlos from South America shared a similar sentiment: *"It's more*

related to what member countries can do than what the Secretariat can do. I've seen that the Secretariat does what it can, but at the end, it's up to the members to be engaged in INFOSAN". Both Amanda and Carlos revealed their desire for the INFOSAN network to become more member-driven with the Secretariat playing a supportive and facilitating role. Reflecting on her lack of engagement, Fatima from the Middle East (Gulf) explained her need to take ownership for driving activities forward: *"I started being aware of my roles and responsibilities, yet, I need to, you know, work harder, to strengthen my, my relation with other INFOSAN members. I'm still at the beginning. I'm starting with my baby steps. I'm not at all an active member, honestly. So my experience, I will summarise it as, I need to work harder on my membership"*. Fatima illustrated the evolution of membership as a process that takes time, not a status that changes immediately from one day to the next.

Other members acknowledged the critical role they need to play but expressed some frustration or regret because they had not invested more effort in their participation. For example, Amanda from North America said, *"I wish I could sometimes do more*", Jessica from the Pacific said, *"I wish I had more time to do more things"*, and Dina from Europe said that she had *"goodwill to do more and more stuff for INFOSAN"* but she was challenged, and "*the main issue is time"*. The perception by multiple members of a lack of time for engagement appeared routed in a lack of prioritisation of INFOSAN activities.

Thirdly, all members acknowledged various aspects of INFOSAN that required improvement to realise the network's full potential. Carlos from South America expressed this succinctly when he said, *"I get the feeling that INFOSAN has a lot of potential that has not been fulfilled – that it's working below its potential"*. Several members explained that they would appreciate more INFOSAN activities related to sharing information on important food safety issues of global interest and promoting partnerships and collaboration between countries. Amanda from North America explained the opportunities for more activities to be delivered concerning those two dimensions and suggested that INFOSAN is *"a gold mine that you can*

still tap with the members". The potential to uncover more valuable experiences in the future appeared to be a strong motivating factor for continued engagement. Speaking about practical enhancements that could be made to improve experiences as an INFOSAN member, Elias from the Middle East (Mediterranean) explained that, *"sometimes it's not just easy to get the information that you want and I believe the website [ICW] needs to be upgraded, and also the members themselves need to be enhanced and need to contribute"*. He explained that when other members did not engage actively during a food safety crisis and share information promptly, it was " *really affecting the value of the system"*. Here, Elias revealed his feelings that everyone has a role to play in supporting each other in the network; in a globally connected food supply system, information systems need to be globally connected too.

Overall, all participants have explained the various barriers they faced and how they limit participation, and many spoke emphatically about how the coordination between agencies within their own country was one of the most significant barriers. Many participants also offered some critical enabling factors that help to overcome existing barriers, including building INFOSAN engagement into daily standard operating procedures to increase personal experience with the network, improve technical food safety capacities at the organisational level, and ensure high-level political buy-in at the national level to foster interagency coordination. Participants also recognised that members have a significant role to play to improve various aspects of INFOSAN in order for the network to reach its full potential. Finally, participants suggested that their recognition of untapped potential within INFOSAN was a significant motivating factor for their engagement in the network.

Chapter five – Discussion[9]

The overall aim of this study was to explore and describe the experiences of INFOSAN members with respect to their participation in network activities as a means to improve global food safety and prevent foodborne illness. To articulate the ways in which this aim has been addressed, this chapter begins with a discussion of the structuring characteristics of INFOSAN that were determined by integrating the results of all three phases of this study and characterised according to the community of practice qualities proposed by Dubé et al. (2006) including, demographics, organisational context, membership characteristics and technological environment. The remaining sections provide answers to the main research questions and discuss how the ICW is being used to support the network activities and how it could be improved, the main barriers to active participation in INFOSAN, the perceived impact of participation in INFOSAN on foodborne illnesses; and how participation in INFOSAN might create value for members. Implications for practice are also presented in this chapter, and recommendations on how the INFOSAN Secretariat could further strengthen the network, support members' active participation, and create value are made. The fact that large proportions of survey respondents were ambivalent with respect to several critical factors, such as trust, is also discussed along with the study limitations.

[9] Some of the sections in Chapter five are derived from constituent papers of this research, already mentioned above; the first page of each publication is included in Appendix one – publications:

- Savelli CJ & Mateus C. (2020) Looking Inside the International Food Safety Authorities Network Community Website. Journal of Food Protection, 83(11), 1889-1899. https://doi.org/10.4315/JFP-20-193
- Savelli CJ & Mateus C. (2021). Exploring the International Food Safety Authorities Network as a Community of Practice: Results from a Global Survey of Network Members. Journal of Food Protection. 84(2), 262–274. https://doi.org/10.4315/JFP-20-313
- Savelli CJ, Mateus C & Simpson, J. (2021). Exploring the Experiences of Members of the International Food Safety Authorities Network: An Interpretative Phenomenological Analysis. Journal of Food Protection. https://doi.org/10.4315/JFP-21-171

5.1. INFOSAN's structuring characteristics as a community of practice

Demographics. The orientation of INFOSAN is operational, focusing on helping members answer questions and find information to solve problems daily. The lifespan is indeterminant but has been created as a permanent community and will continue to provide an ongoing information-sharing mechanism. INFOSAN is a mature community of practice that has moved from a coalescing stage when it was initially launched in 2004 through a maturing stage when INFOSAN has developed a stronger sense of itself into a stewardship phase. Maturation is evidenced by a large number of members (about two thirds) feeling a strong sense of loyalty and belonging to the community. Previous research into participation in virtual communities of practice has shown that fostering a sense of belonging among members is an important motivational factor (Ardichvili, 2008).

Just over half of respondents have indicated that network members trust each other and have reported that a lack of trust is not a barrier to participation in INFOSAN activities for more than a few members. However, nearly half of respondents expressed ambivalence regarding trust among the membership, indicating a significant group of members for whom trust has not yet been built. Building trust among any collaborators is an important social process that has been widely accepted as a prerequisite to effective cooperation (Wang & Ahmed, 2003) and specifically as an antecedent to knowledge sharing in virtual communities of practice (Usoro et al., 2007). Following the Global meeting of INFOSAN members in 2019 (the first such meeting in nearly a decade and only the second ever), as well as the publication of the INFOSAN Strategic Plan for 2020-2025 (the first-ever strategic plan for INFOSAN), INFOSAN as a community of practice is sitting firmly in the stewardship phase and will require stalwart leadership from the Secretariat to sustain momentum.

Organisation context. The creation of INFOSAN was intentional, as opposed to spontaneous, following requests by the Member States at the World Health Assembly (Savelli et al., 2019), but sharing and learning within a community cannot be legislated into existence.

As many INFOSAN members report being only occasionally active in network activities, it emphasises the need for greater facilitation efforts of intentionally created communities than those that form spontaneously (Schwen & Hara, 2003). INFOSAN, like other communities of practice, has the function of promoting collaboration among members. INFOSAN membership crosses boundaries across sectors and countries, and so boundary crossing can be described as high. Despite this, INFOSAN has managed to maintain a certain degree of trust and knowledge sharing, which can be challenging in communities with a high level of boundary-crossing (Wenger et al., 2002).

The environment that INFOSAN operates in can be described as facilitating rather than obstructive. While different members have reported facing various barriers to participation that can be obstructive, the Secretariat is meant to play a facilitating role, acknowledging individual member contexts and supporting each one according to specific needs and requirements. Organisational slack can be considered high, meaning that the INFOSAN Secretariat has the general availability of tangible and intangible resources, including human and financial resources. High organisational slack can enable experimentation and exploration of new ideas within communities of practice (Dubé et al., 2006), and INFOSAN members are encouraged to drive new initiatives they feel would be of benefit to the broader membership.

INFOSAN has a high degree of institutionalised formalism, and the Codex Alimentarius Commission (CAC) revised the ‘Principles and Guidelines for the Exchange of Information in Food Safety Emergency Situations (CAC/GL 19-1995)’ in 2016 to make appropriate references to INFOSAN (FAO/WHO, 2016b). This important revision, endorsed by all CAC members, has further formalised the global mandate of INFOSAN and the important and internationally recognised role that INFOSAN should play in the rapid exchange of information between countries during food safety emergencies. In addition, since the International Health Regulations (IHR), came into force in 2007, INFOSAN has been recognised as a fundamental tool to assist countries in developing the core capacities required

for food safety emergency preparedness and response as described in chapter one. Improved institutionalism provides INFOSAN with legitimacy and may help explain why INFOSAN has a good reputation in most members' organisations, according to the results from phase two. Leadership within INFOSAN is clearly structured, with most operational functions coordinated by the INFOSAN Secretariat at WHO (FAO/WHO, 2019).

In addition, member roles and responsibilities are defined (FAO/WHO, 2015) and made clear upon formal designation by representative government agencies. As INFOSAN is meant to be a member-driven network, new leadership roles may emerge among members over time, helping to spur engagement and accountability (Antonacci et al., 2017). This may also help justify the time spent working on INFOSAN activities, which may be especially important for the large group of members who desired more time to spend on such activities.

Membership characteristics. With more than 600 members registered in 2020, the size of INFOSAN as a community of practice can be considered large (Wenger et al., 2002). Large communities of practices often comprise a core group of very active users who regularly contribute new information and ideas and others whose engagement is more passive (Wenger & Snyder, 2000). In virtual communities of practice such as INFOSAN, the passive participants are known as 'lurkers' and often comprise the largest group of community members (Sun et al., 2014). This is indeed the case with INFOSAN, as demonstrated by ICW-access data reported for study phase one, which show only a limited number of active members and results from this survey whereby the majority of members report being only occasionally active. However, nearly all respondents indicated that participation in INFOSAN has been a valuable experience (despite many being passive participants), which is consistent with other research to suggest that such peripheral members found value in their lurking activities (McDermott, 2001).

The geographic dispersion of INFOSAN is necessarily high and, as such, most members have not participated in face-to-face meetings. In this case, the reliance on the INFOSAN

Community Website is of utmost importance to facilitate asynchronous communications given membership across different time zones. High geographic dispersion also indicates a high degree of cultural diversity which should be considered when engaging INFOSAN members in network activities. Membership at the individual level is closed and reserved for those officially designated on behalf of national authorities, however, it is open to all 194 Member States. While membership enrolment is voluntary, it is strongly encouraged given the formalisation of INFOSAN with CAC and IHR and members are expected to fulfil their roles and responsibilities once designated. As membership is voluntary, it is perhaps not surprising that nearly all respondents have indicated that they like being a member of INFOSAN. Previous research has shown that in communities of practice, members who volunteer are generally more motivated to participate than conscripted members (Dubé et al., 2006). Membership to INFOSAN has been steadily growing each year (by an average of 52 new members per year from 2013-2019.

At the time of phase one of this study, the average INFOSAN member had been registered on the INFOSAN Community Website for three years and ten months. For Emergency Contact Points, the average was four years and five months, and for Focal Points, the average was three years and six months. INFOSAN members registered on the INFOSAN Community Website in 2012 represented the largest group. A growing membership has implications for the INFOSAN Secretariat regarding the considerable energy devoted to helping new members understand their role in the Network. Existing members also play an important role here, and results from the survey indicate that most INFOSAN members assign at least some degree of importance to helping out new members as a reason for participating in INFOSAN activities.

Members' information and communication technology (ITC)-literacy appears quite high considering that the majority of respondents are using the internet to find information and report that email is a more frequent mode of communication between members compared to the telephone or in-person meetings and many members report participation in virtual

meetings (i.e. webinars) organised by the INFOSAN Secretariat. In terms of cultural diversity, membership is quite heterogenous, coming from hundreds of different agencies, in 190 countries, speaking dozens of different languages, and from various professional backgrounds. While unified around a common goal of preventing foodborne illness and improving food safety, the membership's heterogenous nature may help explain the relatively low levels of engagement reported among a large group of members. While cultural heterogeneity can be considered an asset by bringing rich and varied perspectives and experiences, past research has also revealed that it can make information sharing difficult (Pan & Leidner, 2003). The INFOSAN Secretariat must carefully consider such cultural differences when delivering key messages through the network to ensure that misinterpretations or distortions are limited.

Finally, the topic's relevance to members can be considered high as nearly all members report learning about their subject area to some extent and the majority agree that one of the most important things that happens in INFOSAN is that members find solutions to problems in their work. Past research has shown that fostering engagement, developing commitment and creating and sustaining motivation in communities of practice are all done more readily when members focus on problems that are related to their work (Wenger & Snyder, 2000). The most important reasons for participating in INFOSAN were, reportedly, to improve the safety of the food supply and to prevent foodborne diseases, aligning well with the overall mission of INFOSAN, which is to halt the international spread of contaminated food, prevent foodborne disease outbreaks, and strengthen food safety systems globally to reduce the burden of foodborne diseases (FAO/WHO, 2019).

Technological environment. The degree of reliance on information and communication technology (ICT) is high. Nearly all information being shared with INFOSAN members is done through email or on the INFOSAN Community Website, and face-to-face meetings of INFOSAN members are rare. When discussing the survey results at the INFOSAN global

meeting, members have recommended increasing the frequency of face-to-face meetings and doing so in all regions (FAO/WHO, 2020d). Previous research has shown that virtual communities of practice benefit from face-to-face interactions to be the most effective. Such meetings can result in stronger personal relationships among members, which may be essential to maintaining productivity during extended periods of virtual communication (Hildreth et al., 2000). ICT availability within INFOSAN is high, with multiple avenues for collaboration on the ICW, including document sharing, asynchronous discussion forums and synchronous chat functionality. Utilisation of web conferencing tools is also common in INFOSAN with online seminars (i.e. webinars) being organised regularly by the Secretariat (WHO, 2020b).

5.2 How the ICW is being used to support the network activities and how it could be improved

Membership information, including user access to the ICW, indicates a relatively mature membership with good retention. However, there are a relatively small number of very active members (i.e., those members who regularly log on to the ICW and share content in the discussion forum). In the literature, these very active members are sometimes referred to as "super-users" or "community champions" because they are members who regularly share information, engage in discussions, and encourage others to do the same (Ford et al., 2015). A substantial proportion of members are entirely disengaged from network activities that are administered through the ICW. Also, the data suggest that the majority of INFOSAN members visiting the ICW only ever read content and do not actively contribute new knowledge. Inspiring community members to participate actively has been identified as the key to success in online communities previous studied (Koh & Kim, 2004; Koh et al., 2007). Sun et al. (2014) identified possible reasons for such behaviour: environmental influences, personal preferences, individual–group relationships, and security or privacy considerations. Several strategies for motivating participation in online communities are also provided by Sun et al. (Sun et al., 2014), including the provision of external stimuli, improvement of user-

friendliness of the online community interface, encouragement of participation from an administrator or fellow members, and guidance for new community members.

Despite the relatively small number of very active members, the results from this study indicate that the ICW is still perceived by the majority of members as an important and supportive tool for the network, with most members accessing the website to read about food safety alerts issued by the INFOSAN Secretariat. Some interviewed participants also expressed their reliance on the ICW to identify contact points in other countries as an important and supportive feature, an activity not captured in the phase one analysis because doing so is not an activity for which an indicator is made available to the Secretariat. It is also clear from the results that many members would like to see more information posted from the Secretariat and from members themselves.

The survey results concerning the use of the ICW (i.e. many members report infrequent access) are consistent with the results from phase one of this study, which also indicate that only a small subset of the membership regularly access and share information on the ICW. Some participants interviewed during phase three provided some additional context to their patterns of access, suggesting that limited time is a major factor that inhibits their use of the ICW. Others suggested that their infrequent access is more just a matter of lack of awareness. Overall, the results from this study have demonstrated that the ICW is more than just a website; it is an international knowledge exchange portal meant to assist in knowledge management for evidence-informed decision-making on food safety issues. Based on the results of this analysis, the INFOSAN Secretariat made it a strategic objective to redesign and relaunch the ICW as a modern tool to facilitate improved collaboration among members (FAO/WHO, 2019). By updating the ICW, the INFOSAN Secretariat can contribute to a stronger community of INFOSAN members, who are more connected and capable of leveraging the worldwide knowledge and expertise available to combat global food safety emergencies.

5.3 Barriers to active participation in INFOSAN

Major barriers. Numerous barriers to participation in INFOSAN reduce engagement of some members. Potential barriers to active participation in INFOSAN have been ranked according to respondents' perspectives and regional differences were noted. Between regions, the only barrier that is consistently reported in the top five, is the limited capacity and/or infrastructure dedicated to addressing food safety events. This suggests a widespread and systemic problem regarding the under-development of certain fundamental aspects of national food control systems. Such deficiencies have implications for food safety beyond the impact on participation in INFOSAN and would require sustained, national investments in strengthening food control systems by stakeholders involved in the food chain from farm to table.

Overall, the most commonly reported barrier to active participation reported by members is the need for a simpler and more standardised way to share information between national authorities within each members' respective country. Interestingly, several of the interviewed participants in phase three of the study highlighted this very issue and emphasised that communication within the country between different authorities was even more complex and often strained than communication made outside of their country. Additional context for these barriers was provided with some explaining that the lack of clarity on roles and responsibilities may have been a factor as well as the fear of encroaching on other's mandates. Recognising this issue of challenging inter-agency communication as a significant barrier, the INFOSAN Secretariat published a guidance document for INFOSAN members to aid in developing a national protocol for information sharing among various stakeholders involved in food safety emergency response. When adapted to the national context, the final document should provide clear guidance about the procedures for communication between domestic authorities and WHO, including the INFOSAN Secretariat (FAO/WHO, 2020c).

Putting results into action through a participatory approach. At the second global meeting of INFOSAN members, held in December 2019 in Abu Dhabi, United Arab Emirates, more than 285 INFOSAN members from 135 countries were divided into groups according to geographic region. Each group was provided with a list of potential barriers to participation in INFOSAN, ranked according to regional responses to the survey. Participants were asked to consider the list of barriers as a starting point for their group discussion. Each group's goal was to identify solutions to overcome some of these barriers and increase active participation in INFOSAN activities.

In terms of what members can do to overcome the barriers to active participation in INFOSAN, the following suggestions were made: 1) Familiarise themselves with the existing tools and utilise resources available, including templates, webinars, the INFOSAN Community Website, etc.); 2) Advocate for INFOSAN in different settings to raise awareness and understanding (e.g. within and outside of their own organisation, at national and international levels, etc.); 3) Organise national INFOSAN workshops to improve communication and cross-sectoral collaboration including for emergency response with support from the INFOSAN Secretariat; 4) Develop, test, and utilise national food safety emergency response plans; and 5) Participate in a buddy system or twinning initiative that would pair more active INFOSAN members with less active INFOSAN members to develop capacities and improve participation.

In terms of what the INFOSAN Secretariat can do to overcome the barriers to active participation in INFOSAN, the following suggestions were made: 1) Engage regional authorities for collaboration (e.g. training, communication, member identification, etc.); 2) Align contact points in other regional networks with INFOSAN to prevent parallel tracks of communication during emergencies; 3) Clarify processes and protocols for exchange of information between regional networks and INFOSAN; 4) Expand the availability of technical and training material to include all UN official languages (i.e. English, French,

Spanish, Arabic, Russian and Chinese); 5) Continue organising global meetings at an increased frequency (instead of every 10 years) and regional meetings for all regions (and not only Asia and the Americas); 6) Continue to organise webinars on a range of technical topics; 7) Support simulation exercises to test national food safety emergency response plans; 8) Facilitate buddy system or twinning initiative to pair more active INFOSAN members with less active INFOSAN members to develop capacities and improve participation; and 9) Ensure new INFOSAN Community Website is more user friendly to encourage increased engagement.

Additional details are captured in the INFOSAN Global Meeting Report (FAO/WHO, 2020d). Presenting the results from phase two of the study to INFOSAN members and discussing member-driven solutions to overcome the various barriers exemplifies one of the strengths of this study having been conducted by me as a relative insider researcher. I was uniquely positioned to ensure that research findings guided policy decisions regarding the future management of INFOSAN.

5.4 Impact of participation in INFOSAN on foodborne illnesses

The results from this study indicate that just over two thirds of respondents believe that because of INFOSAN, illnesses have been prevented, and lives have been saved. Moreover, many respondents believe that participating in INFOSAN has prevented foodborne illnesses in their own country and that INFOSAN has improved the safety of the global food supply. During the interviews, several participants provided additional context to these results by indicating the ways in which INFOSAN was having such an impact. Specifically, several noted that by obtaining information through INFOSAN, they were able to take timely decisions to implement risk management measures to remove dangerous food from the population. However, a quantitative indicator of the impact of INFOSAN on food safety and the burden of foodborne disease remains elusive. Also, the fact that there are still many members who do not know if INFOSAN has reduced foodborne illnesses globally or

improved the safety of the food supply highlights the need for better indicators to monitor global food safety and foodborne diseases more broadly. This could include the development of a global foodborne disease surveillance system to monitor trends in foodborne illness over time. Such a system should complement and work closely with other ongoing international efforts to track foodborne diseases, including PulseNet International (Nadon et al., 2017) and the Global Microbial Identifier initiative (Wielinga et al., 2017). The lack of such indicators could be a contributing factor that leaves many members unsure of the impact that their participation in INFOSAN is making on food safety and the burden of foodborne illness. Improving foodborne disease surveillance at the national and global levels is also in line with a recent resolution adopted by the World Health Assembly on strengthening food safety efforts in 2020 (WHO, 2020c). Within that resolution, WHO Member States are urged to improve the systematic monitoring of foodborne hazards and surveillance of foodborne disease outbreaks and ensure timely reporting through INFOSAN.

Despite uncertainty among some respondents, many study participants' responses to the survey and accounts during the interviews follow multiple reports in the literature that describe how utilising communication tools such as INFOSAN to facilitate cross-border communication has prevented foodborne illnesses and protected public health and are consistent with the results from the realist synthesis reported in Chapter three. Viewed through a globalisation theory lens (Robinson, 2011; Robinson et al., 2004), worldwide trends towards decentralisation and fragmentation of production processes (including in the global food system) emphasise the significance of these findings. When food is traded globally, the ability to communicate rapidly with regulators worldwide is imperative if a problem arises in a production chain that compromises food safety. At the same time, globalised systems highlight inequalities between different players when not every country is equipped with the same capacities to manage risks. Such inequalities can result in negative consequences beyond foodborne illness, such as trade bans, which can have devastating impacts to national economies. When considered through a modernisation theory lens (Giddens, 1990, 1991), the

development of food safety systems and strengthening of core public health capacities may contribute to more equitable participation in such global systems.

5.5 INFOSAN and value creation

This study's mixed-method design has enabled the integration of evidence concerning the value that some members place on their participation in INFOSAN activities. For some members, value has been made evident through indicators from the first two phases of the study and narratives in the third phase. Considering the conceptual framework for value creation put forth by Wenger et al. (2011), value can be categorised as immediate value (e.g. productive activities), potential value (e.g. robust resources), applied value (e.g. promising practices), and realised value (e.g. return on investment). Some significant examples of these various categories of valued experiences are discussed below.

Immediate value: productive activities. Most importantly, the majority of members of the network have been able to take information received through INFOSAN and apply it to their own risk management decisions, protecting public health in their respective countries. Overall, survey respondents have indicated that the most important reasons for participating in INFOSAN are to improve the safety of the food supply and to prevent foodborne disease. Stories from members supported these assertions by explaining various cases during which the timely receipt of information through the network enabled them to communicate risk to the public or recall harmful products from the market. For members, ensuring food safety and protecting public health was the strongest motivating factor indicated by survey results and supported by stories from interviewed members.

Potential value: robust resources. Results from the survey indicate an appreciation for the technical documentation and resources shared by the Secretariat. Several members shared their own experiences using those documents to guide improvements to their national food safety systems. The survey results also indicate that members rely on each other as resources,

and the stories shared by several participants illustrated the ways in which making global connections and facilitating collaboration on projects was building the sense of community and making it easier to call upon each other in the face of food safety challenges. Many members saw the value in the potential solutions that may be provided to them in the future, which represented an important and valuable reason for participating.

Applied value: promising practices. Many survey respondents reported learning from one another and sharing strategies to solve common problems. The exchange of best practices was a common theme in stories shared by interviewed participants, particularly during meetings of INFOSAN members including during workshops and online events including meetings and trainings. Many members, through their sharing of best practices, encourage others to adopt similar practices. This open exchange contributes to the trusted environment that members have described within the network, and the corresponding value has been expressed.

Realised value: return on investment. Many respondents to the survey indicated that participation in INFOSAN activities has contributed to developing new ideas, cost-saving, and effectiveness for their organisation. These results were supported by participants' stories about how participation in INFOSAN saves them time when looking for contact details for members in other countries, conducting research or responding to food safety event. Survey respondents have also indicated that learning was an important factor for participation in INFOSAN, with nearly everyone reporting some degree of learning about food safety through INFOSAN and learning from each other despite coming from different professional backgrounds. This aspect of deepening knowledge and expertise by learning from one another and interacting regularly is a common feature of communities of practice (Wenger et al., 2002) and is well documented in the literature (Barbour et al., 2018; Kothari et al., 2011; Mairs et al., 2013; Quinn et al., 2014). During phase three, several participants shared their experiences of learning new things from fellow members and ways in which their

participation had contributed to their professional development. These stories have helped to contextualise the survey results and demonstrate the return on investment for these members.

5.6 Implications for practice

This study's results have several implications for practice, some of which have already been applied to make improvements to INFOSAN operations, as already discussed in this chapter. Two major implications are highlighted in this section related to, first, the ways in which the study results have influenced the redesign of the new INFOSAN Community Website, and second, to a value creation framework that can be applied to support participation in INFOSAN and create more value for more members.

First, data from all three phases of the study have contributed to a better understanding of the technological environment within which the network operates. Specifically, different ways that the INFOSAN Community Website is supporting members have been identified, along with some ways to improve. As such, the INFOSAN Secretariat has been provided with detailed results that were systematically and rigorously collected to inform their decisions on the redesign and relaunch of the ICW. The results were subsequently applied to inform the development of a request for proposals from potential vendors to build the new website that was disseminated through the United Nations Global Marketplace (WHO, 2019) and guided the development of the new ICW with the selected vendor since then. Thus, it is expected that the ICW will be relaunched in 2021 as a modern knowledge exchange portal that encourages increased engagement of INFOSAN members and a higher volume of active participants contributing to the ICW on a regular basis.

A recent systematic review of empirical studies by Malinen (2015) aimed at better understanding user participation in online communities concluded that universal design recommendations for online communities have been challenging to create given the heterogeneity of different communities and the speed at which technology changes, including

how people interact with technology. Therefore, community platforms such as the ICW should be fit for purpose to support the members in achieving the network's objectives. Therefore, based on the results of this study and current best practices reported in the literature, a total of 14 specific functions (1 to 14) and five characteristics (15 to 19) have been identified for inclusion in a new ICW as depicted in Figure 19 and elaborated in Appendix nine. It is suggested that by building the new ICW in this way, members' needs will more adequately be met, and engagement will be improved.

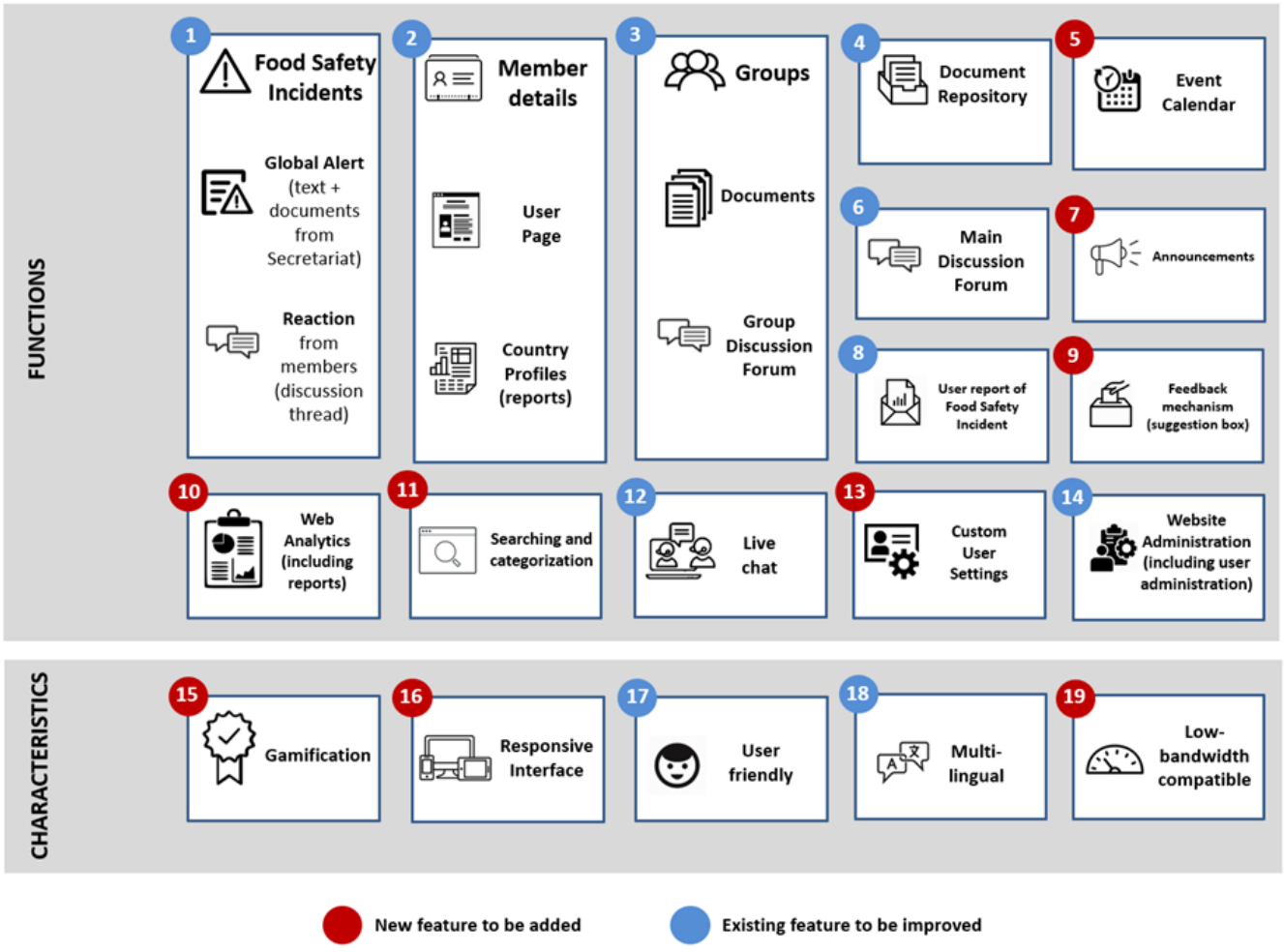


Figure 19. Fourteen specific functions and five characteristics proposed for inclusion in a redesigned INFOSAN Community Website including new features to be added and existing features to be improved

Second, this study's results have been applied to develop a framework for value creation among INFOSAN members (Figure 20). Developing this framework has considered the specific indicators that members' reported were of value to them as well as the value creation stories that were shared during the interviews. It has also considered the barriers that were reported and the enabling factors shared by several participants. In this framework, engagement with INFOSAN is described at three levels, including at the individual level, the organisational level, and the national level. Requirements for engagement in INFOSAN at each of these levels differ.

At the individual level, members must have a personal interest or commitment to fulfilling their roles and responsibilities as INFOSAN members. Achieving this requirement can be supported by outreach from the Secretariat and the provision of information to ensure understanding. At the organisational level, there must be technical capacities to enable individuals within those organisations to obtain the information requested by other INFOSAN members. Such capacities would include essential technical elements of a functional food safety system (e.g. monitoring and surveillance, legislation, inspection, enforcement and more) and could be delivered through targeted training by the Secretariat or other members who have experiences to share. At the national level, there must be political buy-in to facilitate coordination between organisations and allow international information sharing. This level of buy-in should be advocated for by the INFOSAN members themselves once they understand the requirements and benefits of participation in network activities.

Engagement at all three levels is built upon trust, which must be fostered between members and the Secretariat as a foundational requirement. When engagement in INFOSAN activities is achieved at all three levels described, several potential outcomes may be improved, increasing the value of participation. Members may learn from others in different countries more efficiently and develop professionally, and they may develop a stronger sense of community with other members and engage in joint projects to solve everyday problems

related to their jobs. Further, they may utilise INFOSAN to its full potential as a health protection tool to improve food safety and prevent foodborne illnesses worldwide.

