

# Precision Medicine in Practice: What Role for HCI?

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## Abstract

Precision Medicine (PM) promises to tailor prevention, diagnosis, and treatment to individuals using molecular, clinical, and lifestyle data. For example, advances in genomic sequencing, large-scale biomedical datasets, and machine learning are accelerating this vision, particularly in the fields of oncology and pharmacogenomics. Yet, beyond technical developments, PM introduces a range of socio-technical challenges when implemented in real-world healthcare settings. These include interpreting probabilistic predictions in clinical practice, communicating uncertainty to patients and clinicians, integrating data-intensive tools into complex healthcare workflows, and addressing concerns around privacy, cost, and equitable access. Such challenges suggest that PM cannot be understood purely as a biomedical or computational problem, but also requires attention to interaction, interpretation, and governance. This Birds of a Feather (BoF) session brings together researchers and practitioners across HCI, Interactive Health (IH), clinical medicine, and design to discuss how HCI perspectives can help make PM interpretable, workable, and equitable in practice.

## CCS Concepts

• **Human-centered computing** → **Human computer interaction (HCI)**; • **Applied computing** → **Consumer health**; • **Social and professional topics** → **User characteristics**.

## Keywords

Precision Medicine, Human-Computer Interaction, Socio-Technical Systems, Interactive Health

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## 1 Background & Aims

Precision Medicine (PM) is a healthcare paradigm that aims to tailor prevention, diagnosis, and treatment to individuals using molecular, clinical, lifestyle, and environmental data [1, 4, 8, 24]. Advances in genomic sequencing, large-scale biomedical datasets, and machine learning have accelerated this vision [16, 26], and precision approaches are beginning to appear in domains such as oncology [6], pharmacogenomics [25], and risk prediction [13]. However, while the technological capacity for precision is advancing rapidly, its practical realisation remains uneven and incomplete [10]. In real-world healthcare settings, PM raises a number of socio-technical challenges that extend beyond model accuracy or data availability [11]. For example, these include the interpretation of probabilistic predictions in clinical practice [19], the communication of uncertainty to patients and clinicians [12], the integration of data-intensive tools into complex healthcare workflows [9], and broader questions around privacy, cost, and equitable access [2, 7, 11].

Therefore, these challenges suggest that PM cannot be understood solely as a biomedical or computational problem, which has dominated much of the PM research thus far [19]. Instead, it involves the design of interaction, interpretation, and coordination across diverse stakeholders within complex healthcare systems. Here, HCI and Interactive Health (IH) research can contribute to understanding how PM becomes meaningful, interpretable, and workable in practice. Recent scholarship has also called for greater engagement from fields such as HCI and interactive health (IH) to address these challenges [14, 15]. Within the field of HCI, a growing body of work addresses issues closely related to PM [3, 5, 23], although relatively few studies explicitly frame their work using the term PM [19]. Recent work has begun to engage with these challenges in more explicit ways: for example, by conceptualising them under emerging concepts such as *Human-Precision Medicine Interaction* [18, 19, 22]; by using design methods to explore possible futures of PM [17, 20]; and by calling for greater involvement

of HCI in PM research and practice, including in venues such as genetics journals [21].

While HCI and IH research have long engaged with digital health technologies, PM raises interaction challenges that are not fully captured by much of the existing digital health literature. In particular, PM relies heavily on probabilistic predictions, genomic risk information, and large-scale data infrastructures, raising new questions around interpretation, uncertainty communication, and socio-technical governance. Thus, this Birds of a Feather (BoF) proposal aims to bring together researchers and practitioners across HCI, IH, biomedical informatics, and clinical domains to explore the emerging role of HCI in shaping the future of PM. Instead of focusing on technological feasibility alone, the discussion will examine how topics such as interaction design, sensemaking, service infrastructures, and governance influence how PM is interpreted and operationalised. In preparing this proposal, all organisers shared written reflections on the topic. We summarised these reflections and synthesised three broad discussion themes:

