Communication Needs of Elderly at Risk of Falls and their Remote Family

Corina Sas
Lancaster University
Lancaster, UK
corina@comp.lancs.ac.uk

Kieran Brahney
Lancaster University
LA1 4WA, UK
k.brahney@lancaster.ac.uk

Carl Oechsner
Lancaster University
LA1 4WA, UK
c.oechsner@lancaster.ac.uk

Amish Trivedi
Lancaster University
LA1 4WA, UK
a.trivedi@lancaster.ac.uk

Mauricio Nomesque
Lancaster University
LA1 4WA, UK
m.nomesquesilva@lancaster.ac.uk

Zaffar Mughal
Lancaster University
LA1 4WA, UK
z.mughal@lancaster.ac.uk

Keith Cheverst
Lancaster University
Lancaster, UK
k.cheverst@lancaster.ac.uk

Sarah Clinch
Lancaster University
Lancaster, UK
s.clinch@lancaster.ac.uk

Nigel Davies
Lancaster University
Lancaster, UK
n.a.davies@lancaster.ac.uk

Abstract

The aging population experiences increased health risks, both physical and emotional. Two such risks are those of isolation and falling. This papers draws from HCI literature in these two independent research areas to explore the needs of family communication with elderly parents at risk of falls. We report on a study with 7 elderly parents and 3 of adult children, as well as a group interview with 12 elderly living in a sheltered accommodation. Findings indicate important emotional needs on both parts: adult children's anxiety for the wellbeing of their parents at risk of falls, and elderly's need for autonomy and their appreciation for an aesthetic design. We concluded with implications of these findings for designing for family communication in this challenging context.

Author Keywords

Fall detection, family communication needs, elderly people

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

With the global trend of increased aging population, and the higher cost of healthcare, support for elderly people's independent living becomes increasingly important. In addition, their connectedness with their adult children is also vital for avoiding isolation. A specific health risk for elderly people is that of falling, with 28% to 35% of people aged 65 and over falling every year [43]. In addition, the number of injuries caused by falls is anticipated to be 100% higher by 2030. Unsurprisingly, research into fall detection technologies has gained momentum over the last decade. A parallel research direction regarding elderly's risk of isolation has focused on communication technologies for supporting remote connectedness with their adult children and grandchildren. This paper aims to intersect these largely independent research areas to explore the communication needs of elderly at risk of falls and their remote families. The study addresses the following research questions:

(i) What are adult children's needs for communication with their elderly parents at risk of falls? Do they prefer automatic notifications that everything is OK?

(ii) What are elderly's needs for communication with their remote family? Do they experience fear of falls, or they value more their autonomy?

(iii) What is elderly's attitude towards fall detection technology? Do they accept or resist its adoption?

Related Work

The emerging trend of ageing in place and provision of healthcare into the home [14] has fostered a growing interest in ambient assistive living and self-monitoring. Such work has spanned research areas from supporting memory [10,34,39,40] and mental health [33] to assistance in the end of life care [35] or supporting the needs of the caregivers [5,19]. HCI research focusing on designing for elderly people [24,25] and their specific needs (including those of caregivers) has identified several challenges around the issues of privacy [6,18,43] and control [1,7,17,41]. Our study draws from HCI interest in technologies for fall detection and work on novel technologies [32] for remote family communication with elderly relatives.

Fall Detection Technologies

In the last two decades there has been an increased interest in automatic monitoring technologies for detecting elderly people's falls. El-Bendary and colleagues [12] have reviewed academic work on fall detection technologies between 2003 and 2013. They identified a range of fall monitoring systems from video surveillance and sensor networks, to mobile technologies. Some mobile devices involve body-worn sensors located on the wrist, waist or around one's neck [1]. Degen and colleagues [11] implemented a wrist-watch connected to a call center, augmented with tri-axial accelerometers. Marquis-Faulkes and colleagues [26] developed a waterproof wrist watch for elderly people in a sheltered home. The research prototype has been followed by a commercial solution integrating smartwatch with smartphone to detect the fall of elderly people affected by dementia. Besides tracking a person's movement, such body-worn devices can be augmented with biosensors to measure blood pressure or heart rate [20].

Previous work has highlighted two key requirements for fall detection technologies such as unobtrusiveness and durability. For example, Marquis-Faulkes [26] and Gövercin [16] found that elderly people would be most happy with unobtrusive devices. This need has been linked to devices' being bulky and therefore perceived

by elderly people as stigmatizing [23]. As falls can occur in different places, including showers, devices should also be durable and waterproof [26]. Other relevant work is the integrated caregiver-focused mHealth framework providing fall detection services to elderly people [15]. The system integrates mobile phones with smartwatches and neural network algorithms to classify fall events. While the emphasis is on providing a rich set of contextual information about the elderly person's lifestyle, the fall notification is not detailed, and the paper presents limited information about user's input into its design. Another example is Arcelus and colleagues' fall detection system [2] which informs relatives but the paper does not provide details for its mechanics.