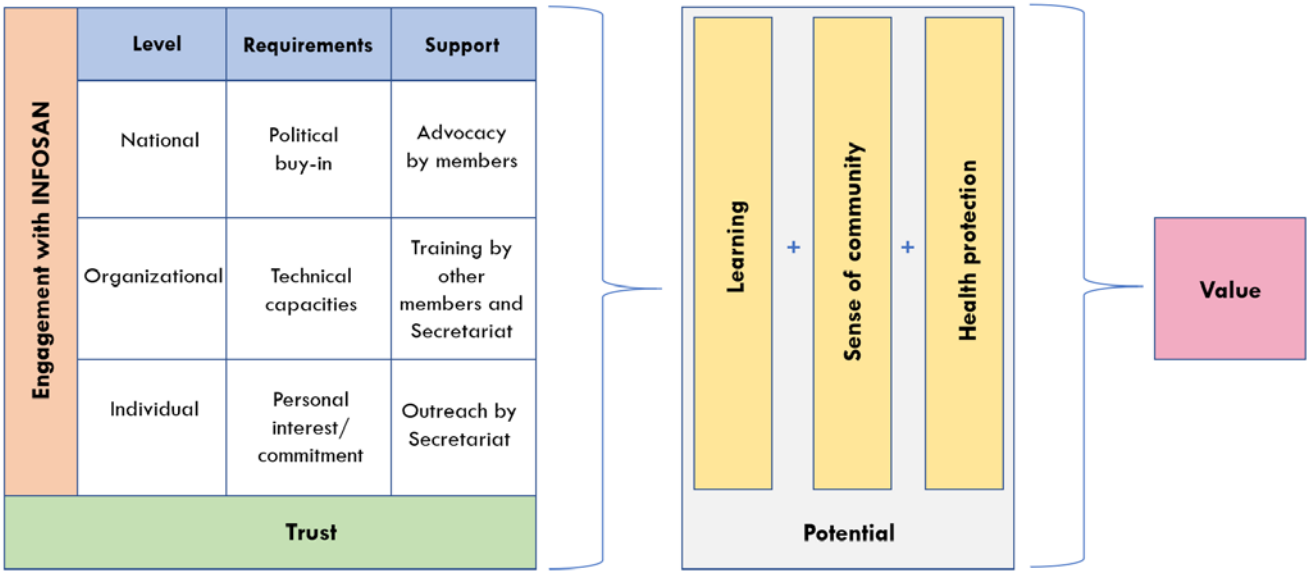


Figure 20. Value creation framework for INFOSAN members

5.7 Looking beyond INFOSAN

The goal of this study was not to attain generalisable results, but rather to provide a rich, contextualized understanding of INFOSAN members' experiences. However, an extension of the results of this study can be considered through theoretical generalisability, whereby one is able to assess the evidence in relation to their own professional or experiential knowledge (Smith et al., 2009). As INFOSAN is just one of many international networks operating to improve specific health outcomes worldwide, facilitators of other international networks may therefore be able to assess the evidence presented in this study in relation to their own context. This concept is also sometimes discussed vis-à-vis qualitative research as case-to-case transfer or transferability and refers to the use of findings from one inquiry to a different group of people or setting (Polit & Beck, 2010). As such, numerous other international networks in the realm of public health, or global affairs more broadly, could potentially

benefit from exploring the resulting value creation framework for INFOSAN members and considering its transferability to their own context.

For example, a WHO network created in 2012 called the Member State Mechanism on Substandard and Falsified Medical Products (the Mechanism) is similar to INFOSAN in many ways, apart from its focus on medicine safety rather than food safety. The Mechanism includes a global focal point network, and members utilise an online platform to communicate, including by sharing global alerts when unsafe medicines are identified in international commerce. A review of the Mechanism in 2017 (World Health Organization, 2017) concluded that engagement should be expanded to include a broader range of active network members in more countries worldwide. Encouraging active engagement in the Mechanism could be done following the value creation framework for INFOSAN members. This would mean that the various levels (i.e. individual, organisational and national) would be targeted to install or strengthen various requirements (i.e. personal interest/commitment, technical capacities, and political buy-in) and then supported by secretariat staff or members as appropriate. Taking such an approach could lead to the same kind of potential outcomes of learning, sense of community and health protection (in this case from substandard and falsified medicines) and thus create value for more members.

5.8 Study limitations

In phase one of the study, one limitation is that the data represent access to and use of the ICW at a single point in time and have not allowed for trend analysis over any period. In relation to this, active participation in this study's context has been conceptualised as logging on to the ICW and sharing content in the discussion forum. However, other possible ways to use the ICW may provide value to members that this analysis has not captured. For example, members may log on to the website to find the contact details of other members, engage in a conversation by e-mail or phone, or use the chat function. Establishing these connections is also a form of participation but has not been captured in the analysis. An improved ICW should include built-in analytics tools to enable observations of trends over time.

As in phase one, one limitation of phase two is that the data represent INFOSAN members' perceptions at a single point in time and do not allow for trend analysis over any period. Also, the questionnaire was available in English, French and Spanish, and while nearly all (98%) of members have reported speaking one of those three languages, making it available in Russian, Arabic, and Portuguese may have encouraged additional responses from members who speak one of those as their first language. Further, given nearly half of the members who were sent the questionnaire did not participate, a certain degree of response bias has been introduced. It is possible that those individuals who did not participate have different perceptions of INFOSAN from those who participated and these perceptions have thus not been captured.

In phase three of the study, while all participants identified challenges or areas for improvement, their overall impressions of INFOSAN were quite positive (even among those who admitted to being relatively inactive members). This could be due to the fact that those members with ambivalent views or negative opinions of INFOSAN may have been less likely to volunteer to share their experiences, thus introducing a bias towards positive experiences being reflected in these results. The potential exclusion of those not willing to share overly negative views could also correlate to my position as an insider researcher (Dwyer & Buckle, 2009). However, upon reflection, my overall impression is that my relative insider position introduced a level of comfort between the participants and myself, which resulted in what I perceived to be quite candid and honest descriptions of experiences from many participants.

The study's results from phase three are also limited to English, even though eight out of ten participants' first language was not English and came from different social and cultural contexts than mine. Some participants seemed to prefer providing generic information rather than detailed information, perhaps because English was not their first language and articulating detailed accounts of feelings and experiences may have been challenging. These observations highlight the fact that while homogenous in some ways with respect to their membership to INFOSAN, professional domain (i.e. food safety) and type of work (i.e.

government regulator), INFOSAN members can differ from each other in many ways too. For example, INFOSAN membership is quite heterogenous with respect to languages spoken, culture, geographic location, profession, level of seniority, and more. While the focus of this inquiry was on members' experiences broadly, a greater focus on homogeneity could have enabled the capturing of details on specific sub-groups of INFOSAN members who have experienced a particular phenomenon of interest (e.g. involved in a major international food safety emergency response in the last three months, located in a low- or middle-income country, not a member to any other international network, etc.).

Also, some participants seemed to prefer providing impersonal rather than personal responses which is not the aim of IPA research (Smith et al., 2009). In some instances, this may have been because the interview was about participants' experiences in a professional network, so they tended to remain in a professional mindset rather than a personal one. Additionally, several participants provided answers concerning other members rather than about themselves, which, again, is not the intention of IPA research (Smith et al., 2009).

Despite these limitations, all interviews contained valuable insights that contributed to the overall phenomenological analysis and deeper understanding of members' experiences as INFOSAN members. Furthermore, in some cases, participants' reflections on other network members' actions were relevant to their own experience since others' actions impacted them and their own experience. Overall, attempts were made to counteract these limitations by asking for specific examples and personal experiences in probing questions during the interviews.

Chapter six – Conclusion[10]

This sixth and final chapter concludes the thesis by summarising how the research objectives have been achieved and the main research questions answered. It also includes reflections on the research conducted including an overview of the new knowledge that has resulted. Recommendations for future work on the topic are made here.

6.1 Achieving the study objectives

This PhD study aimed to explore and describe the experiences of INFOSAN members with respect to their participation in network activities as a means to improve global food safety and prevent foodborne illness. Wenger's CoP framework as a social learning theory provided conceptual direction for this investigation, which has utilised quantitative indicators and qualitative narratives to meet the research objectives. Specifically, INFOSAN's actual functioning as a CoP has been assessed by obtaining systematic insights into members' characteristics, performance, and opinions. In this way, the structuring qualities of INFOSAN have been characterised with respect to demographics, organisational context, membership characteristics and the technological environment. Furthermore, the research has resulted in a broad and deep understanding of members' perceptions of the use of INFOSAN as a global communication tool for knowledge transfer and exchange and the prevention of foodborne

[10] Some of the sections in Chapter six are derived from constituent papers of this research, already mentioned above; the first page of each publication is included in; the first page of each publication is included in Appendix one – publications:

- Savelli CJ & Mateus C. (2020) Looking Inside the International Food Safety Authorities Network Community Website. Journal of Food Protection, 83(11), 1889-1899. https://doi.org/10.4315/JFP-20-193
- Savelli CJ & Mateus C. (2021). Exploring the International Food Safety Authorities Network as a Community of Practice: Results from a Global Survey of Network Members. Journal of Food Protection. 84(2), 262–274. https://doi.org/10.4315/JFP-20-313
- Savelli CJ, Mateus C & Simpson, J. (2021). Exploring the Experiences of Members of the International Food Safety Authorities Network: An Interpretative Phenomenological Analysis. Journal of Food Protection. https://doi.org/10.4315/JFP-21-171

illness. Finally, the study has determined how participation in INFOSAN creates value for members and has explored the mechanisms through which this occurs. This is significant because it is the first time such an investigation has ever been conducted rigorously and systematically.

The mixed-method approach taken to conduct this study, through the integration of results from the various study phases to address the main research questions, strengthens the credibility of the findings and has provided a complete view and deeper understanding of members' experiences. As a multidisciplinary subject, the study has benefited from engaging with a range of literature covering food safety and communities of practice from various perspectives. In addition, communicating with a range of experts during the development of the study and during the peer-review process for the seven constituent publications adds to the credibility of the findings. The results from the study, including the realist synthesis, provide practical frameworks for making improvements to international systems, including INFOSAN, that have the potential to make significant contributions to public health by reducing the burden of foodborne illness worldwide.

Overall, the study has demonstrated that authenticity and reputation are drivers for accepting information from the network. As such, INFOSAN provides trusted information for members in different regions worldwide, functioning as a health protection tool to improve food safety and prevent foodborne illness. Through their participation, members' collective actions to safeguard the global food supply are seen as noble endeavours and worthy investments. Furthermore, international collaborations create valued opportunities for professional development and knowledge transfer and exchange among members. Additionally, for some members, shared ownership for INFOSAN has created mutual respect and opportunities for collaboration within the network to reach common goals.

Unfortunately, the full potential of INFOSAN remains unmet as many barriers still prevent active engagement. However, recognising untapped potential is a significant motivating factor

that leads members to lend time and energy to network activities. Focusing on outreach to sustain personal interest, training to improve technical capacity, and advocacy to obtain political buy-in are ways the INFOSAN Secretariat could encourage increased participation of members in network activities at the individual, organisational and national levels, respectively. When built upon a foundation of trust among members, such engagement could translate into more effective international communication during urgent food safety events and fewer cases of foodborne illness globally.

Future research may consider implementing a value creation framework as depicted in Figure 20 and examining outcomes on that basis. Doing so would help determine if such interventions effectively increase participation and whether they contribute to the desired outcomes of reaching the network's full potential. Such an inquiry could include administering all or parts of the questionnaire designed for phase two of this study on an annual or bi-annual basis to measure changes in members' perceptions over time.

Other future research could aim to understand the experiences of those members who did not respond to the questionnaire through direct and targeted outreach. Also, research aimed at better understanding why large proportions of members were ambivalent about several critical aspects explored in this study (e.g. trust among members, impact of participation on global food safety, impact of participation on the burden of foodborne illness, etc.) should be prioritised. Furthermore, for those members who have indicated that participation in INFOSAN has prevented foodborne illnesses or improved food safety, efforts to quantify such impact in terms of disease burden and from an economic perspective would be worthy, however complex, research endeavours.

If more IPA studies are planned with INFOSAN members in the future, a multi-lingual study team could be assembled, if resources are available, to conduct interviews and analysis in participants' first language to elicit more profound and personal accounts. Such studies could also narrow the focus of interrogation to explore fewer dimensions of membership and

consider enlisting samples with even more homogeneity (e.g. from the same geographic region, with the same level of seniority, with the type of responsibilities, etc.).

6.2 Reflections

Completing this thesis has been an incredibly collaborative endeavour with input received from an international array of INFOSAN members, colleagues, peer-reviewers and other external experts at every step of development and implementation. First, the review of INFOSAN that set the scene for this research benefitted from peer-review prior to publication in Foodborne Pathogens and Disease. Next, the research protocol was reviewed by ethics committees at Lancaster University and the WHO, ensuring it was designed to meet the highest ethical standard. Then, as part of the review process at WHO, the proposal also benefitted from external technical review from three international experts, including one professor who developed the Community Assessment Toolkit that was used as the basis for the questionnaire development in phase two of the study. In addition, the research protocol was then peer-reviewed by several external reviewers prior to being published by BMJ Open.

Prior to launching phase two of the study, the questionnaire was developed with input from six INFOSAN members and WHO colleagues to ensure validity and then translated with support from a group of 11 WHO colleagues who volunteered their time at a translation workshop to ensure robust and accurate versions of the questionnaire in French and Spanish.

The realist synthesis was conducted with input from an expert reference committee comprised of 11 international experts and the review protocol and review benefited from additional peer-review prior to publication in BMJ Open and Globalization and Health, respectively. The results from phases one, two and three have also benefited from peer-review prior to publication in the Journal of Food Protection.

Each time feedback was received through any of these processes, the research was enriched, and the quality of the study was elevated. Overall, because the subject of inquiry was international and multidisciplinary, bringing in so many perspectives from around the world

to guide the research process was befitting. This global endeavour has resulted in a comprehensive outcome with immediate implications for practice and the potential to improve international information sharing on food safety matters worldwide. Other international networks that rely on exchanging information across borders to guide risk management decisions should consider adopting a community of practice model to foster collaboration, build trust and improve participation.

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Appendices

- Appendix one – publications
- Appendix two – Examples of recent large-scale food safety events
- Appendix three – Additional details on the conduct of the realist synthesis
- Appendix four – development of questionnaire for phase two
- Appendix five – interview schedule for study phase three
- Appendix six – Research Proposal and Ethics Application
- Appendix seven – Ethics approval letters
- Appendix eight – Regional authorities with one or more Focal Point(s) registered on the ICW, January 2019
- Appendix nine – WHO Collaborating Centres with Focal Points registered on the INFOSAN Community Website, January 2019
- Appendix ten – specific functions and characteristics to be included in a new ICW
- Appendix eleven – Research posters
- Appendix twelve – Research presentations
- Appendix thirteen – Media interest in my research

Appendix one – Publications

1) Savelli CJ, Bradshaw A, Ben Embarek P & Mateus C. (2019) The FAO/WHO International Food Safety Authorities Network in Review, 2004-2018: Learning from the Past and Looking to the Future. *Foodborne Pathogens and Disease*, *16*(7), 480-488. https://doi.org/10.1089/fpd.2018.2582

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The FAO/WHO International Food Safety Authorities Network in Review, 2004–2018: Learning from the Past and Looking to the Future

Carmen Joseph Savelli,[1,2] Adam Bradshaw,[1] Peter Ben Embarek,[1] and Céu Mateus[2]

Abstract

Contemporary patterns of global food trade necessitate cross-border communication between government authorities when unsafe food enters international commerce. The Food and Agriculture Organization of the United Nations (FAO)/World Health Organization (WHO) International Food Safety Authorities Network (INFOSAN), established in 2004, facilitates urgent communication between >600 members from 188 of the 194 FAO and WHO Member States around the world and supports the strengthening of food safety systems in an effort to mitigate the global burden of foodborne disease. For nearly 15 years, INFOSAN has been operating as a global, virtual community of practice (CoP), fostering knowledge transfer and exchange between members, and enabling crucial international communication during food safety emergencies. During this time, a number of important partnerships have been forged, including with other networks like PulseNet International. Complementarity, and cooperation between global networks like INFOSAN and PulseNet is vital to improve the efficiency and effectiveness of global efforts to curb foodborne illness. Since 2011, detailed data related to the patterns of information exchange during 293 food safety emergencies communicated through INFOSAN have been documented systematically. An analysis of these data reveals that a relatively limited number of active members from a select group of Member States contribute the majority of information exchanged through the network. For example, nine (5%) Member States were each involved in 24 or more food safety events communicated through INFOSAN between 2011 and 2017, whereas 123 (65%) Member States were involved in three events or less, including 36 (19%) involved in none. These data also demonstrate that although the overall responsiveness of members during emergencies has improved in recent years, impediments to rapid and efficient information sharing still persist. A number of potential barriers to active participation in INFOSAN have been hypothesized, but members themselves have not been conferred with on their relative importance. As a member-driven network, future research to investigate the experiences of INFOSAN members in a rigorous and systematic manner is recommended. Such work could illuminate the specific areas in which to introduce operational shifts by the INFOSAN Secretariat, to strengthen the global CoP, increase the value of INFOSAN among members, and have a robust and meaningful impact at country level to reduce the burden of foodborne disease globally.

Keywords: food safety, foodborne illness, international networks, communication, emergency response, community of practice, INFOSAN, World Health Organization, Food and Agriculture Organization of the United Nations

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2) Savelli CJ & Mateus C. (2019). Utilisation of tools to facilitate cross-border communication during international food safety events, 1995-2019: a realist synthesis protocol. *BMJ Open*, *9*(10). http://dx.doi.org/10.1136/bmjopen-2019-030593

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Utilisation of tools to facilitate cross-border communication during international food safety events, 1995–2019: a realist synthesis protocol

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ABSTRACT

Introduction Efficient communication and coordination between countries is needed for prevention, detection and response to international food safety events. While communication tools exist, current evidence suggests that they are only effective within certain contexts and only cover certain geographic areas. There is a need to unpack and explore the mechanisms of how and in what context such communication tools and their components are effective at facilitating international communication and coordination to keep food safe and mitigate the burden of foodborne disease around the globe.

Methods and analysis A realist synthesis will be undertaken to understand how and why certain processes and structures of communication tools, used during international food safety events, influence their utility and effectiveness according to different contextual factors. The focus of this review is explanatory and aims to develop and refine theory regarding how contextual factors trigger specific processes and mechanisms to produce outcomes. Using the realist context–mechanism–outcome configuration of theory development, a range of sources have been used to develop the initial programme theory, including the author's experience, a scoping review of published papers and grey literature and input from an expert reference committee. To support, expand or refute the initial theory, data will be synthesised from published literature and input from the expert reference committee.

Ethics and dissemination Ethical approval is not required for this review as it does not involve primary research. However, it will be conducted according to the appropriate ethical standards of accuracy, utility, usefulness, accountability, feasibility and propriety. The RAMESES publication standards will be followed to report the findings of this review. On completion, the final manuscript will be shared with members of the FAO/WHO International Food Safety Authorities Network (INFOSAN) and published in a peer-reviewed journal.

Strengths and limitations of this study

- Uses realist methods to explore contextual factors and underpinning causal mechanisms of complex international communication during food safety events.
- Utilisation of an international expert review committee consisting of national government officials, international civil servants and academics to ensure complete coverage of the literature.
- Formulation of the context–mechanism–outcome programme theory relies heavily on published literature and therefore may be subject to publication bias.
- Review findings will be context-specific and therefore must be considered within the context of this research.

BACKGROUND

Access to sufficient amounts of safe and nutritious food is a basic requirement for human health. However, around the world unsafe food is known to cause more than 200 acute and chronic diseases, ranging from diarrhoea to cancer.[1] In 2015, the first estimates of the global burden of foodborne diseases were reported by the WHO, indicating that 31 hazards (including bacteria, viruses, parasites, toxins and chemicals) were responsible for 600 million cases of foodborne diseases and 420 000 deaths worldwide in 2010.[2] This burden was disproportionately felt by children under 5 years of age who accounted for 40% of foodborne disease cases and 125 000 deaths.[2] While foodborne diseases are observed worldwide, Africa, South-East Asia and the Eastern Mediterranean regions report the highest burden.[2] In such high-burden areas, unsafe food presents additional consequences beyond disease burden, impeding socioeconomic development, overloading strained healthcare systems and damaging national economies, trade and tourism.[3] Furthermore, a 2018 study by the World Bank[4] indicates that unsafe food costs low-income and middle-income economies approximately US$100 billion in lost productivity and medical expenses each year.

Foodborne diseases are preventable; however, prevention requires investment and coordinated action across multiple sectors to

3) Savelli CJ, Garcia Acevedo RF, Simpson J & Mateus C. (2021)The utilisation of tools to facilitate cross-border communication during international food safety events, 1995-2020: a realist synthesis. *Globalization and Health, 17*(65). https://doi.org/10.1186/s12992-021-00715-2

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Globalization and Health

REVIEW Open Access

The utilisation of tools to facilitate cross-border communication during international food safety events, 1995–2020: a realist synthesis

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Abstract

Efficient communication and coordination are needed between countries to prevent, detect and respond to international food safety events. While communication tools, networks and systems exist, current evidence suggests that they are only useful within particular contexts and several only target specific geographic areas. There is a need to unpack and explore the mechanisms of how and in what context such communication tools and their components are effective at facilitating international communication and coordination to keep food safe and mitigate the burden of foodborne disease around the world.

A realist synthesis was undertaken to understand how and why certain processes and structures of communication tools, used during international food safety events, influence their utility and effectiveness according to different contextual factors. The focus of this review was explanatory and aimed to develop and refine theory regarding how contextual factors trigger specific processes and mechanisms to produce outcomes. Using the realist context–mechanism–outcome configuration of theory development, a range of sources was used to develop an initial programme theory, including the authors' experience, a scoping review of published papers and grey literature and input from an expert reference committee. Literature was then systematically located and synthesised from several databases with input from the expert reference committee to refine the programme theory.

The programme theory developed indicates that when a country has interests in food import or export, has the technical infrastructure to detect and respond to food safety events, and is governed in accordance with regional and/or global laws and regulations relating to food control and global health security, then specific mechanisms will facilitate various outcomes. Mechanisms include trust, experience, support, awareness, understanding, a sense of community, standardisation and intersectoral collaboration. The outcomes include using communication tools to relay information abroad and the prevention of foodborne diseases, among others.

Components of such communication tools may be adapted according to different contextual factors to promote, support and improve their use. Improving international coordination and communication during international food safety events is in the interest of global health security and can mitigate the global burden of foodborne disease.

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4) Savelli CJ & Mateus C. (2019) A mixed-method exploration into the experience of members of the FAO/WHO International Food Safety Authorities Network (INFOSAN): study protocol. *BMJ Open*, *9*(5). https://doi.org/10.1136/bmjopen-2018-027091

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A mixed-method exploration into the experience of members of the FAO/WHO International Food Safety Authorities Network (INFOSAN): study protocol

Carmen Joseph Savelli,[1,2] Céu Mateus[2]

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ABSTRACT

Introduction The International Food Safety Authorities Network (INFOSAN) is a global network of national food safety authorities from 188 countries, managed jointly by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO), which facilitates the rapid exchange of information during food safety related events. The proposed research will interrogate INFOSAN in order to describe and explore the experiences of members and better understand the role of the network in mitigating the burden of foodborne illness around the world.

Methods Examined through a community of practice lens, a three-phase research design will combine quantitative and qualitative methods (including website analytics in phase 1, online survey administration in phase 2 and semistructured interviews in phase 3) to elicit a broad and deep understanding of the network operation and member experiences.

Analysis In phases 1 and 2, quantitative data collected from the INFOSAN Community website and the online questionnaires will be analysed using descriptive summary statistics. In phase 3, interpretative phenomenological analysis will be used to engage in a dialogue with study participants to explore and describe their lived experiences regarding participation in activities related to INFOSAN. An important aspect of the overall analysis will be triangulation of the information collected from each phase, including quantitative indicators and qualitative value stories, in order to provide a robust understanding of member experience.

Ethics and dissemination This study has undergone ethical review and has received approval from Lancaster University's Faculty of Health and Medicine Research Ethics Committee, as well as the ethics review committee of the WHO. Findings from the study will be disseminated as a PhD thesis submitted to Lancaster University. In addition, results of the research shall be submitted for publication to relevant academic or professional conferences and journals or other media, including books or websites.

Strengths and limitations of this study

- ► This study represents the first ever to explore and describe the experiences of all International Food Safety Authorities Network members with respect to their participation in network activities as a means to improve global food safety and to prevent foodborne illness, using a range of data collection methods.
- ► The mixed-method approach will strengthen the credibility of the findings and provide a more complete view and deeper understanding of the experiences of members.
- ► The main limitation of this study is that the online survey will be available in English, French and Spanish only, and interviews will be conducted in English only due to limited resources of the study team.

INTRODUCTION

In 2015, the WHO reported estimates of the global burden of foodborne diseases for the first time. Together, 31 foodborne hazards are estimated to cause 600 million cases of foodborne disease and 420 000 deaths annually, worldwide.[1] Foodborne diseases are preventable, but ensuring a safe national food supply requires a robust food control system and coordination among different government sectors responsible for human health, animal health, agriculture, trade and others. In addition, as a global commodity, food produced in one country can readily cause international outbreaks if contaminated food is exported abroad. Channels of communication on matters of food safety must therefore be well established within and between countries in order to prevent national and international food safety emergencies.[2] It is for these reasons why the WHO launched the International Food Safety Authorities Network (INFOSAN) in 2004. Today, the overall aim of INFOSAN is to halt the international spread of contaminated food, prevent foodborne disease outbreaks and strengthen food safety

5) Savelli CJ & Mateus C. (2020). Looking Inside the International Food Safety Authorities Network Community Website. *Journal of Food Protection*, *83*(11), 1889-1899. https://doi.org/10.4315/JFP-20-193

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General Interest

Looking Inside the International Food Safety Authorities Network Community Website

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ABSTRACT

The International Food Safety Authorities Network (INFOSAN) was launched in 2004 by the World Health Organization (WHO) in collaboration with the Food and Agriculture Organization of the United Nations (FAO). Since then, this global network has aimed to halt the international spread of contaminated food, prevent foodborne disease outbreaks, and strengthen food safety systems globally to reduce the burden of foodborne illness. However, INFOSAN has never been examined as a functional community of practice and its value, according to members, has not been determined in a systematic or rigorous way. A three-phased, mixed-method study has explored the experiences of INFOSAN members with respect to their participation in collaborative network activities to improve global food safety and prevent foodborne illness. Results from phase 1 of this study are discussed here and relate to how the INFOSAN Community Website (ICW) is being used to support network activities. Overall, the descriptive analysis indicates that a small number of active INFOSAN members contribute most of information shared on the ICW. A much larger group of members participates passively, logging on to the site, reading content, but not sharing new information. Four hundred eighty-two food safety incidents are documented on the ICW, the majority of which have been caused by bacterial contamination, most commonly *Salmonella enterica*. The results from phase 1 of this study provide objective, foundational information about engagement of all members and were used to propose new ways to improve the ICW. Integration of these results with results from phases 2 and 3 will help determine whether and how members' reported attitudes and experiences reflect their online behaviors. This information can be used by the INFOSAN Secretariat to increase active participation and improve international information exchange to mitigate the impact of food safety emergencies and prevent foodborne diseases globally.

HIGHLIGHTS

- Members have registered on the INFOSAN Community Website (ICW) from 182 countries.
- Most members are passive consumers of information shared by the Secretariat.
- International food safety incidents (482) are detailed on the ICW.
- Fifty-one percent of food safety incidents on the ICW involve only five pathogens.
- Suggested improvements to the ICW could support increased participation of members.

Key words: Community of practice; Food and Agriculture Organization of the United Nations; Food safety; International collaboration; International Food Safety Authorities Network; World Health Organization

The International Food Safety Authorities Network (INFOSAN) is a global network that aims to halt the international spread of contaminated food, prevent foodborne disease outbreaks, and strengthen food safety systems globally to reduce the burden of foodborne illness. Established in 2004, INFOSAN has since grown to include more than 600 people from 190 countries in 2020 and is jointly managed by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO), with most operational functions led by the Secretariat at WHO. INFOSAN members are officially designated to represent national authorities that have responsibilities in managing food safety activities. The network includes members from various government sectors, including health, agriculture, veterinary services, trade, standards, and education. One of the most important functions of the network is to promote the rapid exchange of information during international food safety–related incidents, including multicountry outbreaks of foodborne illness linked to a common food and international recalls of food due to an identified human health risk *(13)*.

For several years, most communication between the Secretariat and members of the network occurred through

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6) Savelli CJ & Mateus C. (2020). Exploring the International Food Safety Authorities Network as a Community of Practice: Results from a Global Survey of Network Members. *Journal of Food Protection*, *84*(2), 262-274. https://doi.org/10.4315/JFP-20-313

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Research Paper

Exploring the International Food Safety Authorities Network as a Community of Practice: Results from a Global Survey of Network Members

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ABSTRACT

The International Food Safety Authorities Network (INFOSAN) is a global network of national food safety authorities from 190 countries, managed jointly by the Food and Agriculture Organization of the United Nations and the World Health Organization, which facilitates the rapid exchange of information during food safety incidents. Until now, INFOSAN has not been characterized or examined as a functional community of practice, and its value, as understood from the perspective of its members, has not been determined in a systematic or rigorous way. The purpose of this study was to explore and describe the experiences and opinions of INFOSAN members to better understand the role of the network in improving food safety and mitigating the burden of foodborne illness globally. There were four main research questions: (i) How is the INFOSAN Community Website being used to support network activities? (ii) What are the barriers to active participation in INFOSAN? (iii) Do INFOSAN members believe that participation in the network prevents foodborne illness and saves lives? and (iv) Does participation in INFOSAN create value for members, and if so, through what mechanisms does this occur? To answer these questions, an online questionnaire was developed and adapted from English into French and Spanish before being disseminated to INFOSAN members. Responses were received from 239 INFOSAN members in 137 countries over a 10-week period between August and October 2019. This study represents the first to explore and describe the experiences of INFOSAN members with respect to their participation in network activities to improve global food safety and prevent foodborne diseases and to describe the characteristics of INFOSAN as a community of practice. The results suggest that INFOSAN is a valued tool, used globally to reduce the burden of foodborne illness and save lives. The INFOSAN Secretariat could use the results to prioritize future activities to further strengthen the network and support participation of members.

HIGHLIGHTS

- The INFOSAN Community Website is an important and supportive tool for the network.
- Numerous barriers to participation in INFOSAN reduce engagement of some members.
- The majority of members believe that INFOSAN prevents illnesses and saves lives.
- Participation in INFOSAN has been a valuable experience for nearly all members.

Key words: Community of practice; Food and Agriculture Organization of the United Nations; Food safety; International collaboration; International Food Safety Authorities Network; World Health Organization

The International Food Safety Authorities Network (INFOSAN) is a global network that aims to halt the international spread of contaminated food, prevent foodborne disease outbreaks, and strengthen food safety systems globally to reduce the burden of foodborne illness. Established in 2004, INFOSAN has since grown to include more than 600 people from 190 countries in 2020 and is jointly managed by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO), with most operational functions led by the Secretariat at WHO. INFOSAN members are officially designated to represent national authorities that have responsibilities for some aspects of food safety management. The network includes members from various government sectors including health, agriculture, veterinary services, trade, standards, education, and others. One of the most important functions of the network is to promote the rapid exchange of information during food safety–related incidents, including multicountry outbreaks of foodborne illness linked to a common food and international recalls of food due to an identified human health risk *(11)*. Since 2012,

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7) Savelli CJ, Mateus C & Simpson J. (2020). Exploring the Experiences of Members of the International Food Safety Authorities Network: An Interpretative Phenomenological Analysis. *Journal of Food Protection*. https://doi.org/10.4315/JFP-21-171

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General Interest

Exploring the Experiences of Members of the International Food Safety Authorities Network: An Interpretative Phenomenological Analysis

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ABSTRACT

The International Food Safety Authorities Network (INFOSAN) is a global network of national food safety authorities from 190 countries, managed jointly by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) that aims to facilitate the rapid exchange of information during food safety incidents. A three-phase study of INFOSAN was launched in 2019 to characterize and examine the network as a functional community of practice and determine its value systematically and rigorously from its members' perspectives. The first two phases of the study involved analyzing the INFOSAN Community Website and surveying of all of its members. The main objective of this third and final phase of the study was to understand the experiences of a small group of INFOSAN members as they relate to various dimensions of membership. A qualitative methodology was used to provide a deeper understanding of members' experiences and supplement the results from the first two quantitative study phases. Interviews were conducted with 10 INFOSAN members from 10 geographic regions, transcribed verbatim, and analyzed using interpretative phenomenological analysis. The results offer an understanding of INFOSAN members' experiences in the context of what participation in this global network means to them and relate to five themes concerning trust, learning, health protection, sense of community, and future potential. The findings suggest that focusing on outreach to sustain personal interest, training to improve technical capacity, and advocacy to obtain political buy-in are ways in which the INFOSAN Secretariat could enable participation and create value at the individual, organizational, and national level, respectively. Such engagement could translate into more effective international communication during urgent food safety incidents and fewer cases of foodborne illness worldwide.

HIGHLIGHTS

- Authenticity and reputation drive acceptance of information within INFOSAN.
- International collaborations create valued learning opportunities among members.
- Members view actions to safeguard the global food supply as noble endeavors.
- Shared ownership for INFOSAN facilitates mutual respect and collaboration.
- Accessing untapped potential is a significant motivating factor for members.

Key words: Food safety; In-depth interviews; International collaboration; International Food Safety Authorities Network; Qualitative methods; World Health Organization

The International Food Safety Authorities Network (INFOSAN) is a global network that aims to halt the international spread of contaminated food, prevent foodborne disease outbreaks, and strengthen food safety systems globally to reduce the burden of foodborne illness. Established in 2004, INFOSAN has since grown to include nearly 700 members from 190 countries in 2021 and is managed jointly by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO), with most operational functions led by the Secretariat at WHO. INFOSAN members are officially designated to represent national authorities with responsibilities for some aspects of food safety management across various sectors, including, for example, health, agriculture, environment, veterinary services, trade, standards, and education. One of the network's essential functions is to promote the rapid exchange of information during food safety-related incidents, including multicountry outbreaks of foodborne illness linked to a common food item and international recalls of food due to an identified human health risk *(19)*.