- **Theme 1: PM relies on probabilistic outputs that do not align neatly with clinical decision-making.** For example, how can clinicians, patients, and the public interpret probabilistic predictions, information derived from genomic data and AI-generated medical insights?
- **Theme 2: The promise of PM often exceeds what current healthcare infrastructures and workflows can support.** For example, what socio-technical infrastructures, workflows, and decision-support systems are required to integrate PM into healthcare practice?
- **Theme 3: PM raises questions about who is responsible for risk, data, and decision-making across distributed systems.** For example, how can concerns around privacy, cost, data ownership, and equitable access be addressed as PM scales?

We include a set of *How Might We* questions for each theme in the Appendix to guide discussion, though participants are not limited to these prompts.

## 2 Activities

Overall, the format of this BoF is designed to remain lightweight, generative, and participatory, enabling participants to bring perspectives from research, design, and clinical practice. We imagine participants may have a great deal to say on this topic, in which case our role would primarily be to provide context, pose generative questions, and synthesise emerging themes.

Specifically, the session (60–80 minutes in total) will begin with a brief **framing presentation** (15–20 minutes, first activity) introducing PM as a field and outlining several key tensions that arise when PM technologies are implemented in practice. Following this introduction, participants will take part in a structured **participatory brainstorming activity** (15–20 minutes, second activity). Attendees will be invited to contribute ideas, experiences, or questions related to the three discussion themes above. Contributions will be collected on a shared board and grouped into emerging clusters. The following 25–30 minutes (third activity) will be dedicated to an **open and moderated discussion**, where participants collectively reflect on the themes that emerge from

the brainstorming activity. The organisers will facilitate dialogue across perspectives and **synthesise key insights**, highlighting areas where HCI and IH research may contribute to future work in PM at the end of this BoF (5–10 minutes, fourth and final activity).

## 3 Organisers

The organising team brings together complementary expertise spanning HCI, clinical practice, and healthcare design, enabling us to bridge perspectives that are rarely connected in PM discussions. We come together as a team because we are aware that PM is not only a biomedical or computational endeavour; its development and implementation involve complex socio-technical systems where clinicians, patients, researchers, and digital infrastructures interact. Reflecting this complexity, the organisers represent diverse backgrounds and perspectives across academia, healthcare practice, and design practice. Together, we bring experience in studying PM technologies, designing healthcare systems, working within clinical environments, and examining how data-driven technologies reshape healthcare practices. We believe this interdisciplinary composition positions our team well to facilitate an emerging discussion that bridges technical, clinical, and human-centred perspectives on PM. We introduce each organiser below:

- **Yuhao Sun** is a Lecturer (Assistant Professor) in Computer Science at Lancaster University. His research examines the complexities of HCI in PM and the broader health domain, including the challenges faced by healthcare professionals and patients, the factors shaping these challenges, and the design of more effective user-centred solutions. He previously introduced the concept of *Human-Precision Medicine Interaction* to draw the HCI community's attention to the emerging interactional challenges of PM [19].
- **Shuhao Ma** is a HCI and design researcher at the Interactive Technologies Institute, University of Lisbon. His research examines how emerging technologies reshape labor, redistribute risk, and reconfigure value in complex socio-technical systems. Grounded in design justice and sustainability, he studies how innovation unevenly affects stakeholders and shapes the actionable design space. His design practice spans diverse domains, including the gig work, healthcare, crowd-sourcing, social media, and urban regeneration.
- **Wesley McLoughlin** is a Clinical Teaching Fellow in ENT & Ophthalmology at University of Dundee & NHS Tayside. His research focuses on clinical data science, environmental impact in healthcare delivery and employing AI to develop simulated learning tools. He is the creator of both RAPiD and vOKNdram.
- **Bo Kim** (she/her) is a user experience designer and researcher at the Memorial Sloan Kettering Cancer Center. As a design practitioner embedded within a large academic medical center, she designed products that span from data systems for supporting novel drug discoveries to the flagship patient portal that thousands at the hospital relied on. Building upon her background in Human-Computer Interaction, she has shared her work with audiences in academia, health informatics, and user-experience design.