To conclude, most of such prior work has focused primarily on fall detection and less on fall notification. Notification has been mostly addressed through interfaces for either activating the alarm, or for turning off false alarms [37]. There has been also limited work exploring the emotional needs associated with increased risk of falls that both elderly people and their remote family members have in this context. This is surprising, giving that the risk of falls is high among elderly people and potentially a source of anxiety for the rest of the family living remotely. For this, we turn to the HCI literature on remote communication.

Remote Family Communication
Most HCI research on family communication has taken place within CSCW community, highlighting people's preference for synchronous communication [4,22,29]. With increased aging population, more extended families face the challenge of keeping in touch and managing the risks associated with elderly people's independent living. Van Bel and his colleagues [38] identified five

dimensions of social connectedness consisting of shared understanding, mutual awareness of other's experiences, feeling of closeness, the quality of the contact, and saliency of the relationship. Mynatt and colleagues [27] proposed a three-pronged approach for designing technologies to extend elderly's independent living by mitigating crisis, supporting daily routines, and offering peace of mind for adult children. For example, they designed digital family portraits for capturing and visualizing a remote elderly parent's daily life, with the aim of supporting peace of mind for their adult children [28,31]. While the design has not intended to alert the family when the elderly's health is poor, it could potentially be extended to include such notifications.

A related system is CareNet Display [9] which provides ambient interactive access of local members of an elderly's care network to the elderly person's day-to-day unexpected events across seven key areas such as meals, medication, activities, mood, and falls. Empowering elderly people to decide which information to be shared has emerged as particularly important. Another example is the family window system, a video communication tool utilizing always-on video [7,9]. This was intended to support feelings of connectedness within the remote family, in particular through communication between adult children and elderly parents. More subtle forms of social awareness among remote family members have been explored through systems such as SnowGlobe [42]; a lamp which glows when movement is identified in the remote living room. This system suggests the value of ambiguous and physical interaction. Additional work has focused on ambient awareness of routines for expressing emotions between older adults and family member in order to ensure family connectedness [4,8,30].

To summarise, much work has focused on sensing technologies for capturing and communicating behavioural and emotional responses to the remote family members [2,3,26]. Social awareness is often ensured through asynchronous channels in the form of tangibles and displays for historic or real-time data. While most work has focused on sharing and experiencing positive emotions about daily life, there has been less work into designing for family communication in challenging situations where the need for connectedness is intertwined with the need to manage anxiety around the risk of falls.

Method
The aim of this study is to explore the design space for family technologies for automatically detecting and communicating fall events of elderly users living independently or in sheltered accommodation. The study involved semi-structured interviews with seven elderly people, three living independently and four living in sheltered accommodation; and three adult children. In addition to these individual interviews, we also run a group interview with 12 elderly people in a sheltered accommodation. The recruitment process involved emails sent to several local sheltered accommodations and following one positive reply, we visited the accommodation and recruited participants in person. Most of the interviews took place face to face, and a few by phone. All interviews were recorded and transcribed.

Questions concerned elderlies' experience of falls, the concerns triggered by falls and their relevance for both the elderly people and their family members. We also asked about technology's potential to regularly inform family members of one's wellbeing, and elderly people's attitude towards monitoring: *"If you were to fall, would*

you like a device to contact relatives or emergency services?"; "Would you be happy with the device contacting people automatically?"

Interviews with family members focused on the frequency of contact with their elderly relative and the preferred communications methods. Additional questions probed the potential of fall monitoring technology such as form of interaction, frequency and time of use, information provided, as well as:*"Would you like a device that tracks her movements all day and instantly informs you if she fell down?"*

Data analysis consisted of a hybrid approach where existing concepts such as dimensions of connectedness [38], autonomy and peace of mind [27] were used for the deductive coding, while new concepts grounded on the empirical data contributed to the inductive coding [12]. The codes were iteratively refined as new codes emerged under the themes of family's anxiety, elderly's conflicting needs for autonomy and privacy on the one hand, and safety on the other hand, and special communication needs derived from these.

Findings
We now describe each theme, illustrating it with quotes form participants' answers, i.e. C1-3 for children, and P1-7 for elderly parent. The three themes capture emotional aspects: anxiety of adult children, autonomy of the elderly parent, and the aesthetics design of such technologies.

Family's Anxiety for Elderly Parent at Risk of Falls
Anxiety was a major theme throughout the family members' interviews. This is an important finding which goes beyond family's concerns for the wellbeing of their elderly relative [27,28]: *"You do wonder sometimes, like last night there was an ambulance that went past*

and you think is it mother again […] "is she okay"? I mean, we were cross with Mum when she fell out of bed and she didn't press the buzzer because she didn't want to bother anybody. Something to alert us when something has happened and whether she was okay or not [would be useful]" [C2]. As shown above, the risk of falls is perceived as high by the adult children and with negative consequences for the parent's life. As a result, communication with their parents is regular consisting of daily phone calls and weekly visits. Several participants mentioned that whilst they do this because they are anxious, they also enjoy talking and seeing their elderly parent.