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Appendix two – Examples of recent large-scale food safety events

Year	Hazard	Food	Geographic scope	Public health impact	Reference
2008	melamine	milk products from China	Products from were directly exported or secondarily distributed to 47 countries worldwide	~300,000 infants and children became ill in China, and six died	(Gossner et al., 2009)
2011	E.coli O104	fenugreek sprouts from Egypt	Products distributed to Germany and France	~4000 people became infected with enterohaemorrhagic E.coli, and ~800 developed haemolytic uremic syndrome, mainly in Germany but also in France.	(Robert Koch Institute, 2011)
2012	Norovirus	frozen strawberries from China	Products were distributed to Germany	~11,000 cases of norovirus infection in Germany were reported, primarily among school children and children in care facilities	(Bernard et al., 2014)
2013/2014	Hepatitis A virus (HAV)	traceback could not indicate a single point source of contamination; blackberries from Bulgaria and redcurrants from Poland identified as the most common ingredients in the lots of berries associated with cases.	Products exported to at least 13 European countries	~1,500 cases of HAV infection in 13 European countries were identified	(Severi et al., 2015)
2017/2018	L. monocytogenes	ready-to-eat meat products (polony) from South Africa	Products were exported to 15 countries in Africa	~1000 cases of Listeriosis in South Africa, including 200 deaths.	(WHO, 2018e)
2017/2018	S. Agona	infant formula from France	Products were exported or secondarily distributed to more than 80 countries worldwide	37 infants infected with salmonellosis in France	(WHO, 2018c)
2018	L. monocytogenes	Frozen vegetable products	Products were exported or secondarily exported to more than 120 countries worldwide	47 cases of Listeriosis across five countries, including nine deaths	(WHO, 2018b)

Appendix three – Additional details on the conduct of the realist synthesis

Search strategy. To test the initial programme theory, a systematic search of the literature aimed to identify documents written in English, dating back to 1995, that illuminate how different tools facilitate cross-border communication during international food safety events, why they are used, by whom and for what purpose. This search was undertaken using the databases Web of Science, Embase, MEDLINE, PubMed and CINAHL. A comprehensive search algorithm was developed with assistance from a librarian at Lancaster University, United Kingdom, by first selecting key search terms following the review of titles and abstracts from ten known publications describing international food safety events or an international food safety communication tool, system or network. Combinations of the following key words in English (and their truncations where required) using Boolean operators and proximity operators (where possible) were entered into the selected databases: (systems OR network OR tool OR communication OR notification OR "information exchange") AND (international OR multi-state OR multi-country OR imported OR exported) AND (("food safety" OR "food contamination" OR "foodborne diseases") OR (gastroenteritis AND (incident OR emergency OR outbreak)) OR (food AND (incident OR emergency OR outbreak))).

Bibliographic references from documents selected for inclusion were reviewed using the snowballing method to identify other potentially relevant documents. Since grey literature can be a relevant source of information for realist reviews, annual reports, evaluation summaries, or policy documents published by international organisations or government agencies were searched for on respective websites *(Pawson et al., 2005)*. The grey literature search was purposeful and undertaken on the organisational websites related to those tools that have been already identified during the scoping review or through discussions with the expert reference committee or that were later identified following the database searching. Members of the expert reference committee were also asked to provide any grey literature pertaining to such tools they believed may be relevant. The search for evidence was driven by the research objectives and was iterative in practice to identify all relevant information sources to develop the programme theory. Searching concluded when theoretical saturation was reached, and sufficient evidence was collected to confidently assert that the proposed theory is plausible (Wong et al., 2013). The expert reference committee contributed to this review by identifying additional articles and documents for consideration in the review and provided feedback on the emerging programme theory as it was developed and refined. Throughout this process, references were managed using Endnote X7 software.

Study selection criteria and procedures. To ensure that programme theory development considers a wide range of evidence, it is customary to use broad inclusion/exclusion criteria in a realist synthesis *(Pawson et al., 2005)*. The inclusion criteria are studies of any design from peer-reviewed literature and other documents from grey literature written in English, published in 1995 or later, describe an international food safety event or a communication tool and provide evidence that contributes to the synthesis and the emerging programme theory. The year 1995 was chosen because tools used before this are more likely to reference outdated technology (e.g., facsimile) that would not be relevant in today's internet-dependent world. The exclusion criteria are if a document does not describe an international food safety event or a communication tool with sufficient details to inform the programme theory or focuses on outdated communication technology (e.g., facsimile). The title and abstract of studies were screened by me using the inclusion and exclusion criteria, and when unsure of acceptability, a second investigator with food safety and public health expertise from the WHO was consulted. If it was unclear from the title and abstract if a paper should be included (or if the paper did not have an abstract as with many documents from grey literature), the full text was reviewed before exclusion. Decisions on included and excluded texts were discussed between myself and the second investigator until consensus was reached. The expert

reference committee was also engaged in dialogue with the reviewers during selection and appraisal in an effort to include all relevant data from 1995 to July 2020.

Data extraction and study appraisal. In realist synthesis, data extraction is more akin to note-taking *(Pawson et al., 2005)*. Each document included in the study was reviewed using a bespoke data extraction form in Microsoft Excel to facilitate and organise note-taking. The form was intended to focus on the extraction of information about contexts, mechanisms, and outcomes that specifically contributed to the refinement of the initial programme theory. As per the RAMESES guidelines, the quality appraisal was made on the basis of how each study contributed to the development of C–M–O configurations (Wong et al., 2013). In a realist synthesis, quality is determined by assessing two criteria: (1) relevance and (2) rigour (Pawson, 2006). Relevance refers to the degree to which the study's information fits within the scope of the review, and rigour refers to methodological rigour and the degree to which conclusions reached in the study are appropriately drawn based on the research design employed *(Pawson et al., 2005)*. To assess relevance, each document was scored as one of the following categories (adopted from Wozney et al *(Wozney et al., 2017)* and Flynn *et al (Flynn et al., 2018))*: (1) low/no contribution; (2) medium contribution or (3) high contribution. Evidence was also assessed as either objective (empirical) or subjective (anecdotal). The relevance and rigour of each of the included studies were evaluated by two reviewers who summarised their assessment in tabular format for consideration during analysis. Documents were not excluded based on the assessment of rigour, nor were documents from which evidence was anecdotal, but collecting this information provided insight into the rigour of existing research in this field.

Data synthesis. With consideration for abductive and retroductive analysis (Greenhalgh et al., 2017; Meyer & Lunnay, 2013), documents were examined for evidence supporting, refuting, or refining the initial programme theory. The synthesis involved analysing data absent from the initial programme theory (abduction) and moving between theory and observable data (retroduction), enabling the formation of new ideas beyond the initial programme theory. Taking this approach utilised both inductive and deductive analytic processes to understand the C-M-O configuration. A thematic approach was applied to record patterns in context, mechanisms and outcomes within each document reviewed and then across documents. These patterns were compared with the original programme theory to determine if they supported, expanded or refuted its configuration. As articulated in the RAMESES guidelines, the intention here was to interrogate the C-M-O configuration and not provide quantifiable summary data from the studies reviewed (Wong et al., 2013).

Validity. Using an iterative approach to understand how different tools facilitate cross-border communication during international food safety events, why they are used, by whom, and for what purpose allowed researchers to revisit the C-M-O configurations throughout the process as data from the literature was collected. This practice and the intentional inclusion of context in the analysis improve external validity and the potential generalisability of mechanisms identified in the review (Wong et al., 2013). Further, utilising an expert reference committee to elicit feedback, identify additional publications and review the programme theory as it was developed served to bolster internal validity further.

Appendix four – Development of questionnaire for phase two

Appendix five – Interview schedule for phase three

1) Use of the ICW to support network activities

Opening question:

1.1 – The ICW is meant to be a supportive tool to facilitate participation in network activities. In this case, what does supportive mean to you? How should the ICW be supporting members?

Follow-up prompts:

1.1 – Could you describe what your experience has been like using the INFOSAN Community Website (ICW)?

1.2 – Some members use the website regularly and others less frequently. Could you describe an example of a time when you used the ICW? What was it like?

1.3 – Why do you think that only a relatively small group of INFOSAN members are active on the ICW (according to results from the first two phases of this study)?

1.4 – How could the overall experience of using the ICW be improved in order to be more supportive?

2) Barriers to active participation in INFOSAN

Opening question:

2.1 – According to results from phase 2 of this study, many members experience barriers to active participation in INFOSAN. In this case, what does it mean to you to experience barriers to active participation?

Follow-up prompts:

2.2 – Could you describe how you may have experienced any barriers to participation in the network activities and how you might have overcome them?

2.3 – Could you describe any specific enabling factors that have facilitated your participation in INFOSAN activities?

2.4 – How would you describe your experience interacting with the Secretariat (perhaps during a food safety event response)? Can you give an example? What about with other members? Can you give an example?

2.5 – Overall, how can the Secretariat help members become more active participants in INFOSAN activities? How can members help?

3) Perceptions of network achievements and attainment of objectives

Opening question:

3.1 – The INFOSAN Secretariat often suggests that the most important aim of the network is to promote the rapid exchange of information during food safety events. How have you experienced this aspect of the network activities?

Follow-up prompts:

3.2 – Could you describe your experience with INFOSAN activities aimed at sharing information on important food safety issues of global interest?

3.3 – Could you describe your experience with INFOSAN activities aimed at promoting partnership and collaboration between countries?

3.4 – Could you describe your experience with INFOSAN activities aimed at helping countries strengthen their capacity to manage food safety risks?

4) Assessing the value of INFOSAN

Opening question:

4.1 – I'm wondering if and how participating in network activities has been a valuable experience. Could you describe what value means to you in this context?

Follow-up prompts:

4.2. – In your experience, how does participation in INFOSAN create value? Could you describe an example of some experiences that have been valuable to you?

4.3 – When completing the global survey, many members provided examples of food safety events during which helpful information was provided to you through INFOSAN, do you have any examples you would like to describe? What was the impact? How was this valuable?

5) Closing Questions:

5.1 – Overall, how would you summarise your experience as a member of INFOSAN?

5.2 – Is there anything else about your experience as an INFOSAN Member that you would like to share with me at this time?

Probes:

- Could you just explain a bit more about…
- It might be obvious, but could you describe what you mean by…
- And picking up on what you said about XYZ… could you tell me more about…

Appendix six – Research proposal and ethics application

Research Proposal and Ethics Application – Version: 5 August 2018

1) Research Proposal

A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN)

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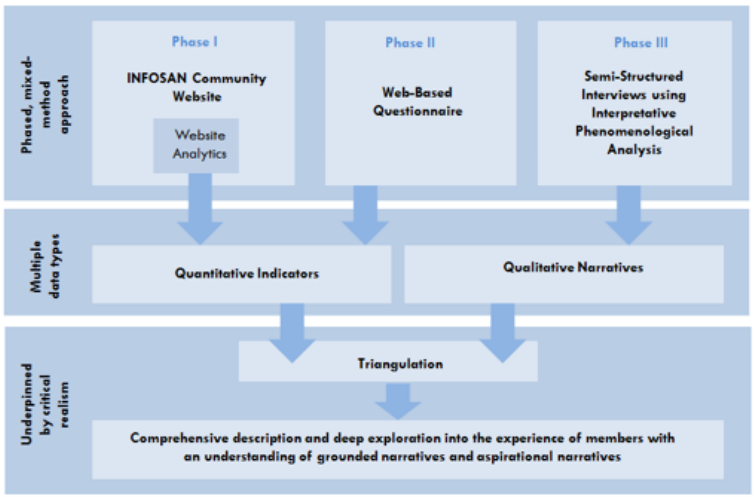
1. Brief summary statement of purpose and design

The International Food Safety Authorities Network (INFOSAN) is a global network of national food safety authorities from 188 Member States, managed jointly by FAO and WHO, which facilitates the rapid exchange of information during food safety related events. The proposed research will interrogate INFOSAN in order to describe and explore the experiences of members and better understand the role of the network in mitigating the burden of foodborne illness around the world. The study will examine access to and usage of the INFOSAN Community Website (ICW), explore barriers and facilitators to active participation in INFOSAN, determine perceptions about the utility of INFOSAN, and scrutinize if and how participation in this network creates value for members. Examined through a community of practice (CoP) lens, the three-phase research design combines quantitative and qualitative methods to elicit a broad and deep understanding of the network operation and member experience (Figure 1). Underpinned by critical realism, examining the network from multiple perspectives using multiple data sources will provide useful insight to consider when future changes or interventions intended to encourage and support active participation in the network are planned by the Secretariat at WHO, where INFOSAN is managed. In the broader context, it is envisioned that improved participation in INFOSAN will lead to a safer global food supply and a reduction in the morbidity and mortality that result from foodborne illnesses. Exploring how this network functions may also contribute to the development of new knowledge regarding the coordination of international virtual networks and communities of practice in the realm of global affairs. The three-phased, mixed-method research framework is presented in Figure 1, below.

2. Background and literature review

In 2015, the WHO reported estimates of the global burden of foodborne diseases for the first time. Together, 31 foodborne hazards are estimated to cause 600-million cases of foodborne disease and 420,000 deaths annually, worldwide (WHO, 2015). Foodborne diseases are preventable, but

Figure 1. Schematic overview of proposed research framework



ensuring a safe national food-supply requires a robust food control system and coordination among different government sectors responsible for human health, animal health, agriculture, trade and others. In addition, as a global commodity, food produced in one country can readily cause international outbreaks if contaminated food is exported abroad. Channels of communication on matters of food safety must therefore be well established within and between countries in order to prevent national and international food safety emergencies (WHO, 2014). It is for these reasons why the WHO launched INFOSAN in 2004. Today, the overall aim of INFOSAN is to halt the international spread of contaminated food, prevent foodborne disease outbreaks, and strengthen food safety systems globally (WHO, 2016). The four main objectives of INFOSAN are to: 1) Promote the rapid exchange of information during food safety related events; 2) Share information on important

food safety related issues of global interest; 3) Promote partnerships and collaboration between countries, and between networks; and 4) Help countries strengthen their capacity to manage food safety emergencies. Using the INFOSAN Community Website (ICW; a secure, online portal), INFOSAN members from around the world exchange information on urgent food safety issues and emerging trends of potential global interest. The ICW also provides a virtual environment to share lessons-learned and allows members to pose questions to one another for the purpose of building knowledge related to food safety (WHO, 2016).

INFOSAN members have a common identity that is defined by a shared domain of interest. By joining the network, each has committed to taking actions that contribute to a safer global food supply by engaging in joint activities and discussions to facilitate knowledge transfer and exchange (KTE). Common responsibilities are also shared by members, as defined by the INFOSAN Secretariat. Combined, these common responsibilities and activities create a sense of community, and are undertaken with the intention of facilitating the application of best practices to improve food safety. In addition, INFOSAN members are each practitioners in their respective countries, some as food regulators, or risk analysts, or epidemiologists or other professionals. While their focus may be different, the uniting factor is that their practice, in some respect, aims to make contributions towards the reduction of foodborne illness. It is the shared domain, community, and practice which allows for INFOSAN to be understood as a Community of Practice (CoP; Wenger, McDermott and Snyder, 2002). A CoP is a group of people sharing a particular concern, problem or passion for an area and who deepen their knowledge and expertise by learning from one another and interacting on a regular basis (Wenger et al., 2002). Such interactions may occur in person or through technology-mediated means, as with INFOSAN.

A growing body of research suggests that KTE can be effectively fostered within CoPs, leading to the uptake and application of best practices by individuals and teams in various sectors including health, business, and beyond (Ho et al., 2010). Multiple systematic reviews (Kothari et al., 2011, Mairs et al., 2013, and Quinn et al., 2014) suggest that fostering a virtual or electronic CoP

among professionals in public health is useful for encouraging KTE which translates into adoption of evidence-based best practices, and by extension, improved public health. Rajic et al. (2013) have described the benefits of facilitating KTE among food safety professionals working at the intersection of agriculture and health. Together, the literature suggests that a CoP like INFOSAN, connecting food safety and public health professionals from around the world, is an appropriate tool to facilitate KTE in this area. However, while INFOSAN has been operating for more than 13 years to facilitate the aforementioned activities among its members, it has never been characterized or examined as a functional CoP and its value, as understood from the perspective of its members, has never been determined in a systematic or rigorous way. Furthermore, a paucity of research has been conducted to investigate the attributes and effectiveness of specific tools or CoPs like INFOSAN to facilitate cross-border communication during international food safety events. To date, most of the publications mentioning such tools focus on summarising a particular incident response, rather than explicitly examining the tools that were utilised. However, such reports of international food safety events commonly conclude with recommendations to better utilise existing international networks and communication tools to improve and expedite information exchange (Einöder-Moreno et al., 2016; Guzman-Herrador et al., 2013; Inns et al., 2016; Knoblauch et al., 2015; Nygard et al., 2008; Pezzoli et al., 2008; Rebolledo et al., 2013). In addition, several published studies have specified the important role that INFOSAN has played in facilitating rapid international communication between government officials that led to the timely implementation of risk management measures during a food safety emergency (Acciari et al., 2015; Gossner et al., 2009; Khardori, 2012).

3. Aim

The overall aim is to explore and describe the experiences of INFOSAN members with respect to their participation in network activities as a means to improve global food safety and prevent foodborne illness.

4. Objectives

1) Assess the functioning of INFOSAN as a community of practice by obtaining systematic insights into the characteristics, performance and opinions of members.
2) Gain a broad and deep understanding of members' perceptions of the utility of INFOSAN as a global communication tool for KTE and the prevention of foodborne illness in their respective country.
3) Determine if participation in INFOSAN creates value for members and explore the mechanisms through which this may occur.

5. Main research questions

1) How is the ICW being used to support the network activities?
2) What are the barriers and enablers to active participation in INFOSAN?
3) Do members of INFOSAN believe that participation in the network has prevented (or will prevent) foodborne illness in their country?
4) Does participation in INFOSAN create value for members and if so, through what mechanisms does this occur?

6. Methodology and methods

6.1. Philosophical underpinnings

The theoretical framework for exploring experiences in CoPs proposed by Wenger et al. (2011) is utilized for this study and has its roots in critical realism. Critical realism is a philosophical perspective that accepts the existence of stable and enduring features of reality independently of one's ability to perceive them (Fade, 2004). Critical realism retains an ontological perspective where the real world exists independent of perceptions, while accepting a constructionist and relativist epistemic orientation, whereby our understanding of the world can only be measured as a sum of different perspectives (Maxwell, 2012). The importance of utilizing quantitative indicators together with qualitative narratives from members is a concept described by Wenger et al. (2011) in order to

understand what kind of experiences create value within CoPs. Quantitative indicators can be readily obtained from most virtual CoPs by measuring the number of unique users logging in to a web portal over time or the number of postings within a discussion forum, for example. However, Wenger et al., (2011) suggest that relying on such indicators alone would require too many assumptions to be made to accurately find meaning in experiences and determine value. Such indicators should rather serve as a point of reference from which value-creation stories can be elicited from members directly in order to provide a more robust understanding of experience. Likewise, examining only qualitative narratives from members would ignore the opportunity to crosscheck information with indicators to determine how perceptions and actions correspond. It is this acknowledgement of multiple perspectives of reality which demonstrates congruence with critical realism. In taking this approach, discrepancies and correspondences can be observed and both grounded narratives and aspirational narratives become illuminated (where grounded narratives are those for which value-creation stories are supported by quantitative indicators and aspirational narratives are not; Wenger et al., 2011).

With an understanding of INFOSAN as a functional CoP, and with an appreciation for the critical realist perspective that underpins its examination, it is incumbent upon the researcher of the proposed study to take a mixed-method approach in order to strengthen the credibility of the findings and provide a more complete view and deeper understanding of the experiences of members. The utilization of such an approach for the investigation of experiences of online community members is strongly supported by a growing body of literature (de Laat and Lally, 2003; Guldberg and Mackness, 2009).

6.2. Setting

The study will be conducted by the researcher from within the Department of Food Safety and Zoonoses (FOS) at the headquarters of the WHO in Geneva, Switzerland (where the INFOSAN Secretariat is based), however the true setting is global since INFOSAN membership spans 188 countries.

6.3 General comments on sampling

For each phase of the research, participants will only include registered INFOSAN members. These individuals have been officially designated by their national government and are all registered on the ICW (N=500). INFOSAN membership includes both men and women in approximately equal proportions.

6.4 General comments on recruitment

Written permission to conduct the proposed research on INFOSAN has been requested to the Director of FOS at the WHO, where the INFOSAN Secretariat is based (Appendix 1). Permission to conduct this study has been granted by the Director on 19 June 2018 (pending ethics review). Upon approval , all members of INFOSAN will receive by email, written introductory information about the proposed research (Information Email #1; Appendix 2), including an invitation to attend an online seminar (i.e. webinar), delivered by the researcher, to find out more information about the study and ask any questions or seek clarification. This webinar, like all future webinars discussed in this proposal, will be scheduled at three different times to allow INFOSAN members across different time zones to participate. The webinar will be delivered using the secure online conferencing tool, WebEx. The live webinars will not be recorded, but a recording will be made by the researcher alone and will be made available to INFOSAN members to view in case they would like to do so at their convenience.

6.5. Phase 1: Analysis of INFOSAN Community Website access and usage

6.5.1. Sampling, recruitment and consent

Information Email #1 will explain the three different phases of the proposed research, and remind INFOSAN members that data analysed in Phase 1 of the study will be extracted from the ICW in accordance with the Terms and Conditions of Use that each member consented to when they registered online (Appendix 3). The relevant text within the Terms and Conditions of Use, reads as follows: "Utilization of website analytics tools or other methods will be applied periodically to

summarize members' access to and usage of the INFOSAN Community Website for monitoring, evaluation and research purposes." As such, data pertaining to all members of INFOSAN with respect to their access to and usage of the ICW, will be utilised in Phase 1 of the study unless a member expressly indicates their wish to be excluded. Information Email #1 (and related webinars) will ensure that INFOSAN members understand that any members not wishing to have their website access and usage data utilised for the purpose of this study will have two weeks to make this indication by email to the researcher. All those members who do not otherwise object will be recruited for Phase 1. Those who are recruited in Phase 1 will have a further two weeks to opt out of the study, after which time this will no longer be possible due to aggregation of the data.

6.5.2. Data collection and analysis

Access to the ICW is granted to the researcher in his capacity as a staff member at WHO and approval for use in this research will be requested to the Director of FOS, WHO (Appendix 1). Data from the ICW will be collected retrospectively for the period between February 2012 (when the website was launched) and May 2018. Information from all recruited members concerning the following variables will be downloaded from the website, anonymised and exported into Microsoft Excel and SPSS for analysis: type of member, sex, country, languages spoken, government sector, primary function (i.e. risk assessment, risk communication, or risk management), and areas of scientific expertise. These data have all been automatically collected and stored in the internal website database at the time of member registration (see screenshot of online registration form in Appendix 4). Additional data about length of membership, last access to the website, and discussion thread initiations, responses and views will also be collected and exported for analysis. Once collected, all anonymised data will be analysed using descriptive summary statistics, which will allow for stratification by a number of variables including type of member, geographic region, and length of membership. Analysing these data will provide an objective, foundational layer of information about the experiences of all members and will be triangulated with data from Phases 2 and 3 to determine if members' reported attitudes and experiences reflect their online behaviours. In addition, triangulated

data will also allow for INFOSAN to be described with respect to its stage of community development according to Wenger et al (2002), taking into account its structuring characteristics as described by Dubé, Bourhis and Jacob (2006).

6.6. Phase 2: Administration of an online survey

6.6.1. Sampling, recruitment and consent

Upon conclusion of data collection and analysis in Phase 1, all members of INFOSAN will receive Information Email #2 (Appendix 5) which will include indicative results from Phase 1 and an invitation to attend a webinar, delivered by the researcher, to learn more about the results from Phase 1 and to provide further details about Phase 2. Immediately following the webinar, all INFOSAN members (N=500) will receive Information Email #3 (Appendix 6), including the invitation to participate in Phase 2 of the study and containing a link to an online survey. Only those who express consent will be recruited as participants for Phase 2. No consent form will be collected because that would compromise anonymity, however, the email will explain that by clicking on the link, the individual confirms that they have read the introductory information and understand what is expected of them as a participant in this phase of the study (full details in Appendix 6).

6.6.2. Data collection and analysis

Recruited participants will be requested to complete an online questionnaire that will take between 30 and 45 minutes. Responses to the questionnaire are intended to provide systematic insights into the characteristics, performance and opinions of INFOSAN members and contribute to a broader understanding of their experiences. The questionnaire will consist of questions from the Community Assessment Toolkit (CAT; Verburg and Andriessen, 2006) as well as a supplemental set of questions, tailored specifically to INFOSAN members. During the development of the CAT, Verburg and Andriessen (2006) demonstrated that the methodology for its development was based on dominant theories of CoPs and group dynamics. The CAT was pilot tested and studied with seven CoPs (n=271) to enable reliability tests and scale analysis. Cronbach's alpha for the scales ranged

from .59 to .91 and as the items referred to quite separate goals, Verburg and Andriessen (2006) reported these values acceptable. Utilizing the CAT in this study will enable future comparative research between CoPs that have been assessed with the same tool (e.g. Roberts, 2015). However, given the unique nature of INFOSAN and the specific objectives of this study, it is also necessary to develop a short set of supplemental questions to examine the experiences of INFOSAN members that are unique to this particular CoP. A preliminary set of supplemental questions has been inserted to the appropriate sections of the CAT questionnaire in Appendix 7. These supplemental questions will be reviewed for content validity by a panel of experts consisting members of the INFOSAN Advisory Group (Appendix 8) since they are familiar with the constructs that the supplemental questions are designed to measure. The expert panel will judge whether the supplemental questions adequately measure the construct they are intended to assess, and whether these supplemental questions are indeed sufficient to measure the domain of interest. A Content Validity Index (CVI) will be computed for each supplementary item and items with a CVI of 0.78 or higher for three or more experts will be considered evidence of good content validity (Polit, Beck and Owen, 2007). Based on feedback from the expert panel, the supplemental questions will be revised prior to pilot testing. After incorporating any suggestions from INFOSAN Advisory Group members, FAO/WHO Regional Food Safety Advisors/Officers (Appendix 9) will be requested to pilot test the supplemental questions. As a measure of reliability, internal consistency will be estimated using the coefficient alpha, also known as Cronbach's alpha. Determining the internal consistency will reflect the extent to which the questionnaire items are inter-correlated, or whether they are consistent in measurement of the same construct (Tsang, Royse and Terkawi, 2017).

Because the questionnaire (including the CAT questions and the supplementary questions) will be disseminated to INFOSAN members in 188 countries, it will be adapted from English into French and Spanish in order to encourage a higher response rate. The aim of the adaptation process is to achieve different language versions of the English instrument that are conceptually equivalent in both French and Spanish. The instrument should be equally natural and acceptable and should

practically perform in the same way, with a focus on cross-cultural and conceptual equivalence, rather than on linguistic/literal equivalence. A well-established method to achieve this goal is to use forward-translations and back-translations (WHO, 2018). This method has been refined over the course of several WHO studies to result in the following process which will be undertaken to adapt the questionnaires into French and Spanish (WHO, 2018). First, one native Spanish speaker and one native French speaker from the Department of Food Safety and Zoonoses at WHO will conduct forward translations of the entire questionnaire. These translators will be health professionals, familiar with the terminology of the area covered by the instrument. Next, two bilingual expert panels will be convened to identify and resolve the inadequate expressions/concepts of the translation, as well as any discrepancies between the forward translation and the English versions of the questions. Next, using the same approach as outlined in the first step, the questionnaire will then be translated back to English by an independent translator (from central translation services at WHO), whose mother tongue is English and who has no knowledge of the questionnaire. As in the forward-translation, emphasis in the back-translation should be on conceptual and cultural equivalence and not linguistic equivalence. Discrepancies should be discussed with the researcher and further work (forward translations, discussion by the bilingual expert panel, etc.) will be iterated as many times as needed until a satisfactory version is reached. This version will then be pre-tested with a group of 20 interns at WHO including 10 native French speakers and 10 native Spanish speakers. A call for volunteers will be disseminated through the WHO intern mailing list. Pre-test respondents will be administered the questionnaire and then systematically debriefed. This debriefing will ask respondents what they thought the questions were asking, whether they could repeat the questions in their own words, and what came to their minds when they heard a particular phrase or term. The debriefing will take the form of a focus group, organized at WHO. The adaptation process followed will be traceable through a number of documents including: 1) initial forward versions; 2) a summary of recommendations by the expert panels; 3) the back-translations; 4) a summary of problems found during the pre-testing of the instrument and the modifications proposed; 5) the final version; and 6) a description of the

samples used in this process (i.e. the composition of the expert panel and the pre-test respondent samples). The process of expanding and adapting the questionnaire is summarized in Appendix 10.

Quantitative data collected from the online questionnaires will be analysed using descriptive summary statistics, allowing for stratification by a number of variables including type of member, geographic region, length of membership, etc. A variety of techniques for univariate, bivariate and multivariate analysis using SPSS will be employed in order to examine patterns and relationships between variables. Depending on the response rate to the survey, the researcher may need to adjust for non-response bias in order to generalise the results to the entire network (Bryman, 2012). The researcher is a native English speaker with a working knowledge of French and basic knowledge of Spanish. As such, for the very few instances where an open text response is an open, answers provided in French or Spanish will be translated by the researcher with the aid of google translate, if necessary.

6.7. Phase 3: Semi-structured interviews

6.7.1. Sampling, recruitment and consent

Upon conclusion of data collection and analysis in Phase 2, all members of INFOSAN will receive Information Email #4 (Appendix 11) which will include indicative results from Phase 2 and an invitation to attend a webinar, delivered by the researcher, to learn more about the results from Phase 2 and to provide further details about Phase 3. The email and webinar will also include a request that members interested in participating in Phase 3 indicate this by emailing the researcher. The online survey in Phase 2 will also serve as a recruitment tool for Phase 3 since a concluding statement on the survey will indicate that members interested in participating in Phase 3 of the research should contact the researcher separately by email.

A minimum of six and a maximum of 12 participants will be included in the study sample, aiming for two participants from each of the six geographic regions delineated by WHO. The purpose is not to be representative of the entire network, however, because INFOSAN is global, including

participants from each region may reveal a richer pool of experience than if all members were selected from a single region. In addition, a sample size within this range should allow for the examination of similarities and differences between individuals, without producing an overwhelmingly large amount of qualitative data that cannot be managed within the confines of the study timeline. This sample of participants will be restricted to those INFOSAN members who have been registered members for a minimum of two years at the time of their interview to ensure they have a reasonable level of experience with the network from which to draw. The sample will be limited to those members who speak English due to limited funding for research conduct (including for translation and interpretation) and limited time for collecting and analysing data in other languages. In the event that at least one member per WHO region does not volunteer after receiving Information Email #4, follow-up emails will be sent to those members from the regions where volunteers are still needed, to indicate as such.

If more than two people from a single WHO region indicate their interest in participating in Phase 3, the two people who have been members the longest will be selected and notified by email from the researcher, providing they are not from the same country. Any individuals who volunteer for Phase 3 but who are not selected will be emailed individually by the researcher and provided with an explanation about how the selection was made (Appendix 12).

Prior to commencing their interview, INFOSAN members who volunteer and are recruited for Phase 3 of the study will need to have read, signed, and returned by email to the researcher, the Phase 3 consent form as detailed in Appendix 13. Immediately before the interview, the researcher will ensure the participants are aware they can choose to withdraw from the study at any time, for any reason, before or during their interview and withdraw their data up to two weeks after their interview.

6.7.2. Data Collection and Analysis

Recruited participants will be requested to participate in a semi-structured interview conducted online using the secure tool, WebEx, because participants are anticipated to be located in

various countries around the world (no face-to-face interviews will be conducted). The interviews will be scheduled to last between 45 minutes and one hour. The same four themes explored in Phase 2 will be explored during the interviews, and the discussion will focus on answering the related questions of 'how?' and 'why?' instead of just 'what?' as elaborated in the interview guide in Appendix 14 (results from Phase 1 and/or 2 may lead to the addition or deletion of certain questions from the current interview guide). The researcher will follow Interpretative Phenomenological Analysis (IPA) to engage in a dialogue with study participants to explore and describe their lived experiences regarding participation in activities related to INFOSAN. Such a method requires a flexible data collection instrument (Smith et al., 2009) and therefore, the semi-structured format of the interviews will be conversational in style, allowing the researcher and participant to engage in a dialogue where questions can be modified depending on responses. This format also enables the researcher to prompt further elaboration in certain areas of interest identified by participants, allowing for more flexibility than a structured interview (Smith et al., 2009). The interviews will be audio recorded and then transcribed by the researcher. Audio recordings will be made using WebEx and immediately downloaded, password protected and encrypted on a laptop. Audio recorded data will be anonymised as far as is possible (given the nature of audio data) by saving the file with an de-identified tag (e.g Participant #1 Region X). Prior to recording, the researcher will remind the participant that they can refrain from using names of people and places to the extent possible when answering questions, to assist with anonymization. Once recording has started, the researcher will not use the participant's name during the interview. Transcripts will be anonymized by replacing identifying names of people or places with a de-identified tag (e.g Participant #1 Region X). Analysis will involve multiple readings of the interview transcripts, coupled with note taking, followed by transformation of notes into emergent themes, and finally, seeking relationships and clustering themes (Smith et al., 2009).