- **Minzhu Zhao** is a Ph.D. candidate in Computer Science at the University of Minnesota. Her area of research lies at the intersection of Human-centered Interaction and Health & Well-Being. She is interested in how technologies and data-driven approaches are integrated into real-world healthcare systems, particularly how users engage with the technical and ethical complexities surrounding these systems.

#### 4 Target Community and Relevance to IH

This BoF will be of interest to several overlapping communities within IH and the broader HCI field. First, researchers working on IH technologies will find relevance in discussions about how predictive models, genomic data, and personalised health services are integrated into real-world healthcare systems. Second, scholars studying human-AI interaction, explainable AI, and data visualisation may be interested in the challenges of communicating uncertainty, probabilistic predictions, and model limitations in PM contexts. Additionally, researchers working in healthcare systems design, CSCW, and socio-technical infrastructures may contribute insights into how PM becomes operationalised through coordination among clinicians, patients, and digital systems. Prior expertise in PM is not required.

Furthermore, we also expect this BoF to attract participants beyond the communities outlined above. The intersection of PM and HCI raises many open and underexplored questions, and researchers from adjacent areas may bring perspectives that help expand the conversation and identify new directions for the community. To support continued engagement beyond the session, we will maintain a website to share updates, materials, and outcomes from the BoF (<https://precision-ih26.github.io>).

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#### A An informal schedule of discussion topics

We will centre around three broad discussion themes that reflect emerging challenges in PM identified by the organisers. The following questions in each theme may help guide the brainstorming:

### A.1 Theme 1: Interpreting PM outputs

- How might we help clinicians, patients, and the public interpret probabilistic predictions derived from molecular, clinical, lifestyle data, and AI-based systems?
- How might we design interfaces and decision-support systems that effectively communicate uncertainty, risk, and model limitations?
- How might we support clinicians and patients in making sense of complex PM-related data and AI-driven insights in ways that are meaningful and actionable in practice?

### A.2 Theme 2: Operationalising PM in practice

- How might we design socio-technical infrastructures that enable PM in real healthcare environments?
- How might we integrate predictive tools into clinical workflows and care coordination systems?
- How might HCI and design help bridge the gap between the aspirational vision of PM and its practical implementation in everyday healthcare settings?

### A.3 Theme 3: Governing PM

- How might we design governance frameworks that address data privacy, cost, and equitable access as PM expands?
- How might HCI research contribute to shaping responsible and inclusive PM systems?
- How might we prevent PM from becoming an elite form of healthcare accessible only to certain populations?

- How might we navigate tensions between large-scale shared health data and privately owned AI systems within PM ecosystems?

## B Venue

This BoF is designed as a small, discussion-oriented session with approximately 10-20 participants. The format emphasises informal and participatory engagement, supported by a space that enables face-to-face interaction and flexible discussion.

## C A plan to attract participants

To attract participants, we will use several channels within the IH and broader HCI communities. First, we will circulate information about the BoF through relevant mailing lists, social media platforms, and research networks connected to IH, digital health, and human-AI interaction. We will also send targeted invitations to researchers who have previously published PM-related studies in HCI venues. Additionally, the organisers will promote the session through their professional networks and research collaborations, including colleagues working in the fields of HCI, biomedical informatics, clinical research, and healthcare design. Furthermore, the organisers will encourage participation among IH conference attendees whose work intersects with topics such as digital health technologies, healthcare data systems, AI in medicine, and design for healthcare services.

Given the focused nature of the topic within the field of IH and the informal format of a BoF, we believe that a small but engaged group of participants will contribute to a productive discussion. We welcome participation from the community at IH 2026.