When asked about automatic notifications such as "*I am well*" or "*everything is OK*" participants expressed interest, albeit they have different views with respect to the prefer frequency of such notifications. Some adult children would prefer to check at their convenience, while others would want daily automatic notifications "*as often the parent wants to say" all well" as she doesn't want me to worry or rush around. Likewise, notification of a fall is always required immediately as it means the difference between life and death"* [C1].

With respect to the content of notification, some participants wanted rich information such as medical data, of contact of an available neighbour, whilst others expressed severe concerns that such medical information could increase their anxiety. An important findings was that such monitoring device should provide needed reassurance that their elderly parent was okay but that it should only be used as an aid and not reduce the current communication methods and in particular the personal, face to face interaction. This suggests that the need of connectedness between the family members still needs to be accounted for [29].

Autonomy and Privacy of Elderly People at Risk of Falls
In sharp contrast with the anxiety of their adult children, elderly parents appear to value more their autonomy, particularly if they are well enough to live independently: "*I would find [a fall detection device] invasive. […] Sometimes I fall over and I'm quite alright [so] I don't want anybody fussing around me. And also if my son knew I was falling over, then I'll be in serious trouble. That's why I personally would find it intrusive because I like to be as independent as possible"* [P6].

This finding highlights a tension between the peace of mind that such technology will provide to the children, and the demand for autonomy and subsequently privacy of the elderly parent [10]. Interestingly, even after they have experienced falls, some elderly people do not seem to experience fear: "*I have had two falls recently [because] I actually passed out. [But] I'm not really afraid because I don't sort of think about"* [P3].

This quote illustrates that anxiety is experienced mostly by those in charge with the caregiving, i.e., adult children, and that parents at risk of falls may benefit from being sensitised towards the value of prompt fall notifications. For example, elderly participants acknowledging that their children are worried about them falling, shown increased interest in wearing such devices for tracking and communicating falls.

Most of the interviewed elderly people made little use of such technology and tend to resist it. A different pattern emerged in the case of elderly people in the sheltered accommodation who tended to wear the panic button wrapped around their neck for manually triggering alarms to a call center.

Aesthetics of Fall Detection Devices
An interesting finding was elderly's interest in the aesthetics of fall detection devices. Particularly those who were using the "panic button" were explicit that the device should be unobtrusive: "*on the wrist would be best, something like a watch. I wouldn't want the device to be too big, such that it becomes not a very good sight to be - I want it to be discrete*" [P2]. Other participants expressed interest in a device which is not only discrete but also aesthetically pleasing: *"It would be preferable if the design was nice rather than naff. That's why I had [the panic button around my neck so it can be hidden under my blouse"* [P1]. In addition, all participants in the group interview have agreed that "*the device should have a modern design if possible".*

Implications for Design
Study findings suggest three design implications [36] extending previous findings on the importance of negotiating between the value of continual contact and one's need for autonomy [21], within the context of risks of falls.

Lowering Adult Children's Anxiety for Elderly Parents
The anxiety experienced by adult children for their elderly parents at risk of falls suggests the value of augmenting traditional fall monitoring devices with communication abilities to send regular daily automatic notifications signalling "*all is well*". This can be used to complement additional voice or face to face interactions, rather than substitute them.

Negotiating Children's Anxiety and Elderly's Autonomy
Despite the risks that serious falls entail, some elderly people living independently expressed a strong sense of autonomy. Others conceded to fall tracking and communication devices, aware that it may bring peace of mind to their children. This suggests that such devices should be configurable, providing control to the elderly person with respect to easily setting the content and frequency of notifications. In order to be adopted, such devices should be discrete and aesthetically pleasing to avoid stigmatization.

Communication Needs in the Context of Risks of Falls
Findings indicate also more subtle issues around elderly's control of what is being communicated, to whom, and the tracking of a diverse range of spatio-temporal contexts within and outside their home. Elderly people's communication needs include preventing false alarms, customizing the list of family members to whom fall notifications are automatically sent, and having their falls detected in a range of contexts from showering and sleeping, to working in the garden. Communication needs of the remote family members include real time access to the elderly people's status, as captured by the fall tracking devices. An additional communication channel should be made available to the family members to discretely nudge their loved ones for example if a longer period of inactivity is detected: *"all is well?".* This could ensure that their loved one is alright by actively sending them a ping which they have to answer to.

Conclusion
This paper explored communication needs between elderly parents at risk of falls and their adult children living remotely. We report on interviews with 19 elderly and 3 adult children. The findings indicate three emotional needs centred on elderly's autonomy and value for aesthetic design, and adult children's anxiety for the wellbeing of their parents at risk of falls. We concluded with three implications for design addressing these emotional needs.

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