An important aspect of the overall analysis will be triangulation of the information collected from each phase including quantitative indicators and qualitative value stories. Anonymised information and quotations from participant interviews will be reported, representing the limits to

confidentiality. The combined strengths of quantitative and qualitative methods can contribute to improved study validity, credibility, and overall integrity and provide a broad and deep understanding of members' experiences (Bryman, 2012; Allsop, 2013; Cresswell, 2009). The indicative results from Phase 3, along with a triangulated analysis of data from all three phases will be communicated to INFOSAN members through Information Email #5 (Appendix 15) and a final webinar, delivered by the researcher.

7. – Ethical issues

7.1. – Data management and storage

In accordance with the General Data Protection Regulation (GDPR) and the (UK) Data Protection Act 2018, all electronic data will be anonymised and stored onto encrypted password-protected storage devices, including data keys and a laptop computer) provided by the WHO. These encrypted files will utilise meaningful file names and version numbers and will be accompanied by a Readme file. Personal identifiers will be kept separately from anonymised data in either encrypted computer storage (for electronic files) or in a locked filing cabinet (for paper files) and destroyed following the completion and acceptance of the PhD thesis. Only the researcher and his supervisors will have access to the anonymised data for the duration of the study. Electronic copies of transcripts will be transferred in person by the researcher from WHO headquarters to Lancaster University on encrypted, password-protected storage devices and then archived for 10 years in secure encrypted storage on the Lancaster University server, after which time they will be destroyed. Storage and destruction of data will be done by Lancaster University's designated Data Protection Officer.

7.2. – Conducting insider research

By the nature of this work-based research project, the researcher is an insider, investigating an issue that examines, in broad terms, the operation of an organizational programme. The researcher is therefore an agent of his organization as a technical officer at WHO and also an agent of Lancaster

University as a PhD student. As such, the ethical considerations for the design of this research project have been carefully made from the insider researcher perspective.

In addition to approval being granted by the Director of FOS to conduct this research, the proposed study will also be subject to scrutiny and approval by the Faculty of Health and Medicine Research Ethics Committee at Lancaster University and the WHO Research Ethics Board before it can commence[1]. In addition, the conduct of the research will be governed by the WHO Code of Ethics and Professional Conduct and the WHO Code of Conduct for Responsible Research which both emphasise the need for all research to be conducted with integrity, accountability, independence, impartiality, respect, and professional commitment.

While there are several positive aspects to being an insider researcher (e.g. informed perspective, ability to implement study recommendations directly, etc.), the potential conflicts of interest must be carefully considered, acknowledged and addressed. As members of INFOSAN are familiar with the researcher in his role at WHO, he will need to ensure transparency and clarity that the proposed research is being conducted as part of a PhD study. It will also be necessary to ensure that despite having access to additional data or information, that only those data collected with the expressed consent of participants is utilised and reported on for the purposes of this study. INFOSAN members must be assured that neither their participation nor abstention will impact their future treatment as an INFOSAN member or the technical support provided to them or their agency by the WHO.

Acknowledging the role of the researcher as an insider is congruent with the methodology used to conduct this research on INFOSAN through a CoP lens. IPA as a research methodology has its theoretical roots in critical realism (Fade, 2004) and is concerned with carefully detailing the lived experience of individuals. As explained by Guldberg and Mackness (2009), utilizing IPA to understand experience aligns with a CoP lens since the focus of analysis is on the interpretations of members and the values they attribute to them. In addition, IPA acknowledges and embraces the role

[1] This process involved review by an external scientific committee (Appendix 16)

of the researcher's interpretation and understanding of members' lived experiences. The researcher, through his insider role on the INFOSAN Secretariat, plays an important part in connecting, communicating and facilitating interaction among members, and therefore his familiarity with the participants and ability to provide expertise in the interpretation and understanding of members' experiences should be considered an asset.

While the role of insider researcher can present some potential conflicts of interest, transparency in process, due permissions from senior WHO staff, and assurances given to INFOSAN members, should ensure this research is conducted to the highest ethical standard. In addition, several techniques well-known to insider researchers will be employed to aid in accurately understanding and documenting the experiences of INFOSAN members, including the practice of reflexivity. The practice of reflexivity will involve active engagement of the self and questioning of the researcher's own perceptions in order to expose their contextualized nature (Green, 2014). A diary will be kept by the researcher during data collection and analysis to document reflexivity including predictions of outcomes for each phase of the study and how they relate to one another.

8. Timetable

The proposed study will be conducted between August 2018 and August 2020. Additional details are illustrated in Figure 2 below.

Figure 2. Timeline for proposed PhD Study 2018 - 2020

<table>
<tr><th></th><th>January</th><th>February</th><th>March</th><th>April</th><th>May</th><th>June</th><th>July</th><th>August</th><th>September</th><th>October</th><th>November</th><th>December</th></tr>
<tr><td rowspan="2">2018</td><td colspan="4">Revise Research Proposal</td><td colspan="3">Ethics approval from WHO REC and FHMREC</td><td>Phase 1 Data Collection</td><td>Phase 1 Data Analysis</td><td>Phase 1 Results Webinars</td><td colspan="2">Phase 2 Data Collection</td></tr>
<tr><td colspan="5">Finalize and Submit background paper</td><td colspan="2">Finalize and submit Realist Synthesis Protocol</td><td colspan="5">Write Realist Synthesis Paper</td></tr>
<tr><td rowspan="2">2019</td><td colspan="2">Phase 2 Data Analysis</td><td>Phase 2 Results Webinars</td><td colspan="3">Phase 3 Data Collection (interviews and transcription)</td><td colspan="3">Phase 3 Data Analysis</td><td>Phase 3 Results Webinars</td><td colspan="2" rowspan="2">Write Phase 3 (triangulation) Paper</td></tr>
<tr><td colspan="2">Write and Submit Realist Synthesis Paper</td><td colspan="4">Write and Submit Phase 1 Paper</td><td colspan="4">Write and Submit Phase 2 Paper</td></tr>
<tr><td>2020</td><td colspan="3">Write and Submit Phase 3 (triangulation) Paper</td><td colspan="5">Write up Thesis</td><td>Viva</td><td colspan="2"></td></tr>
</table>

9. Dissemination plans

The researcher will disseminate findings from the study in the following ways: 1) via webinars, open to all INFOSAN members following each of the three phases of the study; 2) as an oral presentation to staff within FOS, WHO; and 3) as a PhD thesis submitted to Lancaster University. In addition, results of the research shall be submitted for publication to relevant academic or professional conferences and journals or other media including books or websites (Appendix 17).

2) Ethics Application

Faculty of Health and Medicine Research Ethics Committee (FHMREC)

Lancaster University

Application for Ethical Approval for Research

for additional advice on completing this form, hover cursor over 'guidance'.

Guidance on completing this form is also available as a word document

Title of Project: A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN)

Name of applicant/researcher: Carmen Savelli

ACP ID number (if applicable)*: N/A **Funding source (if applicable)** N/A

Grant code (if applicable): N/A

***If your project has *not* been costed on ACP, you will also need to complete the Governance Checklist [link].**

Type of study

☐ Involves existing documents/data only, or the evaluation of an existing project with no direct contact with human participants. **Complete sections one, *two* and four of this form**

☒ Includes *direct* involvement by human subjects. **Complete sections one, *three* and four of this form**

SECTION ONE

1. Appointment/position held by applicant and Division within FHM PhD student

2. Contact information for applicant:

E-mail: c.savelli@lancaster.ac.uk **Telephone:** +41 (0)799456320 (please give a number on which you can be contacted at short notice)

Address: Rue de l'Athénée 22, Geneva, Switzerland, 1206.

3. **Names and appointments of all members of the research team (including degree where applicable)**

Research Student: Carmen Savelli, PhD Student, BSc (Biomedical Science), MPH (Public Health)

Main Supervisor: Dr Céu Mateus, PhD

3. If this is a student project, please indicate what type of project by marking the relevant box/deleting as appropriate: (please note that UG and taught masters projects should complete **FHMREC form UG-tPG**, following the procedures set out on the FHMREC website

PG Diploma ☐ Masters by research ☐ PhD Thesis ☐ PhD Pall. Care ☐

PhD Pub. Health ☒ PhD Org. Health & Well Being ☐ PhD Mental Health ☐ MD ☐

DClinPsy SRP ☐ [if SRP Service Evaluation, please also indicate here: ☐] DClinPsy Thesis ☐

4. Project supervisor(s), if different from applicant: Dr Céu Mateus

5. **Appointment held by supervisor(s) and institution(s) where based (if applicable):** Dr Céu Mateus, Senior Lecturer in Health Economics, Lancaster University;

SECTION TWO

Complete this section if your project involves existing documents/data only, or the evaluation of an existing project with no direct contact with human participants

1. Anticipated project dates (month and year)
Start date: End date:

2. Please state the aims and objectives of the project (no more than 150 words, in lay-person's language):

Data Management

For additional guidance on data management, please go to Research Data Management *webpage, or email the RDM support email:* rdm@lancaster.ac.uk

3. Please describe briefly the data or records to be studied, or the evaluation to be undertaken.

4a. How will any data or records be obtained?
4b. Will you be gathering data from websites, discussion forums and on-line 'chat-rooms' ☐

4c. If yes, where relevant has permission / agreement been secured from the website moderator? ☐

4d. If you are only using those sites that are open access and do not require registration, have you made your intentions clear to other site users? ☐

4e. If no, please give your reasons

5. What plans are in place for the storage, back-up, security and documentation of data (electronic, digital, paper, etc)? Note who will be responsible for deleting the data at the end of the storage period. Please ensure that your plans comply with the General Data Protection Regulation (GDPR) and the (UK) Data Protection Act 2018.

6a. Is the secondary data you will be using in the public domain? ☐

6b. If NO, please indicate the original purpose for which the data was collected, and comment on whether consent was gathered for additional later use of the data.

Please answer the following question *only* if you have not completed a Data Management Plan for an external funder

7a. How will you share and preserve the data underpinning your publications for at least 10 years e.g. PURE?

7b. Are there any restrictions on sharing your data?

8. Confidentiality and Anonymity

a. Will you take the necessary steps to assure the anonymity of subjects, including in subsequent publications? ☐

b. How will the confidentiality and anonymity of participants who provided the original data be maintained?

9. What are the plans for dissemination of findings from the research?

10. What other ethical considerations (if any), not previously noted on this application, do you think there are in the proposed study? How will these issues be addressed?

SECTION THREE

Complete this section if your project includes *direct* involvement by human subjects

1. Summary of research protocol in lay terms (indicative maximum length 150 words):

The proposed study involves an examination of the experiences of members of the International Food Safety Authorities Network (INFOSAN). Experiences will be better understood through conducting research in three phases. In Phase 1, information from an online portal to which each INFOSAN member (N = 500+) is registered will be examined in order to characterize membership and understand patterns of information exchange. In Phase 2, a robust questionnaire will be disseminated to all INFOSAN members to gain a broad understanding of members' perceptions and experiences interacting with one another and to determine if members see a value in participating in INFOSAN. In Phase 3, a small subset of members will be interviewed to more deeply explore some of the issues illuminated in the first two phases. It is envisioned that data from the three phases will provide an understanding of the utility of INFOSAN as a tool to mitigate foodborne disease and facilitate communication about food safety globally, based on the experiences of members.

2. Anticipated project dates (month and year only)

Start date: August 2018 End date: August 2020

Data Collection and Management

For additional guidance on data management, please go to Research Data Management *webpage, or email the RDM support email:* rdm@lancaster.ac.uk

3. Please describe the sample of participants to be studied (including maximum & minimum number, age, gender):

For each phase of the research, participants will only include registered INFOSAN members. Members of INFOSAN currently include approximately 500 adults, located across 188 countries, each working for a national government agency that contributes to ensuring food safety in their country (e.g. Ministry of Health, Ministry of Agriculture, National Veterinary Service, etc.). These individuals have been officially designated by their national government and are all registered on the INFOSAN Community Website (ICW). INFOSAN Membership includes both men and women.

Phase 1: Analysis of INFOSAN Community Website access and usage

Data pertaining to all members of INFOSAN (N=500) with respect to their access to and usage of the ICW will be utilised in Phase 1 of the study unless a member expressly indicates their wish to be excluded (see section 9b.1).

Phase 2: Self-completion online questionnaire

All INFOSAN members (N=500) will be requested by email to participate in Phase 2 of the study. Only those who provide consent (see section 9b.2) will be able to participate.

Phase 3: Semi-structured interviews using Interpretative Phenomenological Analysis (IPA)

Interpretative Phenomenological Analysis (IPA) is a qualitative research approach that aims to detail personal lived experiences and explain how one may understand a certain phenomenon in a certain context (Smith et al., 2009). Sample sizes for studies using IPA are intentionally small in order to concentrate on depth rather than breadth. A minimum of 6 and a maximum of 12 participants will

be included in the sample, aiming for 2 participants from each of the 6 geographic regions delineated by WHO. The purpose is not to be representative of the entire network, however, because INFOSAN is a global network, including participants from each of the 6 regions may reveal a richer pool of experience than if all members were selected from a single region. In addition, a sample size within this range should allow for the examination of similarities and differences between individuals, without producing an overwhelmingly large amount of qualitative data that cannot be managed within the confines of the study timeline. This sample of participants will be restricted to those INFOSAN members who have been registered members for a minimum of two years at the time of the interview to ensure they have a reasonable level of knowledge with the network and its activities from which to draw during the interview. The sample will be limited to those members who speak English due to limited funding for research conduct (including for translation and interpretation) and limited time for collecting and analysing data in other languages. Recruited participants will have to express consent as described in section 9b.3. In the event that at least one member per WHO region does not volunteer after receiving Information Email #4, follow-up emails will be sent to those members from the regions where volunteers are still needed, to indicate as such.

4. How will participants be recruited and from where? Be as specific as possible. Ensure that you provide the *full versions* of all recruitment materials you intend to use with this application (eg adverts, flyers, posters).

Written permission to conduct the proposed research on INFOSAN has been requested from the Director of the Department of Food Safety and Zoonoses (FOS) at the WHO, where the INFOSAN Secretariat is based (Appendix 1). Permission has been granted by the Director on 19 June 2018 (pending ethics review by LHMREC and WHO Research Ethics Review Committee). Upon approval, all members of INFOSAN will receive by email, introductory information about the proposed research (Information Email #1; Appendix 2, including an invitation to attend an online seminar (i.e. webinar), delivered by the researcher, to find out more information about the study and ask any questions or seek clarification. This webinar, like all future webinars discussed in this application, will be scheduled at three different times to allow INFOSAN members across different time zones to participate. The webinar will be delivered using a secure online conferencing tool (i.e. WebEx). WebEx is the preferred online conferencing tool of Lancaster University because of its superior level of security compared to other options (e.g. Skype, FaceTime, etc.).

4.1 Recruitment for Phase 1: Analysis of INFOSAN Community Website Access and Usage

Information Email #1 will explain the three different phases of the proposed research, and will remind INFOSAN members that data analysed in Phase 1 of the study will be extracted from the ICW in accordance with the Terms and Conditions of Use that each member agreed to when they registered (Appendix 3). The relevant text within the Terms and Conditions of Use, reads as follows: "Utilization of website analytics tools or other methods will be applied periodically to summarise members' access to and usage of the INFOSAN Community Website for monitoring, evaluation and research purposes." Information Email #1 (and subsequent webinars) will ensure that INFOSAN members understand that any members not wishing to have their website access and usage data utilised for the purpose of this particular study will have two weeks to make this indication by email

to the researcher. All those members who do not otherwise object will be recruited for Phase 1 of the study.

4.2 Recruitment for Phase 2: self-completion online questionnaire

Upon conclusion of data collection and analysis in Phase 1, all members of INFOSAN will receive Information Email #2 (Appendix 5) that includes indicative results from Phase 1 and an invitation to attend a webinar, delivered by the researcher, to learn more about the results from Phase 1 and to provide further details about Phase 2. Immediately following the webinars, all INFOSAN members will receive Information Email #3 (See Appendix 6), including the invitation to participate in Phase 2 of the study and containing a link to an online questionnaire. Only those who express consent (see section 9b.2) will be recruited as participants for Phase 2 of the study.

4.3 Recruitment for Phase 3: Participation in semi-structured interviews

Upon conclusion of data collection and analysis in Phase 2, all members of INFOSAN will receive Information Email #4 (Appendix 11) that will include indicative results from Phase 2 and an invitation to attend a webinar, delivered by the researcher, to learn more about the results from Phase 2 and to provide further details about Phase 3. The email and webinar will also include a request that members interested in participating in Phase 3 indicate this by emailing the researcher. The online questionnaire in Phase 2 will also serve as a recruitment tool for Phase 3 as a concluding statement on the questionnaire will indicate that members interested in participating in Phase 3 of the research should contact the researcher separately by email. Recruited participants will have to express consent as described in section 9b.3.

If more than two people from a single WHO region indicate their interest in participating in Phase 3, the two people who have been members the longest will be selected and notified by email from the researcher, providing they are not from the same country. Any individuals who volunteer for Phase 3 but who are not selected will be emailed individually by the researcher (Appendix 7) and provided with an explanation about how the selection was made. These individuals will be reminded that if they have additional information they wish to share with respect to their experience as an INFOSAN member, they are always welcome to contact the INFOSAN Secretariat at WHO directly.

5. Briefly describe your data collection and analysis methods, and the rationale for their use.

5.1. Phase 1 Data Collection and Analysis: INFOSAN Community Website Access and Usage

Access to the ICW is granted to the researcher in his capacity as a WHO staff member, and approval for use in this research will be requested from the Director of FOS, WHO (as described above). Data from the ICW will be collected retrospectively for the period between February 2012 (when the website was launched) and May 2018. Information from all members concerning the following variables will be downloaded from the website and exported into Microsoft Excel and SPSS: type of member, sex, country, languages spoken, government sector, primary function (i.e. risk assessment, risk communication, or risk management), and area of scientific expertise. These data have all been automatically collected and stored in the internal ICW database at the time of member registration. Additional data about length of membership, last access to the website, and discussion thread initiations, responses and views will also be collected and exported into Microsoft Excel and SPSS.

Once collected, all data will by anonymised and analysed using descriptive summary statistics, which will allow for stratification by a number of variables including type of member, geographic region, length of membership. Analysing these data will provide an objective first layer of information about the experiences of all members and will be triangulated with data from phases 2 and 3 to determine if members' reported attitudes and experiences reflect their online behaviours. In addition, triangulated data will also allow for INFOSAN to be described with respect to its stage of community development according to Wenger et al (2002), taking into account its structuring characteristics as described by Dubé, Bourhis and Jacob (2006).

5.2. Phase 2 Data collection and analysis: self-completed online questionnaire

Recruited participants will be requested to complete an online questionnaire that will take between 30 and 45 minutes. Responses to the questionnaire are intended to provide systematic insights into the characteristics, performance and opinions of INFOSAN members and contribute to a broader understanding of their experiences. The questionnaire will consist of questions from the Community Assessment Toolkit (CAT; Verburg and Andriessen, 2006) as well as a supplemental set of questions, tailored specifically to INFOSAN members. During the development of the CAT, Verburg and Andriessen (2006) demonstrated that the methodology for its development was based on dominant theories of CoPs and group dynamics. The CAT was pilot tested and studied with seven CoPs (n=271) to enable reliability tests and scale analysis. Cronbach's alpha for the scales ranged from .59 to .91 and as the items referred to quite separate goals, Verburg and Andriessen (2006) reported these values acceptable. Utilizing the CAT in this study will enable future comparative research between CoPs that have been assessed with the same tool (e.g. Roberts, 2015). However, given the unique nature of INFOSAN and the specific objectives of this study, it is also necessary to develop a short set of supplemental questions to examine the experiences of INFOSAN members that are unique to this particular CoP. A preliminary set of supplemental questions has been inserted to the appropriate sections of the CAT questionnaire in Appendix 7. These supplemental questions will be reviewed for content validity by a panel of experts consisting members of the INFOSAN Advisory Group (Appendix 8) since they are familiar with the constructs that the supplemental questions are designed to measure. The expert panel will judge whether the supplemental questions adequately measure the construct they are intended to assess, and whether these supplemental questions are indeed sufficient to measure the domain of interest. A Content Validity Index (CVI) will be computed for each supplementary item and items with a CVI of 0.78 or higher for three or more experts will be considered evidence of good content validity (Polit, Beck and Owen, 2007). Based on feedback from the expert panel, the supplemental questions will be revised prior to pilot testing. After incorporating any suggestions from INFOSAN Advisory Group members, FAO/WHO Regional Food Safety Advisors/Officers (Appendix 9) will be requested to pilot test the supplemental questions. As a measure of reliability, internal consistency will be estimated using the coefficient alpha, also known as Cronbach's alpha. Determining the internal consistency will reflect the extent to which the questionnaire items are inter-correlated, or whether they are consistent in measurement of the same construct (Tsang, Royse and Terkawi, 2017). Because the questionnaire (including the CAT questions and the supplementary questions) will be disseminated to INFOSAN members in 188 countries, it will be adapted from English into French and Spanish in order to encourage a higher response rate. The aim of the adaptation process is to achieve different language versions of the

English instrument that are conceptually equivalent in both French and Spanish. The instrument should be equally natural and acceptable and should practically perform in the same way, with a focus on cross-cultural and conceptual equivalence, rather than on linguistic/literal equivalence. A well-established method to achieve this goal is to use forward-translations and back-translations (WHO, 2018). This method has been refined over the course of several WHO studies to result in the following process which will be undertaken to adapt the questionnaires into French and Spanish (WHO, 2018). First, one native Spanish speaker and one native French speaker from the Department of Food Safety and Zoonoses at WHO will conduct forward translations of the entire questionnaire. These translators will be health professionals, familiar with the terminology of the area covered by the instrument. Next, two bilingual expert panels will be convened to identify and resolve the inadequate expressions/concepts of the translation, as well as any discrepancies between the forward translation and the English versions of the questions. Next, using the same approach as outlined in the first step, the questionnaire will then be translated back to English by an independent translator (from central translation services at WHO), whose mother tongue is English and who has no knowledge of the questionnaire. As in the forward-translation, emphasis in the back-translation should be on conceptual and cultural equivalence and not linguistic equivalence. Discrepancies should be discussed with the researcher and further work (forward translations, discussion by the bilingual expert panel, etc.) will be iterated as many times as needed until a satisfactory version is reached. This version will then be pre-tested with a group of 20 interns at WHO including 10 native French speakers and 10 native Spanish speakers. A call for volunteers will be disseminated through the WHO intern mailing list. Pre-test respondents will be administered the questionnaire and then systematically debriefed. This debriefing will ask respondents what they thought the questions were asking, whether they could repeat the questions in their own words, and what came to their minds when they heard a particular phrase or term. The debriefing will take the form of a focus group, organized at WHO. The adaptation process followed will be traceable through a number of documents including: 1) initial forward versions; 2) a summary of recommendations by the expert panels; 3) the back-translations; 4) a summary of problems found during the pre-testing of the instrument and the modifications proposed; 5) the final version; and 6) a description of the samples used in this process (i.e. the composition of the expert panel and the pre-test respondent samples). The process of expanding and adapting the questionnaire is summarized in Appendix 10.
Quantitative data collected from the online questionnaires will be analysed using descriptive summary statistics, allowing for stratification by a number of variables including type of member, geographic region, length of membership, etc. A variety of techniques for univariate, bivariate and multivariate analysis using SPSS will be employed in order to examine patterns and relationships between variables. Depending on the response rate to the questionnaire, the researcher may need to adjust for non-response bias in order to generalise the results to the entire network (Bryman, 2012). The researcher is a native English speaker with a working knowledge of French and basic knowledge of Spanish. As such, for the very few instances where an open text response is an open, answers provided in French or Spanish will be translated by the researcher with the aid of google translate, if necessary.

5.3. Phase 3: Participation in semi-structured interviews

Recruited participants will be requested to participate in a semi-structured interview conducted online using the secure tool, WebEx, because participants are anticipated to be located in various countries around the world (no face-to-face interviews will be conducted). The interviews will be scheduled to last between 45 minutes and 1 hour. The same four themes explored in Phase 2 will be explored during the interviews, except the questions will focus more on answering the related questions of 'how?' and 'why?' instead of just what as elaborated in the interview guide in Appendix 14 (results from Phase 1 and/or 2 may lead to the addition or deletion of certain questions from the current interview guide). Data collected from all interviewed participants will be included in the analysis.

The interviews will be recorded and then transcribed by the researcher. Analysis will involve multiple readings of the interview transcripts, coupled with note taking, followed by transformation of notes into emergent themes, and finally, seeking relationships and clustering themes (Smith et al., 2009). The researcher will follow Interpretative Phenomenological Analysis to engage in a dialogue with study participants to explore and describe their lived experiences regarding participation in activities related to INFOSAN. Such a method requires a flexible data collection instrument (Smith et al., 2009) and therefore, the semi-structured format of the interviews will be conversational in style, allowing the researcher and participant to engage in a dialogue where questions can be modified depending on responses. This format also enables the researcher to prompt further elaboration in certain areas of interest identified by participants, allowing for more flexibility than a structured interview (Smith et al. 2009). Anonymised information and quotations from participant interviews will be reported, representing the limits to confidentiality.

An important aspect of the overall analysis will be triangulation of the information collected from each phase including quantitative indicators and qualitative value stories. The combined strengths of quantitative and qualitative methods can contribute to improved study validity, credibility, and overall integrity and provide a broad and deep understanding of experience of members (Bryman, 2012; Allsop, 2013; Cresswell, 2009). The indicative results from Phase 3, along with a triangulated analysis of data from all three phases will be communicated by the researcher to INFOSAN members by sending Information Email #5 (Appendix 15) and presenting a final webinar.

6. What plan is in place for the storage, back-up, security and documentation of data (electronic, digital, paper, etc.)? Note who will be responsible for deleting the data at the end of the storage period. Please ensure that your plans comply with General Data Protection Regulation (GDPR) and the (UK) Data Protection Act 2018.

In accordance with comply with General Data Protection Regulation (GDPR) and the (UK) Data Protection Act 2018, all electronic data will be anonymised and stored onto encrypted password protected storage devices, including USB keys and a laptop computer) provided by the WHO. These encrypted files will utilise meaningful file names and version numbers and will be accompanied by a Readme file. Personal identifiers will be kept separately from anonymised data in either encrypted computer storage (for electronic files) or in a locked filing cabinet (for paper files) and destroyed following the completion and acceptance of the PhD thesis. Only the researcher and his supervisors will have access to the anonymised data for the duration of the study. Electronic copies of transcripts will be transferred in person by the researcher from WHO headquarters to Lancaster

University on encrypted password protected storage devices and then archived for 10 years on secure encrypted storage on the Lancaster University server, after which time they will be destroyed. Storage and destruction of data will be done by Lancaster University's designated Data Protection Officer (currently Mike Abbotts, Information Governance Manager, compliance@lancaster.ac.uk); 01524510841).

7. Will audio or video recording take place? ☐ no ☒ audio ☐ video

a. Please confirm that portable devices (laptop, USB drive etc) will be encrypted where they are used for identifiable data. If it is not possible to encrypt your portable devices, please comment on the steps you will take to protect the data.

Yes. portable devices (laptop, USB drive etc) will be encrypted where they are used for identifiable data.

b What arrangements have been made for audio/video data storage? At what point in the research will tapes/digital recordings/files be destroyed?

During Phase 3, audio recordings of interviews with participants will be made using WebEx and immediately downloaded, password protected and encrypted on a laptop. Audio recorded data will be anonymised as far as is possible (given the nature of audio data). The anticipated volume of data collected is estimated to reach no more than 1GB. The audio data will be retained until the completion and acceptance of the PhD thesis at which they will be destroyed. Only the electronic copies of transcripts will be transferred to Lancaster University and then archived for 10 years as described in section 8a.

Please answer the following questions *only* if you have not completed a Data Management Plan for an external funder

8a. How will you share and preserve the data underpinning your publications for at least 10 years e.g. PURE?

All relevant files with documentation will be offered to the UK Data Archive as per the standard ESRC procedures. If the UK Data Archive will not accept the offered data, it will be stored in Lancaster University's data repository (via Pure) where it will be preserved according to Lancaster University's Data Policy for a minimum of 10 years.

8b. Are there any restrictions on sharing your data ?

No, there are no restrictions on sharing data after full anonymization. Data will be anonymised and aggregated to the regional level, and therefore there will be no risk that participants will be able to be identified.

9. Consent
a. Will you take all necessary steps to obtain the voluntary and informed consent of the prospective participant(s) or, in the case of individual(s) not capable of giving informed consent, the permission of a legally authorised representative in accordance with applicable law? yes

b. Detail the procedure you will use for obtaining consent?

9b.1 – Consent for Phase 1: Analysis of INFOSAN Community Website Access and Usage

Consent for the use of members' access and usage data for research purposes was provided at the time when each member registered on the ICW and agreed to the terms and conditions of use (as explained in Appendix 2). However, all members will be given a two week period to withdraw their data from the analysis should they not wish to have it included , after which time this will no longer be possible due to aggregation of the data. This will be done by emailing the researcher (as explained in Appendix 2).

9b.2 – Consent for Phase 2: Participation in an online questionnaire

As explained in section 13.2, all INFOSAN members will receive Information Email #3 (Appendix 6), which includes the invitation to participate in Phase 2 of the study and contains a link to an online questionnaire. No consent form will be collected because that would compromise anonymity, however, the email will explain that by clicking on the link, the individual confirms that they have read the introductory information and understand what is expected of them as a participant in this phase of the study. They will confirm that they understand that any information provided will remain anonymous and that participation is voluntary. They will also consent to the information being anonymised and kept at Lancaster University for a period of 10 years after the study has finished. Participants will also confirm that they can withdraw from Phase 2 of the study at any time while they are completing the questionnaire, but they will be unable to do so after questionnaire submission, given the anonymous nature of the design. The same information contained in the email will be displayed on the first page of the online questionnaire as a reminder to participants.

9b.3 – Consent for Phase 3: Participation in semi-structured interviews

INFOSAN members who volunteer and are recruited for Phase 3 of the study (as explained in section 13.3) will be sent the consent form as prepared in Appendix 13. Prior to commencing their interview, a participant will need to have read, signed, and returned the consent form by email to the researcher. By signing the consent form, each participant will confirm they have read and understood what is expected of them as a participant in Phase 3 of this study (as outlined in Information Email #4) and that they were able to have any related questions answered. They will also confirm their understanding that their interview will be recorded using WebEx, then anonymised as a written transcript, and that audio recordings will be destroyed upon completion and acceptance of the PhD thesis (whereas written transcripts will be stored at Lancaster University for 10 years). Participants will also confirm their understanding of the limits to confidentiality, insofar as anonymised information and quotations from their interview may be used in reports, presentations or publications, along with the pooled information from other participants. In addition, participants will confirm their understanding that the researcher may discuss anonymised data with their supervisor as needed, and that all information shared will remain anonymous unless it is thought that there is a risk of harm to the participant or others, in which case the researcher will need to share this information with their research supervisor. Immediately before the interview, the researcher will ensure the participants are aware they can choose to withdraw from the study at any

time, for any reason, before or during their interview and withdraw their data up to two weeks after their interview.

10. What discomfort (including psychological eg distressing or sensitive topics), inconvenience or danger could be caused by participation in the project? Please indicate plans to address these potential risks. State the timescales within which participants may withdraw from the study, noting your reasons.

It is not anticipated that taking part in any phase of this study would cause participants undue discomfort, distress or danger. However, discussing their experiences preparing for and responding to food safety emergencies may prompt some unhappy memories or reflections on their past or current professional situation at their national government authority. Should any undue distress arise in the course of the interviews in Phase 3, the researcher involved may stop the discussion, allow the participant time to debrief, and decide if they wish to continue or leave the session and either reschedule the discussion for another time, or withdraw completely from Phase 3. Participants are welcome to withdraw from Phase 3 at any time before or during the interview and up to 2 weeks following their interview. The researcher will be able to suggest additional support services as appropriate (details provided in Information Email #4; Appendix 11). Anonymity will be preserved throughout all audio-recorded data, with the use of pseudonyms and the separation of personal details from all code identified data.

11. What potential risks may exist for the researcher(s)? Please indicate plans to address such risks (for example, noting the support available to you; counselling considerations arising from the sensitive or distressing nature of the research/topic; details of the lone worker plan you will follow, and the steps you will take).

There are not expected to be any specific risks to the researcher. Field work will not be conducted as part of this study and no meetings will be held face-to-face with study participants. All data will be collected by the researcher from his normal place of employment at the WHO headquarters from an online website database, via online questionnaires, and by interviews conducted online using WebEx. It is anticipated that this work will be carried out during normal working hours at the WHO. In the event that the researcher resides at WHO outside of normal working hours (either very late or very early to accommodate interviews in another time zone, for example), onsite security personnel remain on patrol since they work 24 hours a day, seven days per week. Internal staff policies at WHO will be followed throughout the conduct of this study, such that any undeclared absence that spans longer than three hours will result in WHO administrators contacting the personal emergency contacts of the researcher to confirm his health and safety. For these reasons, a 'lone worker policy' will not apply. In the event that the conduct of this study results in any undue distress to the researcher, the services of the WHO Staff Counsellor will be available to him, which includes the provision of confidential support services on a range of issues including psychological distress.

12. Whilst we do not generally expect direct benefits to participants as a result of this research, please state here any that result from completion of the study.

There may be no direct benefit of participation in this study. However, some participants may

find it a positive experience to reflect on their role as an INFOSAN member as well as their contributions to a safer food supply, and to participate in research which they may feel is of relevance to them, their institution, their country or the global community.

13. Details of any incentives/payments (including out-of-pocket expenses) made to participants:

No incentives are provided and no payments are made to participants.

14. Confidentiality and Anonymity

a. Will you take the necessary steps to assure the anonymity of subjects, including in subsequent publications? yes

b. Please include details of how the confidentiality and anonymity of participants will be ensured, and the limits to confidentiality.

In Phase 1, data extracted from the INFOSAN Community Website will be extracted and the names of members and countries will be removed and replaced with numbers 1-6, corresponding to a different WHO region since all data will be aggregated and reported anonymously at the regional levels. In Phase 2, the questionnaires will be submitted anonymously and similarly to Phase 1, the country name will be removed and replaced with numbers 1 -6 corresponding to the respective WHO region since all data will be aggregated and reported anonymously at the regional levels. In Phase 3, participants will be interviewed at a distance using WHO's secure WebEx conferencing system. The main researcher is the only one who is going to be transcribing the interviews. In addition, whilst every effort will be made, it may not be possible for the researcher to ensure confidentiality of participation in Phase 3 if participants choose to connect to the researcher by WebEx on their work premises during the working day. Volunteers to Phase 3 will be encouraged to connect by WebEx in a private room to conduct their interview, where no one else can see their computer screen or hear their conversation This information is included in the participant information sheets (Appendices 2 and 11).

Anonymised information and quotations from participant interviews will be reported, representing the limits to confidentiality.

15. If relevant, describe the involvement of your target participant group in the *design and conduct* of your research.

The researcher has had informal conversations with several INFOSAN members in finalizing this study design. These conversations have followed a presentation of the research design at a regional INFOSAN meeting in Miami, USA in November 2017 where INFOSAN members from approximately 30 countries were present. In addition, a more detailed presentation of the study design was delivered at a meeting of 8 INFOSAN members in Geneva, Switzerland where further discussion has contributed to the finalization of the study design. The questionnaire will also be vetted by several target participants (selected because they are also part of the INFOSAN Advisory Group) as described in Appendix 10.

16. What are the plans for dissemination of findings from the research? If you are a student, include here your thesis.

The researcher will disseminate findings from the study in the following ways: 1) via webinars, open to all members of INFOSAN following each of the three phases of the study; 2) as an oral presentation to staff within FOS, WHO; and 3) as a PhD thesis submitted to Lancaster University. In addition, results of the research shall be submitted for publication to relevant academic or professional conferences and journals or other media including books or websites.

17. What particular ethical considerations, not previously noted on this application, do you think there are in the proposed study? Are there any matters about which you wish to seek guidance from the FHMREC?

By the nature of this work-based research project, the researcher is an insider, investigating an issue that examines, in broad terms, the operation of an organizational programme. The researcher is therefore an agent of his organization (WHO) as a technical officer at WHO and also an agent of Lancaster University as a PhD student. As such, the ethical considerations for the design of this research project have been carefully made from the insider researcher perspective.

Initial consent for this research to be conducted has been granted by the Director of FOS at WHO (Appendix 1). This research project will also be subject to scrutiny and approval by the WHO Research Ethics Board before it may commence. Furthermore, the conduct of the research will be governed by the WHO Code of Ethics and Professional Conduct and the WHO Code of Conduct for Responsible Research which both emphasise the need for all research to be conducted with integrity, accountability, independence and impartiality, respect, and professional commitment. In addition, the researcher will keep a reflexive journal to track how his relationship to the research impacts upon it.

While there are several positive aspects to being an insider researcher (e.g. informed perspective, ability to implement study recommendations directly, etc.), the potential conflicts of interest must be carefully considered, acknowledged and addressed. As members of INFOSAN are familiar with the researcher in his role at WHO, he will need to ensure clarity that the proposed research is being conducted as part of a PhD study. It will also be necessary to ensure that despite having access to additional data or information, only those data collected with the expressed consent of participants is utilised and reported on for the purposes of this study. INFOSAN members must to be assured that neither their participation nor abstention will impact their future treatment as an INFOSAN member or the technical support provided to them or their agency by the WHO.

Acknowledging the role of the researcher as an insider is congruent with the overarching framework used to conduct this research. By recognizing INFOSAN as a CoP it is acknowledged that an examination of member experiences should be underpinned by critical realism as a philosophical position that values multiple perspectives, including the insider, in order to understand phenomena. IPA as a research methodology has its theoretical roots in critical realism (Fade, 2004) and is concerned with carefully detailing the lived experience of individuals. As explained by Guldberg and Mackness (2009), utilizing IPA to understand experience aligns with a CoP lens since the focus of analysis is on the interpretations of members and the values they attribute to them. In addition, IPA

acknowledges and embraces the role of the researcher's interpretation and understanding of members' lived experiences. As the researcher, through his role at WHO, plays an important role in connecting, communicating and facilitating interaction among members, his familiarity with the participants and ability to provide expertise in the interpretation and understanding of members experiences is an asset.

So while the role of insider researcher may present some potential conflicts of interest, transparency in process, due permissions from WHO senior staff, and assurances given to INFOSAN members, should ensure this research is conducted to the highest ethical standard. In addition, several techniques well-known to insider researchers will be employed to aid in accurately understanding and documenting the experiences of INFOSAN members, including the practice of reflexivity. The practice of reflexivity will involve active engagement of the self and questioning of the researcher's own perceptions in order to expose their contextualized nature (Green, 2014). A diary will be kept by the researcher during data collection and analysis to document reflexivity including predictions of outcomes for each phase of the study and how they relate to one another.

SECTION FOUR: signature

Applicant electronic signature: Carmen Savelli Date 21 June 2018

Student applicants: please tick to confirm that your supervisor has reviewed your application, and that they are happy for the application to proceed to ethical review ☒

Project Supervisor name (if applicable): Dr Céu Mateus Date application discussed 20 June 2018

Submission Guidance

1. Submit your FHMREC application by email to Diane Hopkins (d.hopkins@lancaster.ac.uk) as two separate documents:
    i. **FHMREC application form.**
    Before submitting, ensure all guidance comments are hidden by going into 'Review' in the menu above then choosing *show markup>balloons>show all revisions in line.*
    ii. **Supporting materials.**
    Collate the following materials for your study, if relevant, into a single word document:
        a. Your full research proposal (background, literature review, methodology/methods, ethical considerations).
        b. Advertising materials (posters, e-mails)
        c. Letters/emails of invitation to participate
        d. Participant information sheets
        e. Consent forms
        f. Questionnaires, surveys, demographic sheets
        g. Interview schedules, interview question guides, focus group scripts
        h. Debriefing sheets, resource lists

    Please note that you DO NOT need to submit pre-existing measures or handbooks which support your work, but which cannot be amended following ethical review. These should simply be referred to in your application form.

1. Submission deadlines:
    i. Projects including direct involvement of human subjects **[section 3 of the form was completed]**. The *electronic* version of your application should be submitted to Diane Hopkins **by the committee deadline date.** Committee meeting dates and application submission dates are listed on the FHMREC website. Prior to the FHMREC meeting you may be contacted by the lead reviewer for further clarification of your application. Please ensure you are available to attend the committee meeting (either in person or via telephone) on the day that your application is considered, if required to do so.
    ii. The following projects will normally be dealt with via chair's action, and may be submitted at any time. **[Section 3 of the form has *not* been completed, and is not required].** Those involving:
        a. existing documents/data only;
        b. the evaluation of an existing project with no direct contact with human participants;
        c. service evaluations.

3. **You must submit this application from your Lancaster University email address, and copy your supervisor in to the email in which you submit this application**

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Appendix 1 – Information sheet and permission form for the Director of the Department of Food Safety and Zoonoses at the World Health Organization

Seeking your authorization to conduct a mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN)

Dear Dr Kazuaki Miyagishima – Director, Department of Food Safety and Zoonoses, WHO,

As you know, since 2015 I have been pursuing my PhD in Public Health at Lancaster University as documented in the WHO Performance Management and Development System. For the research phase of my studies I am proposing to examine the experiences of members of the International Food Safety Authorities Network (INFOSAN) and I am seeking your permission to do so. Attached you can find the full research proposal and below some summary details about the study. At the bottom of this form is a section for your signature should you choose to authorize the study to be carried out as described.

What is the study about?

The purpose of this study is to interrogate INFOSAN in order to describe and explore the experiences of members and better understand the role of the network in mitigating the burden of foodborne illness around the world. The study will examine access to and usage of the INFOSAN Community Website, explore barriers and facilitators to active participation in INFOSAN, determine perceptions about the utility of INFOSAN to mitigate foodborne illness, and scrutinize if and how participation in this network creates value for members.

Why have I been approached?

You have been approached because the study requires information from registered INFOSAN members and I am seeking your authorization to contact them for this purpose.

Do INFOSAN members have to take part?

No. It is completely up to each member to decide whether or not to take part. The study is designed in three phases: Phase 1 will examine access and usage patterns of the INFOSAN Community Website; Phase 2 will involve the completion of an online survey; and Phase 3 will involve individual interviews conducted online using WebEx. Taking part in one phase of the study does not require participation in the other phases.

What will members be asked to do if they take part?

Participation in Phase 1 of the study requires no further action from members. Data on access and usage of the INFOSAN Community Website has already been collected as part of the ongoing monitoring and evaluation activities of the INFOSAN Secretariat in accordance with the Terms and Conditions of Use of the INFOSAN Community Website. Any members not wishing to have their website access and usage data utilized for the purpose of this particular study will be requested to make this known by email to the researcher within a defined two-week period. Those who are recruited in Phase 1 will have a further two weeks to opt out of the study, after which time this will no longer be possible due to aggregation of data.

Participation in Phase 2 of the study requires the completion of an online survey of approximately 30-45 minutes which will explore questions about experience as an INFOSAN member. Once the survey has been submitted, it will not be possible to opt out because survey responses are anonymous.

Participation in Phase 3 of the study will involve a one-on-one individual interview conducted online using WebEx with the researcher. The interview will last approximately 45-60 minutes and will explore in more detail their experiences as an INFOSAN member. Those who are recruited for Phase 3 of the study will have two weeks to opt out after which time this will no longer be possible.

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Will collected data be identifiable?

No. The information provided by participants will be reported anonymously. Any direct quotes from participants will be reported anonymously. Quantitative data will be reported by region so that no country-specific details will be reported. The data collected for this study will be stored securely and only the researcher conducting this study will have access to this data:

- Audio recordings will be deleted once the thesis has been examined and accepted
- The files on the computer will be encrypted (that is no-one other than the researcher will be able to access them) and the computer itself password protected for the duration of the study
- At the end of the study, all related electronic information will be archived for 10 years in secure encrypted storage on the Lancaster University server. At the end of this period, they will be destroyed.
- The typed version of your interview will be made anonymous by removing any identifying information including participant names. Anonymised direct quotations from your interview may be used in the reports or publications from the study, and neither participant name nor your country will be attached to them.
- All personal data will be confidential and will be kept separately from interview responses.

There are some limits to confidentiality: if what is said in the interview makes me think that a participant, or someone else, is at significant risk of harm, I will have to break confidentiality and speak to a member of staff about this. If possible, I will tell you if I have to do this.

What will happen to the results?

The results will be summarised and reported in a PhD thesis and may be submitted for publication in relevant academic conferences and journals, pending necessary clearance from WHO. Only those data collected with the expressed consent of participants is utilized and reported on for the purposes of this study. INFOSAN Members will also be invited to participate in webinars after each phase to learn about the results and next steps.

Are there any risks?

There are no risks anticipated with participating in this study. However, if a participant experiences any distress following participation they will be encouraged to inform the researcher and contact the resources provided in advance. Neither participating nor abstaining will impact their future treatment as an INFOSAN member or the technical support provided to them or their country by the WHO. This will be made clear to all INFOSAN members.

Are there any benefits to taking part?

Although members may find participating interesting, there are no direct benefits in taking part.

Who has reviewed the project?

This study will be reviewed and approved by the Ethics Review Committee at the World Health Organization and the Faculty of Health and Medicine Research Ethics Committee at Lancaster University.

Kind regards,

Carmen Savelli

Subject to clearance by the Ethics Review Committee at the World Health Organization and the Faculty of Health and Medicine Research Ethics Committee at Lancaster University, I, Kazuaki Miyagishima, Director, Department Food Safety and Zoonoses at WHO, authorize the conduct of the proposed research as part of his PhD studies at Lancaster University as described above and in the accompanying proposal, titled, 'A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN)' as prepared by Carmen Savelli.

Signature

19/VI/2018

Date

Appendix 2 – Information Email #1: Introductory information about the study (including the overall Participant Information Sheet) and invitation to attend information webinar #1

To be sent by the INFOSAN Secretariat (infosan@who.int) on behalf of the researcher (cc: c.savelli@lancaster.ac.uk)

Health & Medicine | Lancaster University

Information Email #1

A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN): Introductory Information

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Dear INFOSAN Member,

My name is Carmen Savelli and I am conducting this study as a student in the PhD Public Health programme at Lancaster University, Lancaster, United Kingdom. You may also know me as one of the Technical Officers working as the INFOSAN Secretariat at the World Health Organization (WHO) in Geneva, Switzerland.

What is the study about?

The purpose of this study is to interrogate INFOSAN in order to describe and explore the experiences of members and better understand the role of the network in mitigating the burden of foodborne illness around the world. The study will examine access to and usage of the INFOSAN Community Website, explore barriers and facilitators to active participation in INFOSAN, determine perceptions about the utility of INFOSAN to mitigate foodborne illness, and scrutinize if and how participation in this network creates value for members.

Why have I been approached?

You have been approached because the study requires information from registered INFOSAN members.

Do I have to take part?

No. It is completely up to you to decide whether or not you take part. The study is designed in three phases: Phase 1 will examine access and usage patterns of the INFOSAN Community Website; Phase 2 will involve the completion of an online survey; and Phase 3 will involve individual interviews conducted online using WebEx. Taking part in one phase of the study does not require your participation in the other phases.

What will I be asked to do if I take part?

Participation in Phase 1 of the study requires no further action on your part. Data on access and usage of the INFOSAN Community Website has already been collected as part of the ongoing monitoring and evaluation activities of the INFOSAN Secretariat in accordance with the Terms and Conditions of Use of the INFOSAN Community Website. **Any members not wishing to have their website access and usage data utilized for the purpose of this particular study should make this known by email to the researcher within the next two weeks (c.savelli@lancaster.ac.uk).** Those who are recruited in Phase 1 will have a further two weeks to opt out of the study, after which time this will no longer be possible due to aggregation of data.

Participation in Phase 2 of the study requires the completion of an online survey of approximately 30-45 minutes which will explore questions about your experience as an INFOSAN member. Once the survey has been submitted, it will not be possible to opt out because survey responses are anonymous.

Participation in Phase 3 of the study will involve a one-on-one individual interview conducted online using WebEx with the researcher. The interview will last approximately 45-60 minutes and will explore in more detail your experiences as an INFOSAN Member. Those who are recruited for Phase 3 of the study will have two weeks to opt out after which time this will no longer be possible.

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Will my data be Identifiable?

No. The information you provide will be reported anonymously. Any direct quotes from participants in Phase 3 will be reported anonymously. Quantitative data will be reported by region so that no country-specific details will be reported. The data collected for this study will be stored securely and only the researchers conducting this study will have access to this data:

- Audio recordings will be deleted once the thesis has been examined and accepted
- The files on the computer will be encrypted (that is no-one other than the researcher will be able to access them) and the computer itself password protected for the duration of the study
- At the end of the study, all related electronic information will be archived for 10 years in secure encrypted storage on the Lancaster University server. At the end of this period, they will be destroyed.
- The typed version of your interview will be made anonymous by removing any identifying information including your name. Anonymised direct quotations from your interview may be used in the reports or publications from the study, and neither your name nor your country will be attached to them.
- All your personal data will be confidential and will be kept separately from your interview responses (if you participate in Phase 3). However, there are some limits to confidentiality in Phase 3: if what is said in the interview makes me think that you, or someone else, is at significant risk of harm, I will have to break confidentiality and speak to a member of staff about this. If possible, I will tell you if I have to do this. In addition, whilst every effort will be made, it is not possible for the researcher to ensure confidentiality of your participation in Phase 3 if you choose to connect to the researcher by WebEx on your work premises during the working day. If you volunteer to participate in Phase 3, you are encouraged to connect by WebEx in a private room to conduct your interview, where no one else can see your computer screen or hear your conversation.

For further information about how Lancaster University processes personal data for research purposes and your data rights please visit our webpage: www.lancaster.ac.uk/research/data-protection

What will happen to the results?

The results will be summarised and reported in a PhD thesis and may be submitted for publication in relevant academic or professional conferences and journals or other media including books or websites, pending necessary clearance from WHO. Only those data collected with the expressed consent of participants is utilized and reported on for the purposes of this study. INFOSAN Members will also be invited to participate in webinars after each phase to learn about the results and next steps.

Are there any risks?

There are no risks anticipated with participating in this study. However, if you experience any distress following participation you are encouraged to inform the researcher and contact the resources provided at the end of this sheet. Neither participating nor abstaining will impact your future treatment as an INFOSAN member or the technical support provided to you or your country by the WHO.

Are there any benefits to taking part?

Although you may find participating interesting, there are no direct benefits in taking part. However, some participants may find it a positive experience to reflect on their role as an INFOSAN member as well as their contributions to a safer food supply, and to participate in research which they may feel is of relevance to them, their institution, their country or the global community.

Who has reviewed the project?

This study has been reviewed and approved by the Ethics Review Committee at the World Health Organization and the Faculty of Health and Medicine Research Ethics Committee at Lancaster University.

Where can I obtain further information about the study if I need it?

If you have any questions about the study, please contact the researcher:

Carmen Savelli
c.savelli@lancaster.ac.uk
+41 22 791 3234

Or his primary supervisor in the Department of Health Research at Lancaster University:

Dr Céu Mateus
c.mateus@lancaster.ac.uk
+44 1524 593182

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Or attend the upcoming webinar:

Complaints
If you wish to make a complaint or raise concerns about any aspect of this study and do not want to speak to the researcher or his supervisor, you can contact:

Professor Catherine Walshe
Head of the Division of Health Research
+44 (0)1524 510124
c.walshe@lancaster.ac.uk
Lancaster University
Lancaster
LA1 4YW

If you wish to speak to someone outside of the Public Health Doctorate Programme, you may also contact:

Professor Roger Pickup Tel: +44 (0)1524 593746
Associate Dean for Research Email: r.pickup@lancaster.ac.uk
Faculty of Health and Medicine
(Division of Biomedical and Life Sciences)
Lancaster University
Lancaster
LA1 4YG

Thank you for taking the time to read this information.

Resources in the event of distress
Should you feel distressed either as a result of taking part, or in the future, the following resource may be of assistance:
https://online.supportgroups.com/

Kind regards,

Carmen Savelli

Appendix 3 – Terms and Conditions of Use of the INFOSAN Community Website

The following disclaimer text is displayed on the online registration form of the ICW (https://extranet.who.int/infosan/registration) and must be accepted by all INFOSAN members to in order to complete registration.

Please take note of the following terms of use and disclaimers. By accessing the International Food Safety Authorities Network (INFOSAN) Community Website, the user agrees to accept these terms of use and disclaimers. The Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) reserve the right to update these terms of use and disclaimers without notice.

The INFOSAN Community Website is intended for the use of members of INFOSAN for the purpose of managing information about food safety risks in an interactive and collaborative manner. The content within the INFOSAN Community Website is intended for the internal use of registered INFOSAN members only and may not be disclosed, shared, distributed or transmitted to persons outside the Network, or duplicated, republished, reused for presentation or used in any other way, including for advertising or commercial purposes, without the prior written consent from FAO and WHO.

Although all reasonable precautions have been taken to verify the content contained on the INFOSAN Community Website, FAO and WHO make no warranties or representations regarding the content, presentation, appearance, completeness or accuracy and shall not be held liable for any damages whatsoever as a result of its use or application. The responsibility for the interpretation and use of the content lies with the reader and/or user. FAO and WHO reserve the right to make updates and changes without notice and accept no liability for any errors or omissions in this regard.

FAO and WHO accept no responsibility whatsoever for any inaccurate advice or information that is provided by sources reached via links or references to the content of the INFOSAN Community Website.

The INFOSAN Community Website may contain links to other Internet pages. With regard to these third-party websites, FAO and WHO have no control whatsoever over the content of the linked pages. FAO and WHO therefore shall not be held responsible whatsoever for the content of a page to be reached via such a link and shall not be held liable for any damages arising from their use. FAO and WHO reserve the right to make changes or additions, without prior notification, to the links provided.

The views expressed on the INFOSAN Community Website are those of the authors and do not necessarily reflect those of FAO and WHO.

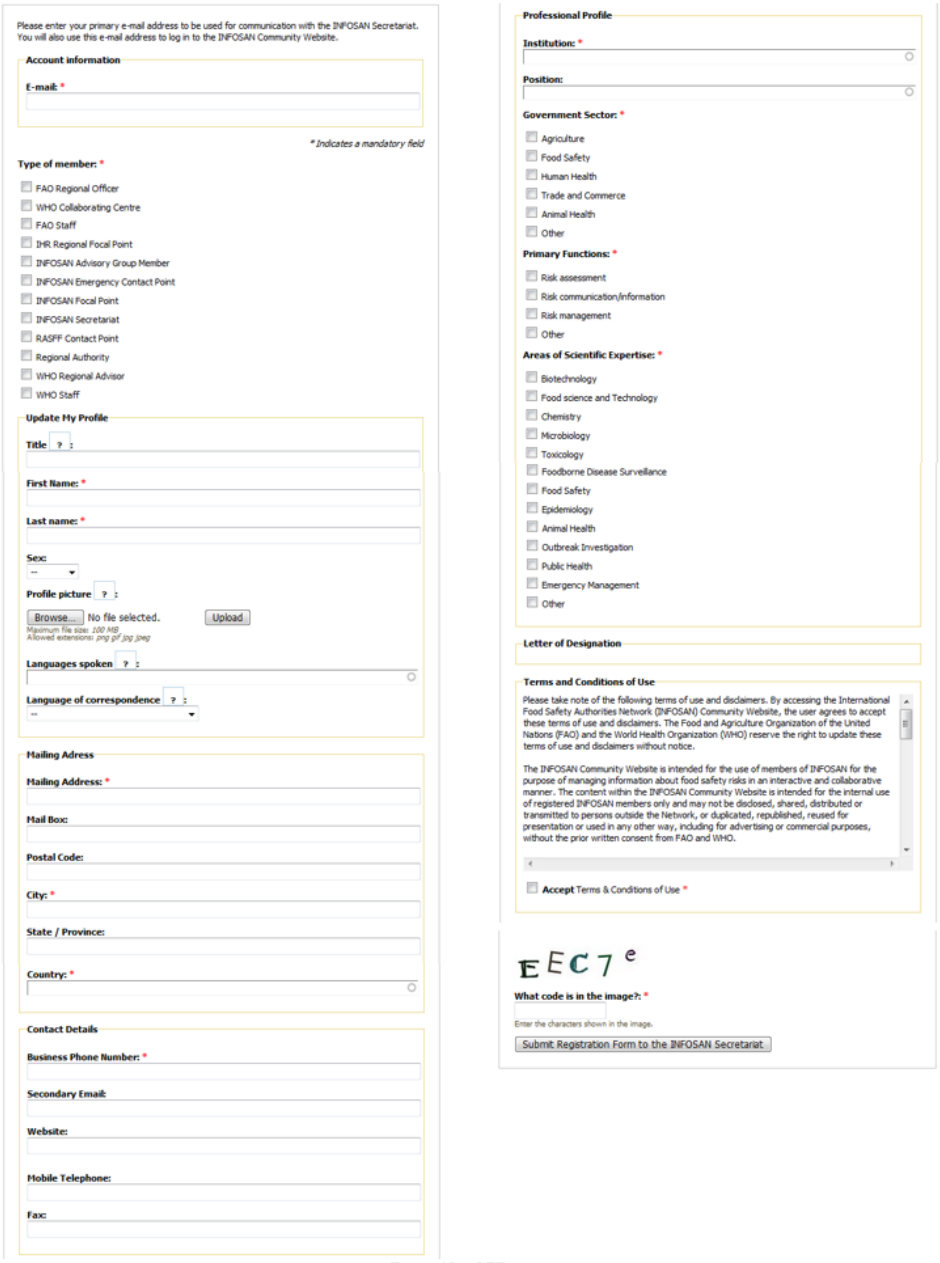
The designations employed and the presentation of content on the INFOSAN Community Website, including maps and other illustrative materials, do not imply the expression of any opinion whatsoever on the part of FAO or WHO concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delineation of frontiers and borders.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by FAO or WHO in preference to others of a similar nature that are not mentioned.

Utilization of website analytics tools or other methods will be applied periodically to summarize members' access to and usage of the INFOSAN Community Website for monitoring, evaluation and research purposes.

[ ] Accept Terms & Conditions of Use

Appendix 4 – INFOSAN Community Website Online Registration Form



Please enter your primary e-mail address to be used for communication with the INFOSAN Secretariat. You will also use this e-mail address to log in to the INFOSAN Community Website.

Account information

E-mail: *

* Indicates a mandatory field

Type of member: *

- FAO Regional Officer
- WHO Collaborating Centre
- FAO Staff
- IHR Regional Focal Point
- INFOSAN Advisory Group Member
- INFOSAN Emergency Contact Point
- INFOSAN Focal Point
- INFOSAN Secretariat
- RASFF Contact Point
- Regional Authority
- WHO Regional Advisor
- WHO Staff

Update My Profile

Title ? :

First Name: *

Last name: *

Sex:

Profile picture ? :

Browse... No file selected. Upload

Maximum file size: 100 MB
Allowed extensions: png gif jpg jpeg

Languages spoken ? :

Language of correspondence ? :

Mailing Adress

Mailing Address: *

Mail Box:

Postal Code:

City: *

State / Province:

Country: *

Contact Details

Business Phone Number: *

Secondary Email:

Website:

Mobile Telephone:

Fax:

Professional Profile

Institution: *

Position:

Government Sector: *

- Agriculture
- Food Safety
- Human Health
- Trade and Commerce
- Animal Health
- Other

Primary Functions: *

- Risk assessment
- Risk communication/information
- Risk management
- Other

Areas of Scientific Expertise: *

- Biotechnology
- Food science and Technology
- Chemistry
- Microbiology
- Toxicology
- Foodborne Disease Surveillance
- Food Safety
- Epidemiology
- Animal Health
- Outbreak Investigation
- Public Health
- Emergency Management
- Other

Letter of Designation

Terms and Conditions of Use

Please take note of the following terms of use and disclaimers. By accessing the International Food Safety Authorities Network (INFOSAN) Community Website, the user agrees to accept these terms of use and disclaimers. The Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) reserve the right to update these terms of use and disclaimers without notice.

The INFOSAN Community Website is intended for the use of members of INFOSAN for the purpose of managing information about food safety risks in an interactive and collaborative manner. The content within the INFOSAN Community Website is intended for the internal use of registered INFOSAN members only and may not be disclosed, shared, distributed or transmitted to persons outside the Network, or duplicated, republished, reused for presentation or used in any other way, including for advertising or commercial purposes, without the prior written consent from FAO and WHO.

Accept Terms & Conditions of Use *

EEC7e

What code is in the image?: *

Enter the characters shown in the image.

Submit Registration Form to the INFOSAN Secretariat

Appendix 5 – Information Email #2: Results from Phase 1 and invitation to attend Webinar #2 (includes Phase 2 Participant Information)

To be sent by the INFOSAN Secretariat (infosan@who.int) on behalf of the researcher (cc: c.savelli@lancaster.ac.uk)

Health & Medicine | Lancaster University

Information Email #2

A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN): Phase 1 results and information about Phase 2

Dear INFOSAN Member,

My name is Carmen Savelli and in August 2018 I contacted you to let you know that I was conducting this study as a student in the PhD Public Health programme at Lancaster University, Lancaster, United Kingdom. You may also know me as one of the Technical Officers working as the INFOSAN Secretariat at the World Health Organization (WHO) in Geneva, Switzerland. I am writing again to inform you of the progress made so far, including results from Phase 1 and provide some additional information for participants in Phase 2.

What is the overall study about?

The purpose of this study is to interrogate INFOSAN in order to describe and explore the experiences of members and better understand the role of the network in mitigating the burden of foodborne illness around the world. The study will examine access to and usage of the INFOSAN Community Website, explore barriers and facilitators to active participation in INFOSAN, determine perceptions about the utility of INFOSAN to mitigate foodborne illness, and scrutinize if and how participation in this network creates value for members.

The study is designed in three phases: Phase 1 is complete and has examined access and usage patterns of the INFOSAN Community Website; Phase 2 will involve the completion of an online survey; and Phase 3 will involve individual interviews conducted online using WebEx. Taking part in one phase of the study does not require your participation in the other phases.

What are the results from Phase 1?

To be inserted



Why have I been approached about Phase 2 of this study?

You have been approached because the study requires information from registered INFOSAN members.

Do I have to take part in Phase 2?

No. It is completely up to you to decide whether or not you take part. Once the survey has been submitted, it will not be possible to opt out because survey responses are anonymous.

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What will I be asked to do if I take part?
Participation in Phase 2 of the study requires the completion of an online survey of approximately 30-45 minutes which will explore questions about your experience as an INFOSAN member. All INFOSAN Members will receive a separate invitation by email(Information Email #3) to provide consent and take the survey.

Will my data be Identifiable?
No. The information you provide will be reported anonymously. Quantitative data will be reported by region so that no country-specific details will be reported. The data collected for this study will be stored securely and only the researchers conducting this study will have access to this data:

- The files on the computer will be encrypted (that is no-one other than the researcher will be able to access them) and the computer itself password protected for the duration of the study
- At the end of the study, all related electronic information will be archived for 10 years in secure encrypted storage on the Lancaster University server. At the end of this period, they will be destroyed.

For further information about how Lancaster University processes personal data for research purposes and your data rights please visit our webpage: www.lancaster.ac.uk/research/data-protection

What will happen to the results?
The results will be summarised and reported in a PhD thesis and may be submitted for publication in relevant academic or professional conferences and journals or other media including books or websites, pending necessary clearance from WHO. Only those data collected with the expressed consent of participants is utilized and reported on for the purposes of this study. INFOSAN Members will also be invited to participate in a webinar after Phase 2 to learn about the results and next steps.

Are there any risks?
There are no risks anticipated with participating in this study. However, if you experience any distress following participation you are encouraged to inform the researcher and contact the resources provided at the end of this sheet. Neither participating nor abstaining will impact your future treatment as an INFOSAN member or the technical support provided to you or your country by the WHO.

Are there any benefits to taking part?
Although you may find participating interesting, there are no direct benefits in taking part. However, some participants may find it a positive experience to reflect on their role as an INFOSAN member as well as their contributions to a safer food supply, and to participate in research which they may feel is of relevance to them, their institution, their country or the global community.

Who has reviewed the project?
This study has been reviewed and approved by the Ethics Review Committee at the World Health Organization and the Faculty of Health and Medicine Research Ethics Committee at Lancaster University.

Where can I obtain further information about the study if I need it?
If you have any questions about the study, please contact the researcher:

Carmen Savelli
c.savelli@lancaster.ac.uk
+41 22 791 3234

Or his primary supervisor in the Department of Health Research at Lancaster University:

Dr Céu Mateus
c.mateus@lancaster.ac.uk
+44 1524 593182

Or attend the upcoming webinar:

Continued on next page...

Continued from previous page...

Complaints
If you wish to make a complaint or raise concerns about any aspect of this study and do not want to speak to the researcher or his supervisor, you can contact:

Professor Catherine Walshe
Head of the Division of Health Research
+44 (0)1524 510124
c.walshe@lancaster.ac.uk
Lancaster University
Lancaster
LA1 4YW

If you wish to speak to someone outside of the Public Health Doctorate Programme, you may also contact:

Professor Roger Pickup Tel: +44 (0)1524 593746
Associate Dean for Research Email: r.pickup@lancaster.ac.uk
Faculty of Health and Medicine
(Division of Biomedical and Life Sciences)
Lancaster University
Lancaster
LA1 4YG

Thank you for taking the time to read this information.

Resources in the event of distress
Should you feel distressed either as a result of taking part, or in the future, the following resource may be of assistance:
https://online.supportgroups.com/

Kind regards,

Carmen Savelli

Appendix 6 – Information Email #3: Invitation to participate in Phase 2 including consent information and link to online survey

To be sent by the INFOSAN Secretariat (infosan@who.int) on behalf of the researcher (cc: c.savelli@lancaster.ac.uk)

Health & Medicine | Lancaster University

Information Email #3

A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN): Invitation to participate in Phase 2

Dear INFOSAN member,

You are invited to participate in Phase 2 of our study to explore the experiences of members of the International Food Safety Authorities Network (INFOSAN).

Phase 2 of the study involves completing an online survey that should take approximately 30-45 minutes of your time. Complete background details are available in the Participant Information Sheet, shared with you previously and also attached for ease of reference.

By proceeding to the survey you confirm that:

- ✓ You have read the information sheet and understand what is expected of you within this study;
- ✓ You confirm that you understand that any responses/information you give will remain anonymous;
- ✓ Your participation is voluntary;
- ✓ You consent for the information you provide to be discussed with my supervisor at Lancaster University;
- ✓ You consent to Lancaster University keeping the anonymised data for a period of 10 years after the study has finished;
- ✓ By clicking on the button below, you consent to taking part in the current study.

If you have any questions about this survey or other aspects of the study, please do not hesitate to contact me at any time: c.savelli@lancaster.ac.uk

Kind regards,

Carmen Savelli

Appendix 7 – Draft questionnaire for Phase 2

Most of the following questions have been taken directly from the Community Assessment Tool (Verburg and Andriessen, 2006). Those questions in written in blue text are supplementary questions, added to the questionnaire in order to address INFOSAN-specific items. In addition, the likert-type scale response anchors have been added as per Vagias and Wade (2006).

PERSONAL DATA

Age _____

Gender _____

Country _____

A) INTRODUCTION
Are you a member of more than one food-safety related community of practice? If yes, which one(s): _____

How long (approximately) have you been a member of INFOSAN?					
	Weeks	Months	Years	Don't know	Prefer not to answer
Specify number in corresponding box	#	#	#		

	Focal Point	Emergency Contact Point	Don't know	Prefer not to answer
What type of member are you?				

B) GOALS
How important are the following goals for you personally as a member of this community? That means, for you personally, what are the most important reasons for participating in INFOSAN?

	Not Important At All	Of Little Importance	Of Average Importance	Very Important	Absolutely Essential	Don't know	Prefer not to answer
– Hearing about new knowledge and experiences from other community members							
– Developing together new ideas for the community							
– Having nice meetings, fun and non-work related activities							
– Developing standards, methods and best practices							
– Making useful contacts/ networking							
– Improving the level of expertise of other members							
– Staying up to date in the topic of the community (i.e. food safety issues)							
– Saving time in finding all kinds of information							
– To advance in my career							
– Helping newcomers in the community							

C) ACTIVITIES

How often do the following activities happen in your community?

	Never	Almost Never	Occasionally	Frequently	Very Frequently	Don't know	Prefer not to answer
– Meetings with discussions							
– Talks about experiences							
– Presentations by members							
– Presentations by non-members							
– Workshops							
– Team-building activities							
– Members writing reports or other publications together							
– Brainstorming							
– Writing project proposals							
– Exchanging e-mails to find solutions to problems							

To what extent would you prefer a change in these activities?

	Decrease frequency greatly	Decrease frequency slightly	No change	Increase Frequency slightly	Increase frequency greatly	Don't know	Prefer not to answer

– Meetings with discussions							
– Talks about experiences							
– Presentations by members							
– Presentations by non-members							
– Workshops							
– Team building activities (such as informal outings)							
– Brainstorming							
– Writing project proposals							
– Members writing publications together							
– Exchanging e-mails to find solutions to problems							

	Very poor	Poor	Acceptable	Good	Very Good	Don't know	Prefer not to answer
How would you rate the way people interact in this community?							

Does your community have the following types of meetings?							
	Never	Almost Never	Occasionally	Frequently	Very Frequently	Don't know	Prefer not to answer
– Face to face meetings							
– Virtual meetings (e.g. video conferences, telephone conferences, via the internet)							

D) PARTICIPATION							
	Not at all	Almost never	Occasionally	Very	Extremely	Don't know	Prefer not to answer
How actively do you participate in the community?							

How often do you have the following types of contact with other members of your community outside of community meetings?							
	Never	Almost Never	Occasionally	Frequently	Very Frequently	Don`t know	Prefer not to answer
– Email exchanges							
– Phone calls							
– Face to face meetings							
– Virtual meetings (e.g. video conferences, telephone conferences, via the internet)							
– Instant chats on the INFOSAN Community Website							
– Discussion forum on the INFOSAN Community Website							

On average, how many hours do you spend on the community per month? _____

How many members do you know by face? _____

With how many members have you had personal contact? _____

INFOSAN has an important mandate, to communicate between national government authorities around the world to keep the global food supply safe. However, some members are more active than others. The following section pertains to potential barriers to participation in INFOSAN.

To what extent do you agree that the following factors limit your participation in INFOSAN Activities?							
	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Don`t know	Prefer not to answer
My role as an INFOSAN member is unclear to me							
My country has limited capacity and/or infrastructure dedicated to addressing food safety events							
My country has insufficient funds dedicated to monitoring and/or responding to food safety events.							
My country lacks human resources and/or expertise dedicated to addressing food safety events.							
My country's national food control system is either underdeveloped or non-existent							

My country's national-level Food Safety Emergency Response Plan is either underdeveloped or non-existent							
There are difficulties in identifying contaminated food and/or ingredients within my country							
There are challenges in conducting food safety risk assessments within my country							
Personnel in my country are not trained to respond to food safety events							
There is a need for a simpler and more standardized way to share information between national authorities within my country							
There is a lack of coordination and/or communication between national authorities within my country							
Legal implications at the national level hinder prompt information-sharing with the INFOSAN Secretariat and INFOSAN member countries							
12. There are political constraints at the national level (e.g. the government does not prioritize food safety, the Emergency Contact Point must reflect national views when communicating with the INFOSAN Secretariat, etc.)							
There are concerns in my country that reporting a food safety event with potential international implications might negatively impact the country's economy or competitive interests (e.g. trade, tourism, etc.)							
There are language barriers.							
There is a lack of trust between INFOSAN members							
There are fears that the confidential nature of information shared may not be respected by parties involved (e.g. the information may not be safeguarded, may be disseminated inappropriately, etc.)							

E) COORDINATION

How active is the co-ordinator/ facilitator of your community (i.e. the INFOSAN Secretariat) in the following activities?

	Never	Almost Never	Occasionally	Frequently	Very Frequently	Don' t know	Prefer not to answer
– Organising meetings							
– Stimulating members to participate in the community							
– Sharing his/ her own expertise with the community members							
– Co-ordinating activities on the INFOSAN Community Website							
– Making external contacts							

– Connecting the community members with each other							
– Promoting the community publicly							
– Alerting members to interesting external activities (e.g. conferences)							

To what extent do you agree that the following statements about the INFOSAN Secretariat?							
	Strongly Disagree	Disagree	Neither Agree nor disagree	Agree	Strongly Agree	Don't know	Prefer not to answer
I fully understand the role of the INFOSAN Secretariat.							
Information communicated by the INFOSAN Secretariat is always sufficiently prompt.							
Information communicated by the INFOSAN Secretariat is always accurate.							

	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied	Don't know	Prefer not to answer
How satisfied are you with the co-ordination of INFOSAN?							

F) INFORMATION AND COMMUNICATION TECHNOLOGY SUPPORT							
How useful do you think the following means of communication are (or might be) particularly for the work of INFOSAN?							
	Not useful at all	Not very useful	No opinion	Very Useful	Essential	Don't know	Prefer not to answer
– Scheduled face to face meetings							
– Informal face to face encounters							
– E-mail							
– Telephone conferences							
– Fax							
– Video connection							
– Chat/ shared white board/ application sharing system							
– Special discussion list / newsgroup for the							

community							
– Written memos or reports							
– Group calendar/ shared project planning tool							
– Document sharing tool							
– Groupware to work jointly on documents (co-editing)							
– A database/ knowledge system in which you are expected to fill in your project experiences and relevant knowledge							

The INFOSAN Community Website was launched in 2012 and all members of INFOSAN are registered on there. This online portal is the gateway through which all members can communicate with each other and with the INFOSAN Secretariat.

Regarding the INFOSAN Community Website:							
	Never	Every few months	Monthly	Weekly	Daily	Don`t know	Prefer not to answer
How often do you access the INFOSAN Community Website?							

	What do you normally use the INFOSAN Community Website for? (check all that apply)
	To read about Alerts issued by the INFOSAN Secretariat
	To read INFOSAN Documents
	To read publications and newsletters from FAO/WHO
	To participate in the Discussion Forum
	To find other INFOSAN members' contact details
	To discuss with other INFOSAN members using the "Chat" function on the INFOSAN Community Website
	To participate in or manage Groups
	Other; Please specify
	Don't know
	Prefer not to answer

To what extent do you agree that the following statements about the INFOSAN Community Website?							
	Strongly Disagree	Disagree	Neither Agree nor disagree	Agree	Strongly Agree	Don`t know	Prefer not to answer
The INFOSAN Community Website an important and supportive tool for the network							

The volume of information posted on the INFOSAN Community Website by the **Secretariat** is sufficient							
The volume of information posted on the INFOSAN Community Website by the **members** is sufficient.							
A mobile friendly version of the INFOSAN Community Website would improve participation							
The INFOSAN Community Website provides a single integrated point of access to a variety of relevant food safety emergency information for INFOSAN members around the world.							
The INFOSAN Community Website creates and maintains knowledge directories about portal generated content including details about food safety events and emergencies.							
The INFOSAN Community Website facilitates information sharing and provides collaborative features that help to foster the Community of Practice among INFOSAN members							
The INFOSAN Community Website facilitates information sharing and provides collaborative features that help to foster the Community of Practice among INFOSAN members							

G) ORGANIZATIONAL SUPPORT							
	Never	Almost Never	Occasionally	Frequently	Very Frequently	Don`t know	Prefer not to answer
Does your organisation allocate time for you to participate in INFOSAN?							
	Strongly discouraged	Discouraged	Neither discouraged or encouraged	Encouraged	Strongly Encouraged	Don`t know	Prefer not to answer
All in all how encouraged do you feel by your organisation to participate actively in INFOSAN?							

	Not at all	To a small extent	To a moderate extent	To a great extent	To a very great extent	Don`t know	Prefer not to answer

Would you like to have more time available for activities concerning INFOSAN?							

H) VALUE OF INFOSAN AS A COMMUNITY OF PRACTICE							
How important are the following ways for you to find new information (e.g. for solving problems, for doing projects, for keeping up to date in your field)?							
	Not important at all	Not very important	Important	Very important	Extremely important	Don't know	Prefer not to answer
– Through INFOSAN							
– Through individual colleagues							
– Via the internet							
– Asking an expert							
– Reading publications or reports							
– Through database consulting							
– Other	explain						

To what extent would you personally like INFOSAN to continue?							
	Not at all	To a small extent	To a moderate extent	To a great extent	To a very great extent	Don't know	Prefer not to answer

Please indicate the extent to which you agree with the following statements.

	Strongly Disagree	Disagree	Neither Agree nor disagree	Agree	Strongly Agree	Don't know	Prefer not to answer
– Some knowledge is so valuable to me that I would not easily share it with others							
– The most important thing that happens in our community is that members find solutions to problems in their work							
– Knowledge is now so developed in the community that it can be turned into innovative ideas							
– Thanks to the combination of the different skills and views in our community many new ideas have been developed							
– People in the community are reluctant to talk about things that have gone wrong in their projects/ work							
– Newcomers have much to learn before they are at the same level as the existing members							
– It is sometimes difficult to learn from each other in the community because we have very different backgrounds							
– Knowledge is now so developed in the community that it can be written up for e.g. manuals, training courses, best practices							
– Most members in this community have developed a strong common understanding and identity over time							

How often does it happen that:							
	Never	Almost Never	Occasionally	Frequently	Very Frequently	Don't know	Prefer not to answer
You have some knowledge or experience that you prefer NOT to share with members of the community							
You hear experiences and other things that you already know							

INFOSAN has been in operation since 2004, and this study is the first of its kind to try and determine if the network has value to members in a robust and rigorous way.

Please indicate the extent to which you agree with the following statements.

	Strongly Disagree	Disagree	Neither Agree no disagree	Agree	Strongly Agree	Don't know	Prefer not to answer
Participating in INFOSAN has been a valuable experience for me							
Participating in INFOSAN has connected me with other food safety professionals around the world.							
Participating in INFOSAN has prevented foodborne illnesses in other countries							
Participating in INFOSAN makes me feel a part of a global community of practice of food safety professions.							

Participating in INFOSAN has provided me with information that was used in my country to **implement risk management measures**.

[ ] Yes [ ] No [ ] Don't know

If Yes, during how many different food safety events? ☐1 ☐2-5 ☐ 6-10 ☐11-20 ☐ >20

If Yes, can you name an example? _____

Participating in INFOSAN has **prevented foodborne illnesses** in my country.

[ ] Yes [ ] No [ ] Don't know

If Yes, during how many different food safety events? ☐1 ☐2-5 ☐ 6-10 ☐11-20 ☐ >20

If Yes, can you name an example? _____

I) RESULTS							
To what extent do you think the members of INFOSAN . . .							
	Not at all	Almost never	Somewhat	Mostly	Completely	Don't know	Prefer not to answer
– Trust each other							
– Feel a sense of loyalty to INFOSAN							
– Have a good common understanding							

– Feel a sense of belonging to INFOSAN							

To what extent do you think INFOSAN has. . .							
	Not at all	Almost never	Seldom	Frequently	Constantly	Don ' t know	Prefer not to answer
– Contributed to cost savings for your organisation							
– Contributed new ideas to your organisation – Made a real contribution to the effectiveness of your organisation							
– Contributed to developing new methods or approaches for your organisation							
– Contributed to the documentation of information, such as knowledge systems, manuals, training instructions or best practices							
– A good reputation in your organisation							

To what extent do you think the members are . . .							
	Never	Rarely	Sometimes	Often	Always	Don ' t know	Prefer not to answer
– Reluctant to share their knowledge with other members							
– Generally very enthusiastic and motivated to participate							

Through being a member of INFOSAN, to what extent…							
	Not at all	Slightly	Somewhat	Moderately	Extremely	Don ' t know	Prefer not to answer
– Have you learned a lot about your subject area?							
– Have you made useful new contacts?							
– Have you been able to solve problems in your work?							
– Have your career prospects improved?							

– Have you been better able to find all kinds of information?							
– Have you been able to work more efficiently?							
– Have you been better able to keep up to date in your field?							
– Has your reputation and visibility in the organisation improved?							
– Have you been able to transfer what you heard in the community to your project team(s)or department?							

All in all do you like being part of the community?

Yes [ ] **No [ ]** **Don't know [ ]** **Prefer not to answer [ ]**

In your opinion, in what areas does the community need improvement? (check all that apply)	
	– In the area of the tools that support community activities
	– The overall organization of the community
	– The way INFOSAN is supported by FAO/WHO
	– The co-ordination of INFOSAN
	– Other; Please specify:
	– Don't know
	– Prefer not to answer

Preface: INFOSAN aims to prevent the international spread of contaminated food and foodborne disease and strengthen food safety systems globally. The main objectives are to: 1) Promote the rapid exchange of information during food safety incidents/emergencies; 2) Share information on important food safety issues of global interest; 3) Promote partnership and collaboration between countries; and 4) Help countries strengthen their capacity to manage food safety emergencies.

Please indicate the extent to which you agree with the following statements.							
	Strongly Disagree	Disagree	Neither Agree nor disagree	Agree	Strongly Agree	Don't know	Prefer not to answer
The objectives of INFOSAN are still valid							
The activities and outputs of INFOSAN are consistent with the overall goal and the attainment of its objectives							
The activities and outputs of the program are consistent with the intended impacts and effects							
The objectives of INFOSAN have been achieved							

INFOSAN activities are cost-efficient							
INFOSAN objectives are achieved in a timely manner							
INFOSAN activities are implemented in the most efficient way compared to alternatives							
Because of INFOSAN, illnesses have been prevented.							
Because of INFOSAN, lives have been saved.							
INFOSAN operates in a sustainable way.							
INFOSAN promotes the rapid exchange of information during food safety incidents/emergencies							
INFOSAN shares information on important food safety issues of global interest							
INFOSAN promotes partnership and collaboration between countries and networks							
INFOSAN helps countries strengthen their capacity to manage food safety emergencies							
INFOSAN has improved the safety of the global food supply.							
INFOSAN has reduced foodborne illness globally							
Information communicated by INFOSAN **members** is always sufficiently prompt							
Information communicated by INFOSAN **members** is always accurate							

Appendix 8 – INFOSAN Advisory Group Members

1. Dr Gillian Mylrea, World Organisation for Animal Health (OIE), France
2. Professor Alan Reilly, University College Dublin, Ireland
3. Ms Jenny Bishop, Ministry for Primary Industries, New Zealand
4. Dr Hugo Fragoso Sanchez, Agri-food Safety, Aquaculture and Fisheries of the National Health Service, Food Safety and Quality (SENASICA), Mexico
5. Dr Zainab Jallow, Food Safety and Quality Authority, The Gambia
6. Dr Peter Gerner-Smidt, Centers for Disease Control and Prevention (CDC), USA
7. Ms Isabelle Laberge, Canadian Food Inspection Agency, Canada
8. Mr Jan Baele, European Commission, Health and Food Safety, Belgium
9. Dr Caroline Merten, European Food Safety Authority, Italy
10. Dr Mariam Harib Al Yousuf Alsuwaidi, Abu Dhabi Food Control Authority, UAE
11. Ms Camille Brewer, Food and Drug Administration (FDA), USA
12. Mr Mark Samadhin, Public Health Agency of Canada, Canada
13. Dr Jørgen Schlundt, Nanyang Technological University, Singapore
14. Mr Terry Donohoe, Formerly Food Standards Agency (FSA), United Kingdom

For additional information about the INFOSAN Advisory Group, see details online:
http://www.who.int/foodsafety/areas_work/infosan/INFOSAN-AG/en/

Appendix 9 - FAO/WHO Regional Food Safety Advisors/Officers

WHO Regional Food Safety Advisors

African Region
Lusubilo Mwamakamba, mwamakambal@who.int, Burkina Faso

Region of the Americas
Dr Enrique Perez Gutierrez, pereze@paho.org, USA

Eastern Mediterranean Region
Mr Soren Madsen, madsens@who.int, Jordan

European Region
Dina Pfeifer, pfeiferd@who.int, Denmark

South East Asian Region
Dr Gyanendra Gongal, gongalg@who.int, India

Western Pacific Region
Peter Sousa Hoejskov, hoejskovp@who.int, Philippines

FAO Regional Food Safety Officers

Near East and North Africa
Dr Fatima Hachem, fatima.hachem@fao.org, Egypt

Asia
Dr Sridhar Dharmapuri, sridhar.dharmapuri@fao.org, Thailand

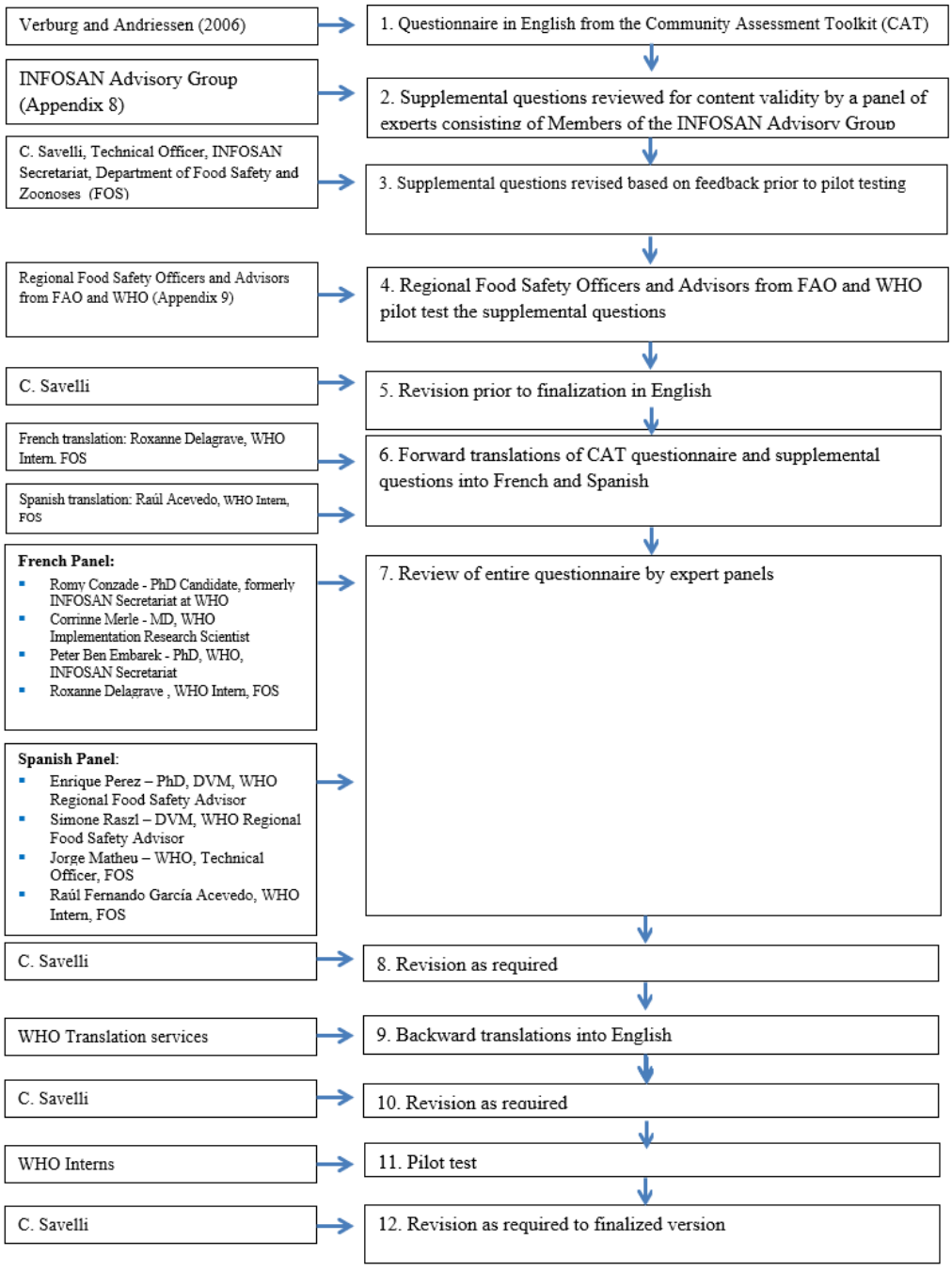
Pacific
Ms Ann Hayman, Ann.Hayman@fao.org, Fiji

Latin America and the Caribbean
Dr Marisa Caipo, marisa.caipo@fao.org, Chile

Europe and Central Asia
Ms Mary Kenny, Mary.Kenny@fao.org, Hungary

Africa
Blaise Ouattara, Blaise.Ouattara@fao.org, Ghana

Appendix 10 – Expansion and Adaptation of Questionnaire



Appendix 11 – Information Email #4: Results from Phase 2 and invitation to attend Webinar #3 (includes Phase 3 Participant Information)

To be sent by the INFOSAN Secretariat (infosan@who.int) on behalf of the researcher (cc: c.savelli@lancaster.ac.uk)

Health & Medicine | Lancaster University

Information Email #4

A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN): Phase 2 results and information about Phase 3

Dear INFOSAN Member,

My name is Carmen Savelli and in August 2018 I first contacted you to let you know that I was conducting this study as a student in the PhD Public Health programme at Lancaster University, Lancaster, United Kingdom. You may also know me as one of the Technical Officers working as the INFOSAN Secretariat at the World Health Organization (WHO) in Geneva, Switzerland. I am writing again to inform you of the progress made so far, including results from Phase 2 and provide some additional information for participants in Phase 3.

What is the overall study about?

The purpose of this study is to interrogate INFOSAN in order to describe and explore the experiences of members and better understand the role of the network in mitigating the burden of foodborne illness around the world. The study will examine access to and usage of the INFOSAN Community Website, explore barriers and facilitators to active participation in INFOSAN, determine perceptions about the utility of INFOSAN to mitigate foodborne illness, and scrutinize if and how participation in this network creates value for members.

The study is designed in three phases: Phase 1 is complete and has examined access and usage patterns of the INFOSAN Community Website; Phase 2 is complete and involved the completion of an online survey by INFOSAN members; and Phase 3 will involve individual interviews conducted online using WebEx. Taking part in one phase of the study does not require your participation in the other phases.

What are the results from Phase2?

To be inserted



Why have I been approached about Phase 3 of this study?

You have been approached because the study requires information from registered INFOSAN members.

Do I have to take part in Phase 3?

No. It is completely up to you to decide whether or not you take part. Between 6 and 12 volunteers will be selected for Phase 3. If more than 2 people from a single WHO region indicate their interest in participating in Phase 3, the two people who have been members the longest will be selected and notified by email from the researcher, providing they are not from the same country.

Continued on next page...

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What will I be asked to do if I take part?

Participation in Phase 3 of the study will involve a one-on-one individual interview conducted online using WebEx with the researcher. The interview will last approximately 45-60 minutes and will explore in more detail your experiences as an INFOSAN Member.

To volunteer for Phase 3, please express your interest by contacting the researcher: c.savelli@lancaster.ac.uk

Will my data be Identifiable?

No. The information you provide will be reported anonymously. Any direct quotes from participants in Phase 3 will be reported anonymously. Quantitative data will be reported by region so that no country-specific details will be reported. The data collected for this study will be stored securely and only the researchers conducting this study will have access to this data:

- Audio recordings will be deleted once the thesis has been examined and accepted
- The files on the computer will be encrypted (that is no-one other than the researcher will be able to access them) and the computer itself password protected for the duration of the study
- At the end of the study, all related electronic information will be archived for 10 years in secure encrypted storage on the Lancaster University server. At the end of this period, they will be destroyed.
- The typed version of your interview will be made anonymous by removing any identifying information including your name. Anonymised direct quotations from your interview may be used in the reports or publications from the study, and neither your name nor your country will be attached to them.
- All your personal data will be confidential and will be kept separately from your interview responses. There are some limits to confidentiality: if what is said in the interview makes me think that you, or someone else, is at significant risk of harm, I will have to break confidentiality and speak to a member of staff about this. If possible, I will tell you if I have to do this. In addition, whilst every effort will be made, it is not possible for the researcher to ensure confidentiality of your participation in Phase 3 if you choose to connect to the researcher by WebEx on your work premises during the working day. If you volunteer to participate in Phase 3, you are encouraged to connect by WebEx in a private room to conduct your interview, where no one else can see your computer screen or hear your conversation.

For further information about how Lancaster University processes personal data for research purposes and your data rights please visit our webpage: www.lancaster.ac.uk/research/data-protection

What will happen to the results?

The results will be summarised and reported in a PhD thesis and may be submitted for publication in relevant academic or professional conferences and journals or other media including books or websites, pending necessary clearance from WHO. Only those data collected with the expressed consent of participants is utilized and reported on for the purposes of this study. INFOSAN Members will also be invited to participate in webinars after each phase to learn about the results and next steps.

Are there any risks?

There are no risks anticipated with participating in this study. However, if you experience any distress following participation you are encouraged to inform the researcher and contact the resources provided at the end of this sheet. Neither participating nor abstaining will impact your future treatment as an INFOSAN member or the technical support provided to you or your country by the WHO.

Are there any benefits to taking part?

Although you may find participating interesting, there are no direct benefits in taking part. However, some participants may find it a positive experience to reflect on their role as an INFOSAN member as well as their contributions to a safer food supply, and to participate in research which they may feel is of relevance to them, their institution, their country or the global community.

Who has reviewed the project?

This study has been reviewed and approved by the Ethics Review Committee at the World Health Organization and the Faculty of Health and Medicine Research Ethics Committee at Lancaster University.

Where can I obtain further information about the study if I need it?

If you have any questions about the study, please contact the researcher:

Carmen Savelli
c.savelli@lancaster.ac.uk
+41 22 791 3234

Or his supervisor in the Department of Health Research at Lancaster University:

Dr Céu Mateus
c.mateus@lancaster.ac.uk

Continued on next page...

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Or attend the upcoming webinar:

Complaints
If you wish to make a complaint or raise concerns about any aspect of this study and do not want to speak to the researcher or his supervisor, you can contact:

Professor Catherine Walshe
Head of the Division of Health Research
+44 (0)1524 510124
c.walshe@lancaster.ac.uk

Lancaster University
Lancaster
LA1 4YW

If you wish to speak to someone outside of the Public Health Doctorate Programme, you may also contact:

Professor Roger Pickup Tel: +44 (0)1524 593746
Associate Dean for Research Email: r.pickup@lancaster.ac.uk
Faculty of Health and Medicine
(Division of Biomedical and Life Sciences)
Lancaster University
Lancaster
LA1 4YG

Thank you for taking the time to read this information.

Resources in the event of distress
Should you feel distressed either as a result of taking part, or in the future, the following resource may be of assistance:
https://online.supportgroups.com/

Kind regards,

Carmen Savelli

Appendix 12 – Email to volunteers for Phase 3 that were not selected

To be sent from the researcher: c.savelli@lancaster.ac.uk

Health & Medicine | Lancaster University

Dear <<Name>>,

Many thanks for your interest in participating in Phase 3 of our study to explore the experiences of members of the International Food Safety Authorities Network (INFOSAN).

We have seen an overwhelmingly positive response to our call for volunteers to fill a limited number of interview slots. Unfortunately, due to resource restrictions including time restraints we will not be able to include you in this phase of the study.

Volunteers were selected on the basis of geographic location (maximum of two participants per WHO region) and length of membership to INFOSAN. If more than two members volunteered from the same region, the two who have been members of INFOSAN the longest were selected. This is what happened in your case.

Please be reminded that your active participation in the INFOSAN community is valued and appreciated and we hope you continue to engage in the important activities of the Network in the future.

If you have any additional information you wish to share regarding your experience as an INFOSAN member, you are always welcome to contact the INFOSAN Secretariat at WHO directly (infosan@who.int) outside of the context of this study.

Kind regards,

Carmen Savelli

Appendix 13 – Consent form for volunteers participating in Phase 3

To be sent from the researcher: c.savelli@lancaster.ac.uk

Health & Medicine | Lancaster University

A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN): Phase 3 consent form

Many thanks for your interest in participating in Phase 3 of our study to explore the experiences of members of the International Food Safety Authorities Network (INFOSAN).

Consent Form

Before you consent to participating in the study we ask that you re-read the participant information (contained in Information Email #4 and attached for ease of reference) and mark each box below with your initials if you agree. If you have any questions or queries before signing the consent form please contact the researcher, Carmen Savelli (c.savelli@lancaster.ac.uk or +41 (0) 79 9456 320).

		Initial here
1.	I confirm that I have read the participant information and fully understand what is expected of me within this study	☐
2.	I confirm that I have had the opportunity to ask any questions and to have them answered.	☐
3.	I understand that my interview will be audio recorded and then made into an anonymised written transcript.	☐
4.	I understand that audio recordings will be kept until the research project has been examined.	☐
5.	I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.	☐
6.	I understand that once my data have been anonymised and incorporated into themes it might not be possible for it to be withdrawn, though every attempt will be made to extract my data, up to the point of publication.	☐
7.	I understand that the information from my interview will be pooled with other participants' responses, anonymised and may be published.	☐
8.	I consent to information and quotations from my interview being used in reports, conferences and training events.	☐
9.	I understand that the researcher will discuss data with their supervisor as needed.	☐
10.	I understand that any information I give will remain confidential and anonymous unless it is thought that there is a risk of harm to myself or others, in which case the principal investigator will need to share this information with their research supervisor.	☐
11.	I consent to Lancaster University keeping written transcriptions of the interview for 10 years after the study has finished.	☐
12.	I consent to take part in the above study.	☐

Name of Participant_____ Signature_____ Date _____

Name of Researcher _____Signature _____Date _____

Appendix 14 – Interview Guide for Phase 3

The semi-structured format of the interviews will be conversational in style, allowing the researcher and participant to engage in a dialogue where questions can be modified depending on responses. However, the following questions can serve to start discussions within the bounds of the four themes:

Theme 1) Use of the ICW to support network activities

Preface: The INFOSAN Community Website was launched in 2012 and all members of INFOSAN are registered on there. This online portal is the gateway through which all members can communicate with each other and with the INFOSAN Secretariat.

Questions about experiences:

- How often do you access the INFOSAN Community Website?
- What do you normally use it for?
- Do you think it is supporting the activities of INFOSAN?
- Do you think it could be improved and how?
- Do you think the INFOSAN Secretariat should be posting more frequently on the website?
- What kind of information do you think the INFOSAN Secretariat should be posting there?
- How do you think we might be able to get more members engaged on the website, e.g. involved in discussions, sharing documents, etc.?
- What new features would you like to see?
- Do you think a mobile version of the website would improve participation?

Theme 2) Barriers and facilitators to active participation in INFOSAN

Preface: INFOSAN has an important mandate, to communicate between national government authorities around the world to keep the global food supply safe. However, we know that some members are more active than others. Let's discuss some of the potential barriers to and facilitators to participation.

Questions about experiences:

- Is limited capacity in your country a barrier to participation (i.e. Limited capacity/infrastructure dedicated to addressing food safety; insufficient funds; human resources/expertise; national food control system underdeveloped) and if so, how?
- Is lack of training a barrier (Laboratory analysis; food safety risk assessment; outbreak investigation), and if so, how?
- Does a lack of national food safety standards pose a barrier, and if so, how?
- What is coordination between national authorities like at the national level?
- Does a lack of coordination pose a barrier, and if so, how?
- Are their legal constraints that bar your participation in INFOSAN (e.g. legal implications hinder prompt information sharing; lack of food safety legislation; lack of cooperation from industry, etc.), and if so, how?
- Is food safety a priority in your country? If not, does this pose a barrier, and if so, how?

- Are their perceptions that participating in INFOSAN may have a negative impact on the economy (i.e. through damages to trade or tourism sectors)?
- Is the mandate of INFOSAN clear? If not, how could it be clarified?
- If more members understood their roles and responsibilities better, would that facilitate participations? What would be the best way to do this?
- Have you ever attended any INFOSAN training either online or in person? What did you think about the training? How could the training be improved?
- Do you think language barriers restrict active participation in INFOSAN , and if yes, how so?
- Do you have concerns over confidentiality that limit what you share with INFOSAN?
- How could these concerns be addressed to help facilitate your improved participation?
- Are there any obvious weaknesses of INFOSAN, which if rectified could significantly improve the functioning and thereby the impact of INFOSAN?

Theme 3) Perceptions of network achievements and attainment of objectives (including reducing foodborne illness)

Preface: INFOSAN aims to prevent the international spread of contaminated food and foodborne disease and strengthen food safety systems globally, by: 1) Promoting the rapid exchange of information during food safety incidents/emergencies; 2) Sharing information on important food safety issues of global interest; 3) Promoting partnership and collaboration between countries; and 4) Helping countries strengthen their capacity to manage food safety risks "from farm to table".

Questions about experiences:

- How useful has INFOSAN been in promoting the rapid exchange of information during food safety incidents/emergencies?
- Have you been involved in such exchanges? What was that like? Did you get the information you needed quickly enough to respond and implement risk management measures?
- What have your experiences been like when dealing with the INFOSAN Secretariat?
- Does INFOSAN share information on important food safety issues of global interest that you have found useful?
- Have you shared information with other network members?
- What have your experiences been like in terms of using information you received through INFOSAN or sharing information with others in the network?
- Has INFOSAN promoted partnership and collaboration between countries and networks? If yes, how so? Was it useful?
- What has been your experience when interacting with other INFOSAN members during a food safety emergency?
- Has INFOSAN helped countries strengthen their capacity to manage food safety risks "from farm to table"? If yes, how so?
- How could INFOSAN improve the way it functions in order to better achieve its objectives?

Relevance:

- To what extent are the objectives of INFOSAN still valid?

- Are the activities and outputs of INFOSAN consistent with the overall goal and the attainment of its objectives?
- Are the activities and outputs of INFOSAN consistent with the intended impacts and effects?

Effectiveness:

- To what extent have the objectives been achieved or are likely to be achieved?
- What are the major factors influencing the achievement or non-achievement of the objectives?

Efficiency:

- Were INFOSAN activities cost-efficient?
- Were objectives achieved in a timely manner?
- Were INFOSAN activities delivered in the most efficient way compared to alternatives?

Impact:

- What has been the biggest impact that INFOSAN has made?
- What real difference has INFOSAN made to members? To the safety of the global food supply? To the improvement of global food safety systems?
- How have populations' health been affected?

Sustainability:

- What are the major factors which influence the achievement or non-achievement of the sustainability of INFOSAN?

Theme 4) Assessing value of INFOSAN

Preface: INFOSAN has been in operation since 2004, and this study is the first of its kind to try and determine if the network has value to members in a robust and rigorous way.

Questions about experiences:

- What has participation in INFOSAN been a valuable experience for you? How so?
- Have you been able to connect with other food safety professionals to exchange information related to food safety?
- Has information received through INFOSAN led you to implement risk management measures in your country to prevent foodborne illness? Can you tell me about some specific events?
- Do you believe that participation in INFOSAN has reduced foodborne illness in your country? How so? How do you think this could be measured?
- Do you think participation in INFOSAN will reduce foodborne illness in your country the future? Globally?
- Does the utilization of the INFOSAN Community Website add value to the network activities?
- Do you feel like you are part of a global community? Is that something you value?

Is there anything else about your experience as an INFOSAN Member that you would like to share with me at this time?

Appendix 15 – Information Email #5 – Results from Phase 3 and study conclusion (including invitation to attend Webinar #4)

To be sent by the INFOSAN Secretariat (infosan@who.int) on behalf of the researcher (cc: c.savelli@lancaster.ac.uk)

Health & Medicine | Lancaster University

Information Email #5

A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN): Phase 3 results and study conclusion

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Dear INFOSAN Member,

My name is Carmen Savelli and in May 2018 I first contacted you to let you know that I was conducting this study as a student in the PhD Public Health programme at Lancaster University, Lancaster, United Kingdom. You may also know me as one of the Technical Officers working as the INFOSAN Secretariat at the World Health Organization (WHO) in Geneva, Switzerland. The study has now concluded.

What was the overall study about?

The purpose of this study is to interrogate INFOSAN in order to describe and explore the experiences of members and better understand the role of the network in mitigating the burden of foodborne illness around the world. The study will examine access to and usage of the INFOSAN Community Website, explore barriers and facilitators to active participation in INFOSAN, determine perceptions about the utility of INFOSAN to mitigate foodborne illness, and scrutinize if and how participation in this network creates value for members.

The study was designed in three phases: Phase 1 has examined access and usage patterns of the INFOSAN Community Website; Phase 2 involved the completion of an online survey by INFOSAN members; and Phase 3 involved individual interviews conducted online using WebEx.

What are the results from Phase 3?

To be inserted



Continued on next page...

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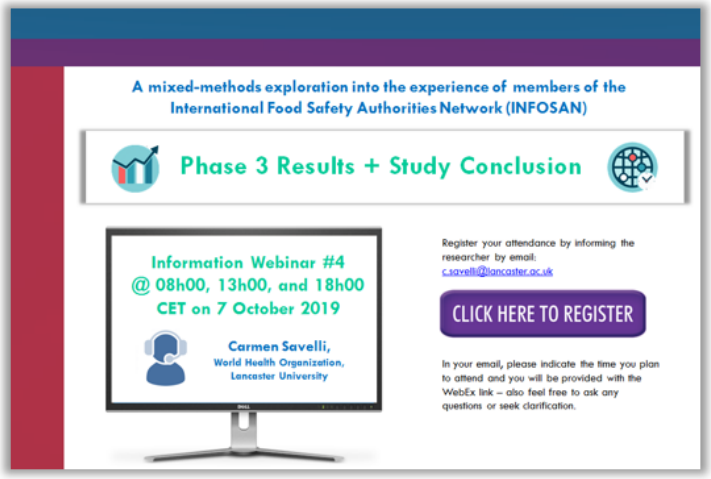
How can I find out more about the results from Phase 3 and the overall study conclusion?
Attend the upcoming Webinar:



What are the next steps?

The results of this study have been shared with the INFOSAN Secretariat and other senior staff at the World Health Organization for their consideration. Improving the capacity of INFOSAN members to better prevent, detect, and respond to food safety emergencies is a priority.

Any forthcoming publications linked to the study results will be announced by email to the INFOSAN members by the INFOSAN Secretariat.

If you have any additional feedback about this study you are welcome to contact the researcher (c.savelli@lancaster.ac.uk).

If you have other feedback about INFOSAN in general that you wish to share with WHO, please contact the INFOSAN Secretariat directly (infosan@who.int).

Many thanks to all INFOSAN members who contributed time and data to this study. Your participation has been invaluable and is sincerely appreciated.

Kind regards,

Carmen Savelli

Appendix 16 - Scientific Review Committee Members

1. **Prof Alan Reilly**, BSc, MTech, CBiol, MIBiol, FIFSTI
   Adjunct Professor, University College Dublin, Institute of Food and Health, Ireland
   → INFOSAN Advisory Group Member
   → Formerly Chief Executive at the Food Safety Authority of Ireland
   → alan.reilly@foodsafety.ie

2. **Dr Jorgen Schlundt**, PhD
   Director and Professor, Nanyang Technological University Food Technology Centre, Singapore
   → INFOSAN Advisory Group Member
   → Formerly Director of the Department of Food Safety and Zoonoses, WHO HQ
   → jschlundt@ntu.edu.sg

3. **Dr Robert Verburg,** PhD
   Associate professor, Faculty of Technology, Policy and Management, Delft University of Technology, Netherlands
   → Developer of the Community Assessment Tool (CAT)
   → R.M.Verburg@tudelft.nl

Appendix 17 – Proposed PhD Publication Plan

A series of linked manuscripts will be written and submitted for publication in peer-reviewed academic journals as outlined below:

1	**Working Title**	**The International Food Safety Authorities Network, 2004-2017: Lessons learned from 14 Years of Experience**.
	Authors	C Savelli[1,2], C Mateus[2], F Widjaja[1], A Bradshaw[1], P Ben Embarek[1]
	Affiliations	1) World Health Organization, United Nations 2) Lancaster University, United Kingdom
	Article Type	Policy and Practice
	Potential Journal	WHO Bulletin
	Structure	Not more than 3000 words and 50 references, plus a non-structured abstract (250 words)
	Purpose and expectations	Explain how the network was started, how it has evolved, what types of food safety incidents it has been utilized for and the responsiveness of members to emergency information requests from WHO, and identify need to determine barriers and facilitators to participation (i.e. set out the research rationale for my study and conclude that conducting a study with my research objectives would be useful).

2	**Working Title**	**Utilisation of tools to facilitate cross-border communication during international food safety incidents,1995-2017: A realist synthesis protocol**
	Authors	C Savelli[1,2], C Mateus[2], P Ben Embarek[1]
	Affiliations	1) World Health Organization, United Nations 2) Lancaster University, United Kingdom
	Article Type	Review Protocol
	Potential Journal	BMC Systematic Reviews
	Purpose	Explain how my review will be conducted

3	**Working Title**	**Utilisation of tools to facilitate cross-border communication during international food safety incidents,1995-2017: A realist synthesis**
	Authors	C Savelli[1,2], C Mateus[2], A Bradshaw[1], P Ben Embarek[1]
	Affiliations	1) World Health Organization, United Nations 2) Lancaster University, United Kingdom
	Article Type	Realist synthesis
	Potential Journal	WHO Bulletin
	Structure	Not more than 3000 words plus a structured abstract (250 words, including Objective, Methods, Findings, Conclusion)
	Purpose and expectations	Identify the evidence base to show the need for international collaboration across multiple sectors on matters of food safety and the paucity of information on the actual evaluation of the international global systems/networks/tools that exist and to show that most of the work has been conducted from a European perspective only. Demonstrate that more understanding and widespread adoption and utilization of a global system (like INFOSAN) is needed. Mapping out of other existing networks and providing context for the role and position of INFOSAN.

4	**Working Title**	**Analysis of the INFOSAN Community Website: Who is using it and for what?**
	Authors	C Savelli[1,2], C Mateus[2], P Ben Embarek[1]
	Affiliations	1) World Health Organization, United Nations 2) Lancaster University, United Kingdom
	Article Type	Research
	Potential Journal	WHO Bulletin
	Structure	Not more than 3000 words plus a structured abstract (250 words, including Objective, Methods, Findings, Conclusion)
	Purpose and expectations	Describe what kind of members; by expertise; by country; region; usage over time; discussion forum (This is phase 1 one of my research)

5	**Working Title**	**Results from an online survey of INFOSAN members**
	Authors	C Savelli[1,2], C Mateus[2], P Ben Embarek[1]
	Affiliations	1) World Health Organization, United Nations 2) Lancaster University, United Kingdom
	Article Type	Research
	Potential Journal	WHO Bulletin
	Structure	Not more than 3000 words plus a structured abstract (250 words, including Objective, Methods, Findings, Conclusion)
	Purpose and expectations	Quantitative analysis on members perceptions regarding barriers and facilitators to participation in INFOSAN and its overall utility as a health protection tool to mitigate the negative publish health impact of international food safety incidents (This is phase two of my research)

6	**Working Title**	**Summary of interviews with key informants on INFOSAN + triangulation to results from previous two phases**
	Authors	C Savelli[1,2], C Mateus[2], P Ben Embarek[1]
	Affiliations	1) World Health Organization, United Nations 2) Lancaster University, United Kingdom
	Article Type	Research
	Potential Journal	WHO Bulletin
	Structure	Not more than 3000 words plus a structured abstract (250 words, including Objective, Methods, Findings, Conclusion)
	Purpose and expectations	Qualitative analysis to explore in further depth, some of the key themes identified in part two of the research (this is phase three of the research) + triangulate with results from phases 1 and 2 in order to present an overall understanding of aspirational vs grounded narratives. Summarise future directions for the network including main conclusions from thesis.

Appendix seven – Ethics approval letters

1) Lancaster University

Applicant: Carmen Savelli
Supervisor: Ceu Mateus
Department: Health Research
FHMREC Reference: FHMREC17098

23 August 2018

Dear Carmen

Re: A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN)

Thank you for submitting your research ethics application for the above project for review by the **Faculty of Health and Medicine Research Ethics Committee (FHMREC)**. The application was recommended for approval by FHMREC, and on behalf of the Chair of the Committee, I can confirm that approval has been granted for this research project.

As principal investigator your responsibilities include:

- ensuring that (where applicable) all the necessary legal and regulatory requirements in order to conduct the research are met, and the necessary licenses and approvals have been obtained;
- reporting any ethics-related issues that occur during the course of the research or arising from the research to the Research Ethics Officer at the email address below (e.g. unforeseen ethical issues, complaints about the conduct of the research, adverse reactions such as extreme distress);
- submitting details of proposed substantive amendments to the protocol to the Research Ethics Officer for approval.

Please contact me if you have any queries or require further information.

Tel:- 01542 593987
Email:- fhmresearchsupport@lancaster.ac.uk

Yours sincerely,

Becky Case
Research Ethics Officer, Secretary to FHMREC.

2) World Health Organization

World Health Organization

Research Ethics Review Committee (WHO ERC)

20, AVENUE APPIA – CH-1211 GENEVA 27 – SWITZERLAND – HTTP://WWW.WHO.INT/ETHICS/REVIEW-COMMITTEE/EN/ – HTTPS://EXTRANET.WHO.INT/ERCWEB/LOGIN.PHP

WHO ERC
Review Summary

Protocol ID: ERC.0003071
Country: Multi-country
Protocol Title: A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN)
Version: 1 **Dated:** 21/06/2018
WHO Responsible Staff Member: Carmen SAVELLI
Responsible Unit: WHO/HQ/HSE/FOS

Dear Dr Carmen SAVELLI,

Please find the review summary of the Protocol "A mixed-methods exploration into the experience of members of the International Food Safety Authorities Network (INFOSAN)", which was submitted to the Secretariat on 21/06/2018. This proposal underwent expedited review.

The outcome of the review is provided below. When responding, please submit the following:

1. A cover memorandum that addresses your responses, POINT BY POINT, to each of the queries in sections A and B.
   Section C contains Suggestions to improve the proposal but there is no obligation to follow them.

2. An Amended protocol including the responses in bold, highlighted or in track changes. Please ensure that tracking formatting changes is switched off or that all formatting changes have been accepted and that no comments which the team may exchange during the editing are included in the track changes version. The protocol should include all relevant documentation (ICF, study instruments, peer review, etc.) even if already submitted.

Please note that comments in the introductory paragraph are meant for the WHO Responsible Staff Member, though you may decide to share them with the PI.

PLEASE RESPOND TO THIS REVIEW SUMMARY WITHIN A three MONTH PERIOD, OR PROVIDE THE ERC SECRETARIAT A VALID JUSTIFICATION FOR THE DELAY.

According to the ERC, this study has the potential to develop understanding of the role of the INFOSAN network in mitigating the burden of foodborne diseases. The researchers are requested to ensure that the planned processes for data management and anonymisation are embedded in the protocol, and to clarify the data ownership. Please find specific comments below.

A. Amendments (Response and change required)
This section includes queries and comments on your protocol, study instruments or the informed consent form for which the ERC requires your response and where relevant, appropriate amendments to the protocol, study instruments or the informed consent.

1. Protocol
   1.1. Please provide an amended proposal specifying the version number and/or date on each page.
   1.2. Anonymisation: please explain in the protocol the mechanism for de-identifying the interview data (that is, the audio files and transcripts), and elaborate as to how and when this will be undertaken. A statement on these processes is made in the ethics application to the University (at page 27 of 78), but this should be included in the protocol itself.

B. Clarifications (Response required but change may not be required)

This section includes queries on your protocol, study instruments or the informed consent form for which the ERC requires a clarification, and for you to make changes to your protocol.

1. Protocol

1.1. Data ownership: please clarify which organisation will own the data collected for this project.

C. Suggestions

This section consists of suggestions for alternative scientific or technical approaches or methods for conducting the research, but which do not raise critical, ethical issues. These are meant to be helpful to investigators and are presented as suggestions for you to consider incorporating into a revised protocol. No response from you is required for any comment in this section. If, however, you do make changes to the protocol as a result of these suggestions, please submit the revised protocol to the ERC.

Although the introductory email to INFOSAN members states that "there are no direct benefits in taking part" in the research, it was noticed that elsewhere in the proposal some positive aspects were identified for members taking part. These may include, for example, the opportunity for participants to reflect on their role as a member of the network. It is suggested that these points can be added to the introductory emails, if the researcher wishes to do so, to flesh out the invitation and explanation of what will be involved.

World Health Organization

Research Ethics Review Committee (WHO ERC)

20, AVENUE APPIA – CH-1211 GENEVA 27 – SWITZERLAND – HTTP://WWW.WHO.INT/ETHICS/REVIEW-COMMITTEE/EN/ – HTTPS://EXTRANET.WHO.INT/ERCWEB/LOGIN.PHP

Protocol ID: ERC.0003071

Based on the above comments, the Committee has the following recommendation(s) for this proposal:

[ ] The proposal is ***Approved as submitted.*** No modifications are required.

[X] The proposal is ***Conditionally Approved; requires amendments and/or clarifications.*** Final approval is contingent upon an adequate response by the Principal Investigator, to the satisfaction of the reviewers or the Chair on behalf of the ERC.

[ ] The proposal is ***Not approved; requires additional information and/or rewriting.*** A revised version of the proposal should be re-submitted by the WHO responsible staff member as a new submission to the ERC for re-review by Committee.

[ ] The proposal is ***Rejected***. The proposal is ethically unacceptable, for the reasons stated above. The Principal Investigator may submit a new proposal that takes into consideration the ethical issues raised by the Committee. If you do not agree with the Committee's assessment, please feel free to submit an appeal to the Chair of the ERC, through the Secretariat.

NOTE: Final Approval of the Proposal is contingent upon submission of the following:
[**X**] Local ethics approval(s) [ ] Other relevant documents
The ERC would like to receive a copy of the recommendations of the local ethics committee when available.

IMPORTANT
1. *Any changes to the proposal or to the attachments (informed consent/study instruments etc.) should be approved by ERC before being implemented.*
2. *The approval for this proposal is valid for a period of* ***one year only.***
3. *Please resubmit this proposal for a Continuing Review at least 2 months before the next re-approval period.*

Chairperson ..... **Date**..02 August 2018

Name: Antonella Lavelanet

FINAL APPROVAL	**FOR THE SECRETARIAT**
Amendments and Clarifications to the proposal have been reviewed. The protocol (Version: 5 Aug Date: 2018) and informed consent Forms (Dated: 5 Aug 2018) submitted on ..23.05.2018..... are approved by the ERC	Amendments and Clarifications to be reviewed: [ ] Electronically by ERC [ ] by Primary reviewers [ ] by Secretariat Amendments approved / Clarifications accepted on Local ERC approval(s) obtained on 23/08/18 Relevant Documents submitted on Comments:
Chairperson	
Name	
Date 8.9.2018	Signature Date 5/9/2018

Appendix eight – Regional authorities with one or more Focal Point(s) registered on the ICW, January 2019

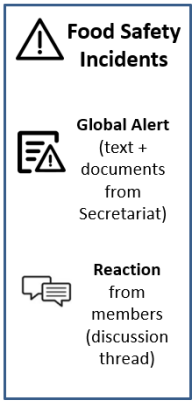
Regional Authority	Acronym	Geographic region covered	Main area of collaboration with the INFOSAN Secretariat
European Centre for Disease Prevention and Control	ECDC	Europe	Contributing to rapid risk/outbreak assessments during foodborne disease outbreaks in Europe
European Commission	EC	Europe	Exchanging information during food safety incidents with the Rapid Alert System for Food and Feed (RASFF)
European Food Safety Authority	EFSA	Europe	Exchanging information on emerging food safety risks through the EFSA Emerging Risks Exchange Network (EREN)
African Union Interafrican Bureau for Animal Resources	AU-IBAR	Africa	Supporting an Africa-wide rapid alert system based on INFOSAN
Inter-American Institute for Cooperation on Agriculture	IICA	Africa	Collaborating on training initiatives for INFOSAN members in the Caribbean
Arab Industrial Development and Mining Organization	AIDMO	North Africa and the Eastern Mediterranean	Engaging with the Arab Food Safety Initiative for Trade Facilitation (SAFE) project to support links with the Arab RASFF
Arab Organization for Agricultural Development	AOAD	North Africa and the Eastern Mediterranean	Engaging with the Arab SAFE project to support links with the Arab RASFF
The International Regional Organization for Plant and Animal Health	OIRSA	Central America	Collaborating on training initiatives for INFOSAN members in Central America

Appendix nine – WHO Collaborating Centres with Focal Points registered on the INFOSAN Community Website, January 2019

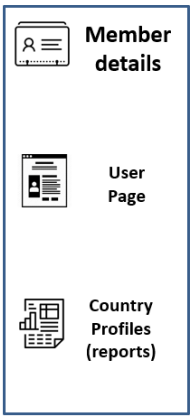
WHO Collaborating Centre	Country	Topic of collaboration
Institute of Nutrition Mahidol University	Thailand	Nutrition and food safety
National Food Institute, University of Denmark	Denmark	Antimicrobial resistance and foodborne pathogens and genomics
Singapore Food Agency	Singapore	Food contamination monitoring
Food and Environmental Hygiene Department	Hong Kong SAR (China)	Risk analysis of chemicals in food
National Institute for Public Health and the Environment	The Netherlands	Risk assessment of pathogens in food and water
Institut Pasteur	France	*Listeria*/listeriosis

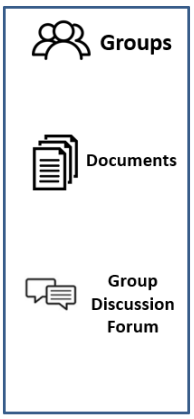
Appendix ten – Specific functions and characteristics to be included in a new ICW

Food Safety Incident pages (1). The new ICW should provide time-sensitive information about international food safety incidents to members around the world. All incident pages should include a standard set of information that can be selected from drop-down lists to search and filter for incidents. Members should be able to interact with food safety incident pages by adding comments and uploading documents which would refer to response actions taken in their own country because of an incident. This kind of activity accounts for the greatest proportion of member contributions on the current ICW and should continue to be encouraged and supported. The information on food safety incident pages would benefit members by notifying them of potential international food safety issues and facilitating the implementation of preparedness and risk management measures. Nearly a quarter of the incidents recorded on the ICW involve food contamination with non-typhoidal *Salmonella enterica.* According to estimates published by the WHO in 2015, the *S. enterica* is also the foodborne hazard that presents the greatest disease burden in terms of disability adjusted life years (DALYs) at the global level (WHO, 2015a). Mitigating the impact of this pathogen should continue to be a priority for INFOSAN members. Reading what others have done in response to instances of food contamination with *S. enterica* or any other foodborne hazard, can aid INFOSAN members in their own national response efforts to prevent illness (FAO/WHO, 2020b).

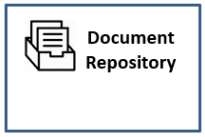


Member details (2). The new ICW should contain the contact details of all members (this information should be automatically populated from an online registration form). The Secretariat frequently needs to contact members and request or provide information about ongoing food safety incidents and members may need to contact each other on a bi-lateral basis to inquire about food safety issues. Members will need to export member details based on pre-defined criteria (e.g. all members from one region). Automatically generated 'country profile' pages should also be available from each user's personal dashboard upon login, providing an overview of membership and recent involvement in food safety incidents. The Secretariat should be able to edit all members' details and members should be able to edit their own details. Having such details available to all members aids in preparedness and facilitates urgent communication during food safety incidents (FAO/WHO, 2010). For example, the ability to export contact information can help when creating contact lists for specific incident responses or meetings. Country profiles illustrate involvement in past food safety incidents and can help to quickly review national membership, making it easier to assess if updates need to be made.

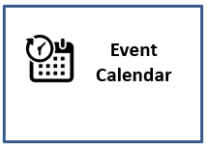




Groups (3). The option to create sub-groups within the ICW should be an option for members themselves, either open to all, or with membership to be agreed by the manager of the group. Such groups could be, for example, groups of members that share a common language or belong to the same region or they could be based on specific food safety topics. Members of groups should be able to upload documents and hold discussions in these groups (and the content within groups would only be visible to the members of the group). Members could benefit from participating in groups by exchanging information on specific topics of interest, exchanging experiences and resources and learning new things (Ford et al., 2015).



Document repository (4). The document repository would provide an organised place to store documents. All documents that are uploaded to the ICW would be indexed into the document repository, making it easy for users to find what they are looking for (e.g. training materials). Both the Secretariat and members should be able to upload documents that are indexed into the repository, but ownership should be clear (e.g. Secretariat document vs member document). Having a document repository that is easily searchable will make it easier to find content on the new ICW and is a helpful tool to aid in knowledge creation and dissemination (Nonaka et al., 2006; Venkatraman & Venkatraman, 2018).

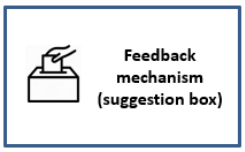


Event calendar (5). An event calendar would allow the Secretariat or members to add details about important upcoming events (e.g. regional INFOSAN meetings) and populate them with details and attachments. Both the Secretariat and members should be able to create events, but there should be a clear delineation between member-created events and Secretariat-created events. Members would benefit by having a clear indication of upcoming events of potential interest and would be encouraged to attend.

Main discussion forum (6). The discussion forum will allow users to communicate asynchronously on food safety topics of concern (including ongoing incidents) and should integrate standard features of modern discussion forums. Any user can initiate a new thread in the forum; discussions may be moderated by the Secretariat; users should be able to add attachments to their text including a range of media types (e.g. documents, videos, etc.). The forum benefits members by fostering a learning community and facilitation interaction between members and the Secretariat. The forum allows for the sharing of new knowledge and the exchanging of ideas to improve food safety. In previous studies of online communities of practice, participation in discussion forums has been linked to several positive outcomes as it can indicate loyalty and satisfaction (Blanchard & Markus, 2004).

Announcements (7). The Secretariat should be able to make announcements to all members (e.g. pop-up notification when a member logs on to the ICW). Announcements may be linked to calendar events and would benefit members by alerting them to important information of potential interest (e.g. new report published, new event planned, etc.). This kind of function can contribute to knowledge dissemination.

User generated report of a food safety incident (8). INFOSAN members should be able to access a template on the ICW to report a food safety incident to the Secretariat. This would function as a downloadable template which could be emailed to WHO (using a members' email client). Having a template for reporting food safety incidents encourages the provision of more complete information during a response effort (FAO/WHO, 2020b).



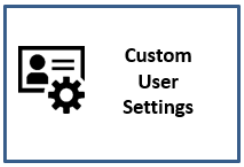
Feedback mechanism (i.e. virtual suggestion box; 9). The INFOSAN Secretariat strives for continuous improvements and welcomes feedback from members. Members should be able to leave feedback (anonymously) with suggestions on how to improve the ICW, or INFOSAN operations in general. Obtaining feedback in this way opens a direct line of communication and demonstrates the willingness of the Secretariat to take on board members' suggestions to drive improvement. Several studies of online communities have demonstrated that high member satisfaction is associated with an increased sense of belonging, less turnover and increased participation (Cullen & Morse, 2011; Escobar et al., 2014; Park et al., 2014).

Web analytics (including reports; 10). The INFOSAN Secretariat needs to be able to understand how the website is being used over time, both to track the benefits and identify and solve issues. Automated monthly reports should be generated and emailed to the Secretariat to quantify: 1) traffic; 2) new content (e.g. new reports, incidents, documents, etc.); 3) new members; 4) liveliness (e.g. new posts, number of members posting, etc); 5) interaction (e.g. number of 'likes' of posts, number of replies to posts, etc); and 6) responsiveness (e.g. speed of posts when new content is uploaded, speed of replies to posts, etc.). There should be a dashboard that displays these different metrics which includes customisable options to allow for exported reports with all or some of the information (e.g. by time, or country, or region, or members, etc.). Adding built-in web-analytic functionality will aid the INFOSAN Secretariat in understanding better how members are using the site and identify certain areas that may need improvement in order to boost collaborative knowledge sharing on the ICW. Monitoring the activity of members in this way can help to identify 'champions' who can help to inspire others to increase their activity (Ford et al., 2015).

Searching and categorisation (11). It is important that users and the Secretariat can simply and effectively find useful information on the website. This will include identification of past and current events and alerts, searches for different members, information topics and documents and items in forums or groups. As part of this, consideration needs to be given to any categories or directory structures used as well as the search functionality included. All users should be able to search all content, and this will benefit members by enabling them to find the information they seek quickly and enhance the exchange of knowledge and information. This can especially be vital during global food safety events where the rapid exchange of information is essential.

Live chat (12). Users need to be able to identify who is currently online and be able to interactively chat with other users or the Secretariat who are currently online. Any users who are logged on to

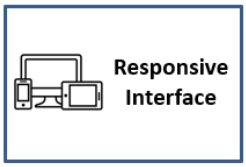
the ICW should be able to start a chat with any other members who are online. This will support user participation and will allow the Secretariat to maintain a closer relationship with users. This could also help to initiate spontaneous dialog and boost knowledge exchange between members that would not otherwise have the chance to converse.



Custom user settings (13). A settings dashboard should allow users to change their settings regarding email notifications they receive from the ICW (e.g. every time a new discussion thread is started, or a weekly digest, etc.). Users should be able to subscribe or unsubscribe to various content on the ICW (recognising that a core set of information would always be transmitted to members when it concerned a food safety incident requiring immediate action). Being able to customise what information is sent by email to members can eliminate email-fatigue and ensure that members are getting the information they are interested in, in their desired format and frequency.

Website administration (including user administration (14). As resources are limited, a flexible and intuitive design is needed for the Secretariat to administer the website (FAO/WHO, 2019). User-friendly web administration will save time for the INFOSAN Secretariat and ensure the website is kept up-to-date for a better user experience.

Gamification (15). Gamification may involve the automatic or manual assignment of virtual badges or awards for certain types of member engagement (e.g. using the discussion forum, sharing documents, reporting incidents to the Secretariat, milestones in length of membership, etc.). Such badges would be displayed on a member's profile. The Secretariat should be able to pre-define badges/awards that are automatically bestowed as well as customise badges/awards that may be presented ad-hoc. Recent studies have shown that gamifying learning environments and online collaboration spaces can boost learning performance (Davis et al., 2018) as well increase both the quality and quantity of knowledge contributions (Suh & Wagner, 2017). Members may appreciate acknowledgement for contributions and gamification may contribute to increased participation and contribution on the ICW.

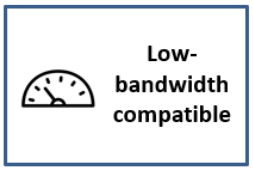


Responsive interface (16). Relying on current best practices, all pages should have an adaptive behaviour, taking care of both screen resolutions and touch devices. A responsive interface could encourage improved participation by members as many have indicated they more often use mobile devices to access the ICW. As per the results from the global survey of INFOSAN members, more than 80% of members agreed that a mobile friendly version of the ICW would improve participation (Savelli & Mateus, 2021).

User friendly (17). The interface of the new ICW should be optimised for mobile devices, focus on primary tasks of the site, elevate the most relevant content and give users a logical path to follow for easy navigation to provide a good user experience. The new ICW user interface should focus on several key principles,

including clarity, user-centricity, simplicity, consistency, and a strong visual hierarchy(Lee et al., 2006). A more user-friendly site should encourage increased utilisation of the ICW by users.

Multi-lingual (18). The website interfaces need to be multilingual to support the international community which uses it. As 98% of INFOSAN members speak either English, Spanish or French, this has important implications for the language of program delivery, including for the design of the interface of the new ICW and for the information shared with members and food safety alerts posted on the ICW. Users should be able to select which language the user-interface is displayed in; there should be an option to auto-translate the other content on the site using an external internet translation tool. Multilingualism enables a greater proportion of the global membership to consume content on the ICW and the translated interfaces facilitate greater participation.



Low-bandwidth compatible (19). With membership spanning the globe, many users are in places where the internet is very slow. The website needs to be able to adapt to that reality. Users should have the ability to switch between high and low bandwidth versions of the new ICW. Such compatibility will ensure all users around the world will have equal opportunities to access the information shared and make contributions to the ICW in accordance with their local situation. Collaborations that are more inclusive of all participants are more likely to share complex forms of knowledge and be more motivated overall (Gungor, 2019).

Appendix eleven – Research posters

1) International Association for Food Protection, European Symposium on Food Safety, 24-26 April 2019, Nantes, France.
https://iafp.confex.com/iafp/euro19/meetingapp.cgi/Paper/20112

The (FAO/WHO) International Food Safety Authorities Network

INFOSAN: Looking inside this Global Community of Practice

Carmen Joseph Savelli[1,2], Céu Mateus[2]

1. World Health Organization; 2. Lancaster University

World Health Organization

Lancaster University

What is INFOSAN?

The International Food Safety Authorities Network (INFOSAN) is a global network of national food safety authorities, managed jointly by FAO and WHO. INFOSAN enables the rapid exchange of information during food safety emergencies to stop the spread of contaminated food from one country to another. INFOSAN also facilitates the sharing of experiences and tested solutions in and between countries in order to optimize future interventions to improve food safety and protect the health of consumers.

What is a Community of Practice?

A community of practice is a group of people who share a concern or a passion for something they do, and learn how to do it better as they interact regularly.

Introduction

Since 2004, INFOSAN has aimed to halt the international spread of contaminated food, prevent foodborne disease outbreaks, and strengthen food safety systems globally. However, INFOSAN has never been examined as a functional community of practice and its value, according to members, has not been determined in a systematic or rigorous way.

Purpose

A three-phased, mixed-method study is ongoing to explore the experiences of INFOSAN members with respect to their participation in network activities in order to improve global food safety and prevent foodborne illness. Background details and results related to phase 1 are presented here and pertain to information and data available on the INFOSAN Community Website (ICW, Figure 2).

Methods

Registration data has been collected for each member on the ICW since 2012. Anonymized data was analyzed using descriptive summary statistics, and stratified by a number of variables including type of member, geographic region, and length of membership. Records of access to and usage of the ICW were also downloaded from the site. In addition, data regarding food safety events and member involvement in these was also extracted from the ICW and summarized in Figures 2-4 and Table 1.

Results

Figure 1. INFOSAN community characteristics and activity among registered members

48% of registered INFOSAN members are female

52% of INFOSAN members have been registered for 3 or more years

33% (188/574) of all comments in the discussion forum of the INFOSAN Community Website between 2012 and 2019 were made by 10 community members (including the INFOSAN Secretariat)

71% (466/658) of registered INFOSAN members have never made a comment in the discussion forum

The authors would like to acknowledge members of the INFOSAN Secretariat at WHO for their contributions: Peter Ben Embarek, Adam Bradshaw and Raul Garcia

Figure 2. The INFOSAN Community Website

Figure 3. Member State involvement in food safety events communicated through INFOSAN, 2011-2017

Figure 4. Average number of Member States involved in each food safety event communicated through INFOSAN, 2011-2017

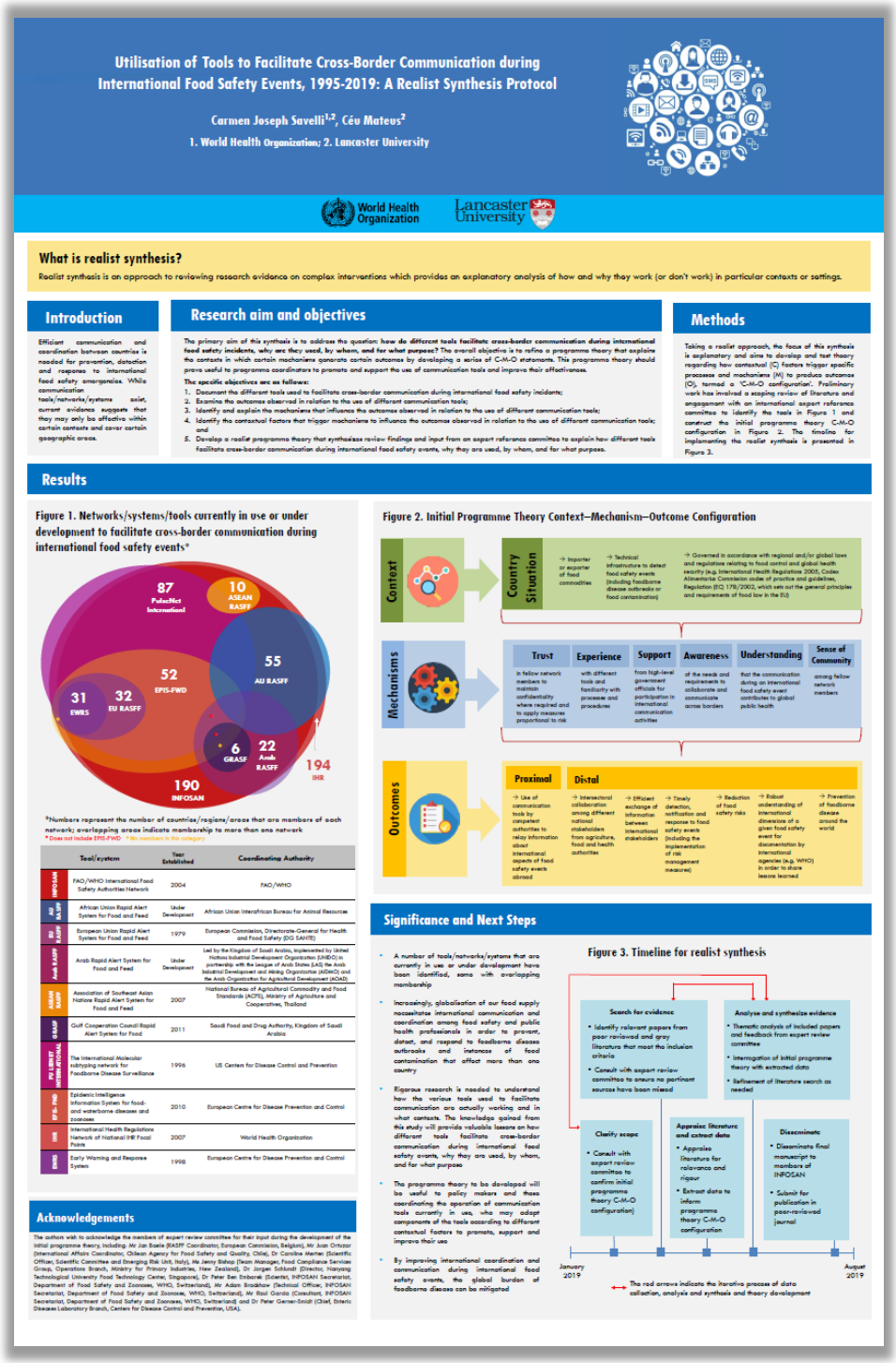
Table 1. Top 10 Member States most frequently involved in food safety events communicated through INFOSAN, 2011-2017

Member State	Number of events MS were involved in (N = 293) n (%)
1. United States of America	91 (31%)
2. China (including HK and Macao)	64 (22%)
3. Canada	60 (20%)
4. Australia	48 (16%)
5. United Kingdom	48 (16%)
6. France	40 (14%)
7. Germany	40 (14%)
8. Netherlands	36 (12%)
9. New Zealand	28 (9%)
10. Italy	22 (8%)
10. Singapore	22 (8%)

Significance and Next Steps

- The data provide objective, foundational information about the engagement of all members and will be triangulated with data from phases 2 and 3 of the ongoing study to determine if members' reported attitudes and experiences reflect their online behaviours.
- This information can be used by the INFOSAN Secretariat to increase active participation and improve international information exchange to mitigate the impact of food safety emergencies.
- Over the past 15 years, INFOSAN has grown into a truly global network with a global mandate, endorsed by 194 Member States of the World Health Organization.
- In addition, the entrenchment of INFOSAN within the IHR (2005) framework, as well as within important Codex Alimentarius Commission guidelines, provides further acknowledgement and support for the need for such a network as well as its global importance.
- Perhaps most importantly, INFOSAN has demonstrated its utility in numerous global food safety emergencies.
- In a complex global landscape, INFOSAN has emerged as the only network of its kind with a truly global mandate to connect food safety authorities around the world for the purpose of exchanging information during food safety emergencies.
- However, INFOSAN does not function without limitations: **active participation among a broader base of members could be improved.**
- Next steps will include further research to explore the experiences of members and thoroughly define the interlinkages between INFOSAN and other regional and global initiatives that could highlight the specific areas in which to introduce operational shifts by the INFOSAN Secretariat (phase 2 of this study involves a survey of all INFOSAN members and phase 3 involves interviews with a sub-set of members).
- In turn, this may increase the value of active participation among INFOSAN members, eliminating barriers to participation and leading to a stronger global community of practice and a robust and meaningful impact at country-level to reduce the burden of foodborne disease globally.

2) International Association for Food Protection, European Symposium on Food Safety, 24-26 April 2019, Nantes, France.
https://iafp.confex.com/iafp/euro19/meetingapp.cgi/Paper/20125



Utilisation of Tools to Facilitate Cross-Border Communication during International Food Safety Events, 1995-2019: A Realist Synthesis Protocol

Carmen Joseph Savelli[1,2], Céu Mateus[2]

1. World Health Organization; 2. Lancaster University

World Health Organization | Lancaster University

What is realist synthesis?

Realist synthesis is an approach to reviewing research evidence on complex interventions which provides an explanatory analysis of how and why they work (or don't work) in particular contexts or settings.

Introduction

Efficient communication and coordination between countries is needed for prevention, detection and response to international food safety emergencies. While communication tools/networks/systems exist, current evidence suggests that they may only be effective within certain contexts and cover certain geographic areas.

Research aim and objectives

The primary aim of this synthesis is to address the question: how do different tools facilitate cross-border communication during international food safety incidents, why are they used, by whom, and for what purpose? The overall objective is to refine a programme theory that explains the contexts in which certain mechanisms generate certain outcomes by developing a series of C-M-O statements. This programme theory should prove useful to programme coordinators to promote and support the use of communication tools and improve their effectiveness.

The specific objectives are as follows:

1. Document the different tools used to facilitate cross-border communication during international food safety incidents;
2. Examine the outcomes observed in relation to the use of different communication tools;
3. Identify and explain the mechanisms that influence the outcomes observed in relation to the use of different communication tools;
4. Identify the contextual factors that trigger mechanisms to influence the outcome observed in relation to the use of different communication tools; and
5. Develop a realist programme theory that synthesises review findings and input from an expert reference committee to explain how different tools facilitate cross-border communication during international food safety events, why they are used, by whom, and for what purpose.

Methods

Taking a realist approach, the focus of this synthesis is explanatory and aims to develop and test theory regarding how contextual (C) factors trigger specific processes and mechanisms (M) to produce outcomes (O), termed a 'C-M-O configuration'. Preliminary work has involved a scoping review of literature and engagement with an international expert reference committee to identify the tools in Figure 1 and construct the initial programme theory C-M-O configuration in Figure 2. The timeline for implementing the realist synthesis is presented in Figure 3.

Results

Figure 1. Networks/systems/tools currently in use or under development to facilitate cross-border communication during international food safety events*

*Numbers represent the number of countries/regions/areas that are members of each network; overlapping areas indicate membership to more than one network

* Does not include EPIS-FWD ^ No members in this category

	Tool/system	Year Established	Coordinating Authority
INFOSAN	FAO/WHO International Food Safety Authorities Network	2004	FAO/WHO
AU RASFF	African Union Rapid Alert System for Food and Feed	Under Development	African Union Interafrican Bureau for Animal Resources
EU RASFF	European Union Rapid Alert System for Food and Feed	1979	European Commision, Directorate-General for Health and Food Safety (DG SANTE)
Arab RASFF	Arab Rapid Alert System for Food and Feed	Under Development	Led by the Kingdom of Saudi Arabia, implemented by United Nations Industrial Development Organization (UNIDO) in partnership with the League of Arab States (LAS) the Arab Industrial Development and Mining Organization (AIDMO) and the Arab Organization for Agricultural Development (AOAD)
ASEAN RASFF	Association of Southeast Asian Nations Rapid Alert System for Food and Feed	2007	National Bureau of Agricultural Commodity and Food Standards (ACFS), Ministry of Agriculture and Cooperatives, Thailand
GRASF	Gulf Cooperation Council Rapid Alert System for Food	2011	Saudi Food and Drug Authority, Kingdom of Saudi Arabia
PULSENET INTERNATIONAL	The International Molecular subtyping network for Foodborne Disease Surveillance	1996	US Centers for Disease Control and Prevention
EPIS-FWD	Epidemic Intelligence Information System for food- and waterborne diseases and zoonoses	2010	European Centre for Disease Prevention and Control
IHR	International Health Regulations Network of National IHR Focal Points	2007	World Health Organization
EWRS	Early Warning and Response System	1998	European Centre for Disease Prevention and Control

Figure 2. Initial Programme Theory Context–Mechanism–Outcome Configuration

Significance and Next Steps

- A number of tools/networks/systems that are currently in use or under development have been identified, some with overlapping membership
- Increasingly, globalisation of our food supply necessitates international communication and coordination among food safety and public health professionals in order to prevent, detect, and respond to foodborne disease outbreaks and instances of food contamination that affect more than one country
- Rigorous research is needed to understand how the various tools used to facilitate communication are actually working and in what contexts. The knowledge gained from this study will provide valuable lessons on how different tools facilitate cross-border communication during international food safety events, why they are used, by whom, and for what purpose
- The programme theory to be developed will be useful to policy makers and those coordinating the operation of communication tools currently in use, who may adopt components of the tools according to different contextual factors to promote, support and improve their use
- By improving international coordination and communication during international food safety events, the global burden of foodborne disease can be mitigated

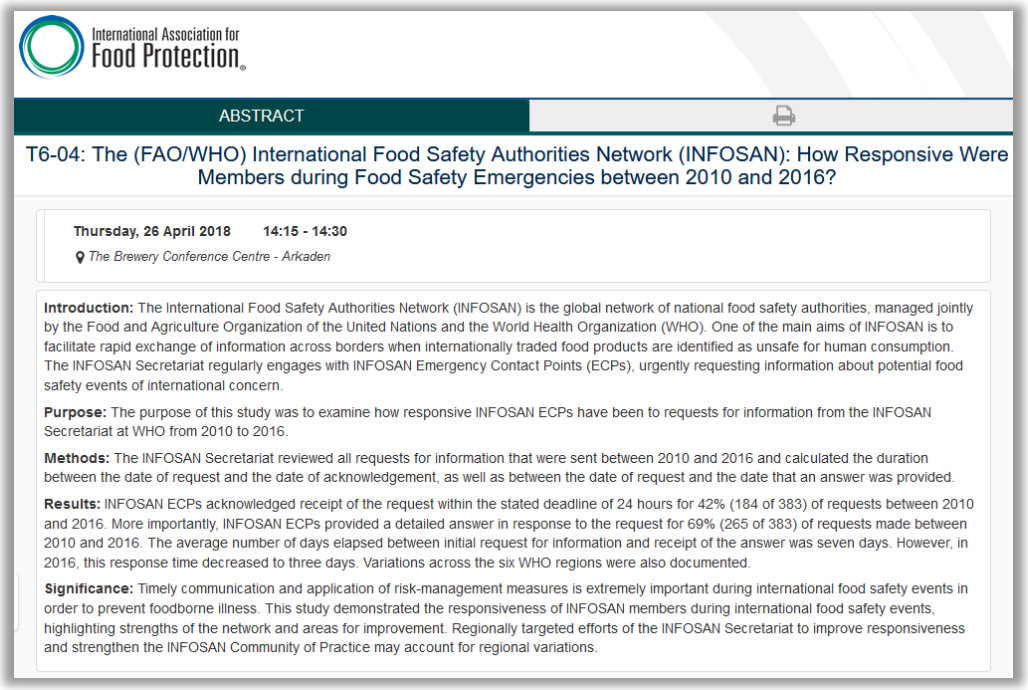
Figure 3. Timeline for realist synthesis

Acknowledgements

The author wish to acknowledge the members of expert review committee for their input during the development of the initial programme theory, including: Mr Jan Baelle (RASFF Coordinator, European Commission, Belgium), Mr Juan Ortuzar (International Affairs Coordinator, Chilean Agency for Food Safety and Quality, Chile), Dr Caroline Merten (Scientific Officer, Scientific Committee and Emerging Risk Unit, Italy), Ms Jenny Bishop (Team Manager, Food Compliance Services Group, Operations Branch, Ministry for Primary Industries, New Zealand), Dr Jorgen Schlundt (Director, Nanyang Technological University Food Technology Center, Singapore), Dr Peter Ben Embarek (Scientist, INFOSAN Secretariat, Department of Food Safety and Zoonoses, WHO, Switzerland), Mr Adam Bradshaw (Technical Officer, INFOSAN Secretariat, Department of Food Safety and Zoonoses, WHO, Switzerland), Mr Raul Garcia (Consultant, INFOSAN Secretariat, Department of Food Safety and Zoonoses, WHO, Switzerland) and Dr Peter Gerner-Smidt (Chief, Enteric Diseases Laboratory Branch, Centers for Disease Control and Prevention, USA).

Appendix twelve – Research presentations

1) International Association for Food Protection, European Symposium on Food Safety, 25-27 April 2018, Stockholm, Sweden.
https://iafp.confex.com/iafp/euro18/meetingapp.cgi/Paper/18346



International Association for Food Protection

ABSTRACT

T6-04: The (FAO/WHO) International Food Safety Authorities Network (INFOSAN): How Responsive Were Members during Food Safety Emergencies between 2010 and 2016?

Thursday, 26 April 2018 **14:15 - 14:30**

The Brewery Conference Centre - Arkaden

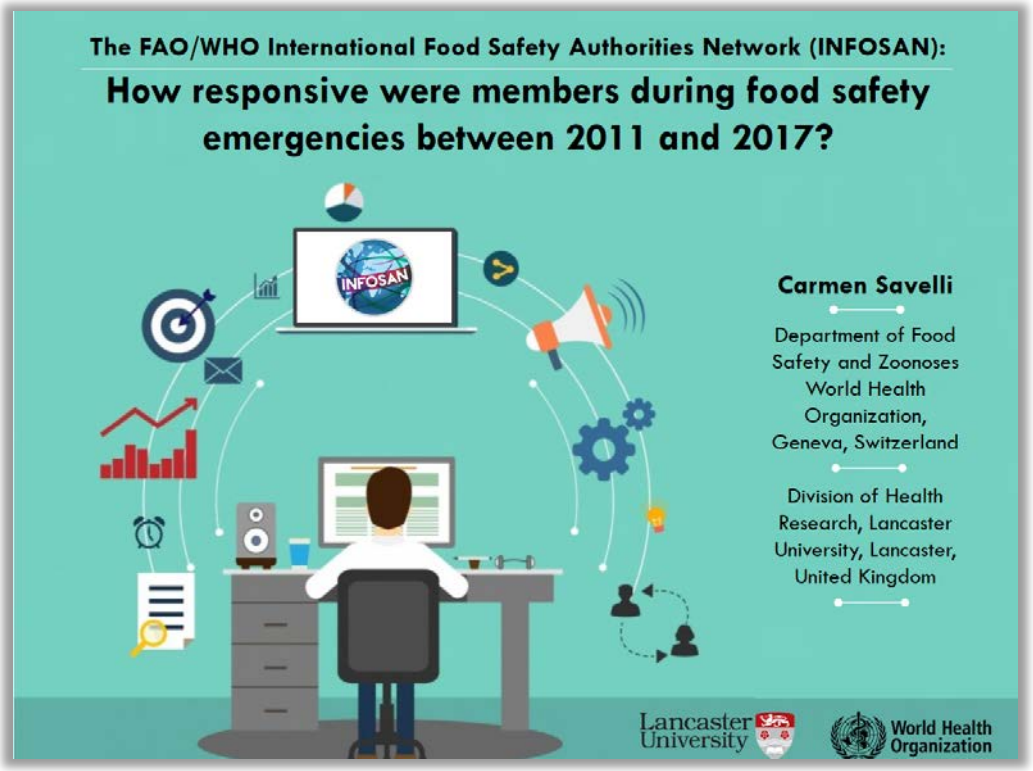
Introduction: The International Food Safety Authorities Network (INFOSAN) is the global network of national food safety authorities, managed jointly by the Food and Agriculture Organization of the United Nations and the World Health Organization (WHO). One of the main aims of INFOSAN is to facilitate rapid exchange of information across borders when internationally traded food products are identified as unsafe for human consumption. The INFOSAN Secretariat regularly engages with INFOSAN Emergency Contact Points (ECPs), urgently requesting information about potential food safety events of international concern.

Purpose: The purpose of this study was to examine how responsive INFOSAN ECPs have been to requests for information from the INFOSAN Secretariat at WHO from 2010 to 2016.

Methods: The INFOSAN Secretariat reviewed all requests for information that were sent between 2010 and 2016 and calculated the duration between the date of request and the date of acknowledgement, as well as between the date of request and the date that an answer was provided.

Results: INFOSAN ECPs acknowledged receipt of the request within the stated deadline of 24 hours for 42% (184 of 383) of requests between 2010 and 2016. More importantly, INFOSAN ECPs provided a detailed answer in response to the request for 69% (265 of 383) of requests made between 2010 and 2016. The average number of days elapsed between initial request for information and receipt of the answer was seven days. However, in 2016, this response time decreased to three days. Variations across the six WHO regions were also documented.

Significance: Timely communication and application of risk-management measures is extremely important during international food safety events in order to prevent foodborne illness. This study demonstrated the responsiveness of INFOSAN members during international food safety events, highlighting strengths of the network and areas for improvement. Regionally targeted efforts of the INFOSAN Secretariat to improve responsiveness and strengthen the INFOSAN Community of Practice may account for regional variations.



2) 25th Canadian Conference on Global Health, 17-19 October 2019, Ottawa, Canada
https://www.csih.org/sites/default/files/uploads/ccgh2019oralabstracts.pdf

Savelli, Carmen Joseph, World Health Organization, Switzerland

The (FAO/WHO) International Food Safety Authorities Network (INFOSAN): Looking inside this global community of practice

Issue/objective: The International Food Safety Authorities Network (INFOSAN) is a global network of national food safety authorities, managed jointly by FAO and WHO. Since 2004, INFOSAN has enabled the rapid exchange of information during food safety emergencies to stop the spread of contaminated food from one country to another. INFOSAN also facilitates the sharing of experiences and tested solutions in and between countries and across sectors to optimize future interventions to improve food safety and protect the health of consumers around the world.

However, INFOSAN has never been examined as a functional community of practice and its value, according to members, has not been determined in a systematic or rigorous way.

A three-phased, mixed-method study is ongoing to explore the experiences of INFOSAN members with respect to their participation in network activities to improve global food safety and prevent foodborne illness. Details related to phase 1 are presented here and relate specifically to how the INFOSAN Community Website (ICW) is being used to support network activities.

Methodology/approach: Registration data has been collected for each member on the ICW since 2012. Anonymized data was analyzed using descriptive summary statistics and stratified by several variables including type of member, geographic region, and length of membership. Records of access to the ICW were also downloaded from the site.

Results: As of January 2019, the ICW has 524 registered members from 183 WHO Member States; 186/524 (35%) are Emergency Contact Points, 338/524 (65%) are Focal Points; 241/507 (48%) are female. The majority of these INFOSAN members, 290/524 (55%), have been registered on the ICW for 3 or more years and 270/524 (52%) have logged on to the ICW within the preceding 6 months.

Discussion/conclusion: In a complex global landscape, INFOSAN has emerged as the only network of its kind with a truly global mandate to connect food safety authorities around the world for exchanging information during food safety emergencies. The ICW helps to facilitate the work of the Network. The results from phase 1 of this study provide objective, foundational information about engagement of all members and will be triangulated with data from phases 2 and 3 of the ongoing study to determine if members' reported attitudes and experiences reflect their online behaviours. This information can be used by the INFOSAN Secretariat to increase active participation and improve international information exchange to mitigate the impact of food safety emergencies and prevent foodborne diseases globally.

3) Second Global Meeting of the FAO/WHO International Food Safety Authorities Network (INFOSAN), 9-11 December 2019, Abu Dhabi, United Arab Emirates
https://www.who.int/publications/i/item/9789240003934

Food and Agriculture Organization of the United Nations

World Health Organization

MEETING REPORT

The Second Global Meeting of the FAO/WHO International Food Safety Authorities Network

(INFOSAN)

9-11 DECEMBER 2019

Abu Dhabi, United Arab Emirates

INTERNATIONAL FOOD SAFETY AUTHORITIES NETWORK

Hosted by the Abu Dhabi Agriculture and Food Safety Authority

ABU DHABI AGRICULTURE AND FOOD SAFETY AUTHORITY

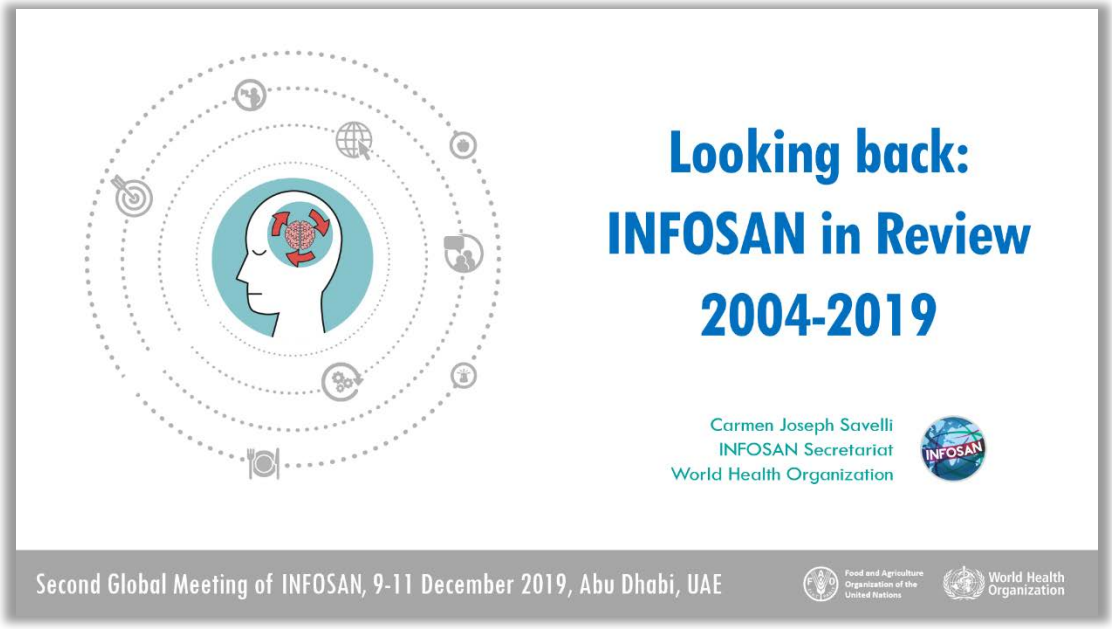
Carmen Joseph Savelli, INFOSAN Secretariat, WHO

Looking back – INFOSAN in Review: 2004-2019

The stimulus for the creation of a global network of food safety authorities originated directly from Member States' requests articulated at the World Health Assembly and the Codex Alimentarius Commission. In response to a clear need, expressed prominently and repeatedly in multiple global fora, the WHO officially launched INFOSAN in 2004, in cooperation with FAO, at the FAO/WHO Second Global Forum for Food Safety Regulators. After 15 years of growth, INFOSAN operates as a voluntary network of more than 600 members from 190 countries. The work of the INFOSAN Secretariat is supported by an international Advisory Group and many other regional and global partners. INFOSAN has four main objectives: 1) Promote the rapid exchange of information during food safety incidents; 2) Share information and resources on important food safety related issues of global interest; 3) Promote partnerships and collaboration between national agencies, between countries, and between networks; and 4) Help countries strengthen their capacity to manage food safety emergencies.

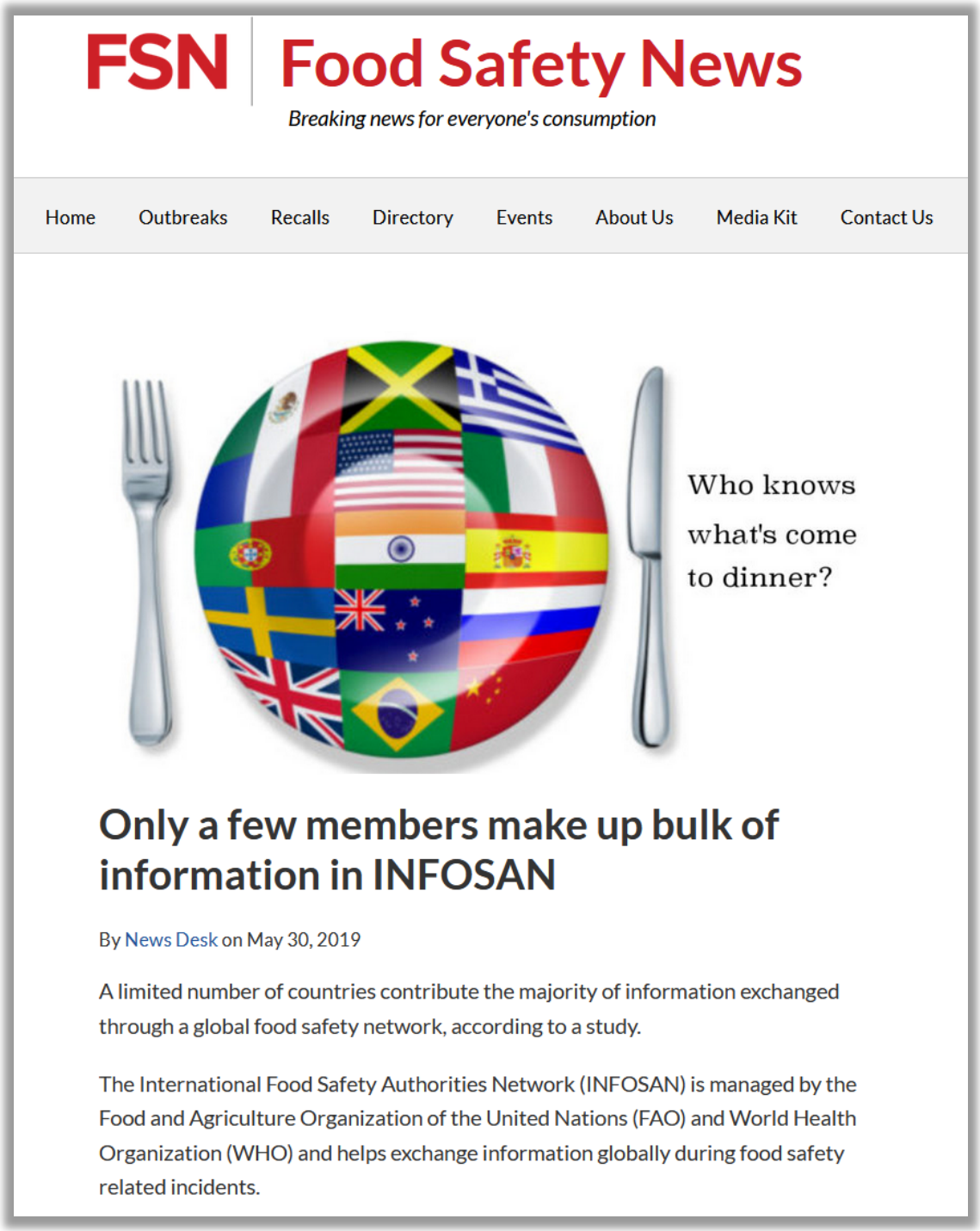
In January 2019, a study of INFOSAN was launched[1] to explore and describe the experiences of members to better understand the role of the network in improving food safety and mitigating the burden of foodborne illness globally. An online questionnaire was developed and adapted from English into French and Spanish before being disseminated. By email, registered national INFOSAN members (480) were requested to complete the questionnaire and 239 responses were received from INFOSAN members in 130 countries. About 70% agree that because of INFOSAN, illnesses have been prevented; 69% agree that because of INFOSAN, lives have been saved; 63% agree that INFOSAN has improved the safety of the global food supply; 61% agree that INFOSAN has reduced foodborne illness globally; 93% of INFOSAN members say that participating in INFOSAN has been a valuable experience. More than half of respondents agreed that the following barriers limited their participation in INFOSAN: there is a need for a simpler and more standardized way to share information between national authorities within their country (60%); there are challenges in conducting food safety risk assessments within their country (59%); their country has insufficient funds dedicated to monitoring and/or responding to food safety events (55%); their country has limited capacity and/or infrastructure dedicated to addressing food safety events (54%). This study represents the first ever

1. Read more about this study online: https://bmjopen.bmj.com/content/9/5/e027091.info



Appendix thirteen – Media interest in my research

1) Food Safety News. Only a few members make up bulk of information in INFOSAN. 30 May 2019. https://www.foodsafetynews.com/2019/05/only-a-few-members-make-up-bulk-of-information-in-infosan/



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Only a few members make up bulk of information in INFOSAN

By News Desk on May 30, 2019

A limited number of countries contribute the majority of information exchanged through a global food safety network, according to a study.

The International Food Safety Authorities Network (INFOSAN) is managed by the Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) and helps exchange information globally during food safety related incidents.

2) Codex Alimentarius Magazine. Food safety emergencies: a member-driven network is connecting food safety authorities around the world. 2019. http://www.fao.org/3/ca5180en/ca5180en.pdf.

Facing food safety emergencies

A member-driven network is connecting food safety authorities around the world

The FAO/WHO International Food Safety Authorities Network (INFOSAN), established in 2004, facilitates urgent communication among more than 600 members from 188 FAO and WHO Member States, ensuring rapid sharing of information during food safety emergencies to stop the spread of contaminated food from one country to another.

In January 2019, a study was launched to explore the experiences of INFOSAN members and better understand the role of the network in mitigating the burden of foodborne illness around the world. The study will:

- examine access to and usage of the INFOSAN Community Website
- explore barriers and facilitators to active participation in INFOSAN
- determine perceptions about the utility of INFOSAN to mitigate foodborne illness and
- scrutinize how participation in this network creates value for members.

Data collected to date suggest that a certain group of active members in several Member States contribute much of the information exchanged through the network. For example, 9 (5%) Member States were each involved in 24 or more food safety events communicated through INFOSAN between 2011 and 2017, whereas 123 (65%) Member States were involved in 3 events or less, including 36 (19%) involved in none. These data also demonstrate that although the overall responsiveness of members during emergencies has improved in recent years, impediments to rapid and efficient information sharing may persist for some INFOSAN members.

Several potential barriers to active participation in INFOSAN have been hypothesized, but members themselves have not been conferred with on their relative importance. This study will therefore investigate the experiences of INFOSAN members in a rigorous and systematic manner to illuminate the specific areas in which the INFOSAN Secretariat can introduce operational shifts to:

- strengthen the global INFOSAN Community of Practice
- increase the value of INFOSAN among members and
- have a robust and meaningful impact at country level to reduce the burden of foodborne disease globally.

A manuscript providing additional background to this study has recently been published online, titled "The FAO/WHO International Food Safety Authorities Network in Review, 2004–2018: Learning from the Past and Looking to the Future".

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