7^{th} International Workshop on Mental Health and Well-being: Sensing and Intervention

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ABSTRACT

Mental health issues affect a significant portion of the world's population and can result in debilitating and life-threatening outcomes. To address this increasingly pressing healthcare challenge, there is a need to research novel approaches for early detection and prevention. Toward this, ubiquitous systems can play a central role in revealing and tracking clinically relevant behaviors, contexts, and symptoms. Further, such systems can passively detect relapse onset and enable the opportune delivery of effective intervention strategies. However, despite their clear potential, the uptake of ubiquitous technologies into clinical mental healthcare is slow, and a number of challenges still face the overall efficacy of such technology-based solutions. The goal of this workshop is to bring together researchers interested in identifying, articulating, and addressing such issues and opportunities. Following the success of this workshop for the last five years, we aim to continue facilitating the UbiComp community in developing a holistic approach for sensing and intervention in the context of mental health.

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CCS CONCEPTS

• **Applied computing** → **Health care information systems**; • **Human-centered computing** → **Ubiquitous and mobile computing**.

KEYWORDS

Mental Health; Mobile Sensing; mHealth; Predictive Modeling; Behavioral Intervention

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1 INTRODUCTION

Mental illness is an urgent global issue. Today, more than 450 million people worldwide suffer from mental illnesses [12], with prevalence continuing to grow. For example, the number of people suffering from depression has increased more than 18% from 2005 to 2015 [13]. Such mental health problems are associated with devastating personal burdens. Mental illnesses are the leading cause of years lost to disability globally [8] and are linked to approximately 800,000 cases of suicide every year [13]. Mental illness results in a huge societal-level economic burden as well, with a projected global cost of $6 trillion by 2030 [3].

However, mental health issues often remain undiagnosed and untreated. Wang et al. [15] reported that only one-third of adults with mental health issues receive any treatment. Further, our current healthcare systems are largely *reactive* — that is, patients typically only receive treatment after the onset of relapse, which can contribute to the aforementioned consequences related to personal well-being and healthcare expenditure.

As such, there has been an increased interest in the early detection of mental health issues. For example, the National Institute of Mental Health (NIMH) considers identifying early-warning signs (e.g., biomarkers and behavioral cues) to be a key objective in their strategic plan [10]. The NIMH, along with other federal institutes like the National Institute on Drug Abuse (NIDA) are also increasingly emphasizing the comorbidity links between compulsive drug use and mental health, especially in light of the growing opioid crisis, recognizing that whether addiction leads to mental illnesses or vice versa, it is key to treat both issues concurrently [11]. We similarly plan to spotlight addiction as a new area of attention for this year's workshop.

Ubiquitous technologies provide a unique opportunity to advance this goal by tracking behavioral patterns and identifying appropriate moments for intervention. For more than a decade, the UbiComp community has applied wearables and mobile phone based systems to sense biobehavioral markers of different mental illnesses [1, 2, 4–7, 9, 14, 16, 17]. While these studies illustrate the potential of sensing and intervention systems, the adoption of such ubiquitous technologies in mental healthcare practice remains low — indicating that a number of challenges still need to be resolved to achieve successful integration of ubiquitous technologies into clinical care.

Such challenges include integrating multimodal data with different timescales, handling issues of data sparsity and misclassification, developing personalized predictive models, tailoring intervention steps to individual needs, providing meaningful and actionable feedback to both participants and treatment providers, ensuring adherence over long periods of time, and addressing privacy concerns given the sensitive nature of collected data. Moreover, there is a range of clinical challenges in order to understand how such technologies can be embedded into clinical pathways, establishing clinical evidence for the efficacy of such technologies, and regulatory classification of such technologies as medical devices. These issues are multifaceted and require cross-disciplinary approaches. Addressing these issues are essential for successful development and adoption of ubiquitous technologies to support mental health and wellbeing.

2 WORKSHOP GOAL AND FOCUS

The goal of this workshop is to bring together academic and industry UbiComp researchers both with a technical and clinical background interested in addressing these challenges (and identifying others) by exploring novel technologies, analysis methodologies, and design techniques. The past editions of the UbiComp Workshop on Mental Health have been a great success in convening community members to engage with such topics (you can see the content from previous workshops here https://ubicomp-mental-health.github.io/). Building on insights gathered from that experience, the present workshop has refined and extended its focus and scope and encourages submissions from a range of topics, including but not limited to:

- Design and implementation of computational platforms (e.g., mobile phones, instrumented homes, skin-patch sensors) to collect health and well-being data.
- Investigation of new methodologies for intervention (e.g., conversational agents, AR/VR applications).
- Design of automated inference systems from sensor data of high-level contexts (environmental, social) indicative of mental health status.
- Design and implementation of feedback (e.g., reports, visualizations, proactive behavioral interventions, subtle or subconscious interventions etc.) for both patients and caregivers.
- Development of robust behavioral models that can handle data sparsity and mislabeling issues.
- Integration of multimodal data from various sensor streams for personalized predictive modeling.
- Development of methods for sustaining user adherence and engagement over long periods of time.
- Design of privacy-preserving strategies for data collection, analysis, and management.
- Deployment in low-income communities/countries.
- Identification of opportunities for UbiComp approaches (e.g., digital phenotyping, predictive modeling, micro-randomized intervention trials, adaptive interventions) to better understand factors related to addiction, drug use, and treatment efficacy and devise a research agenda in this space.
- Integration of ubiquitous technologies into existing healthcare infrastructures and government policy.
- Ethical aspects and frameworks for ubiquitous technologies for mental health.
- Experience reports from clinical studies in any phase, from early pilot studies to large-scale clinical trials.
- Experience report on regulatory issues of Ubicomp technologies for mental health, including FDA approval or CE marking.

2.1 Types of submission and selection criteria

As in the previous five years, we will accept regular (up to 6 pages) and short (up to 3 pages) paper contributions that describe novel technologies, approaches, and studies related to ubiquitous computing in mental health.

In the previous years, we specifically solicited *challenge papers*, in which authors described a specific challenge to be pitched and discussed at the workshop. This format was quite popular and led to a lively discussion during the workshop. We intend to continue the format this year and solicit challenge papers to highlight and discuss some of the specific challenges that exist in the design, deployment, or adoption of ubiquitous technologies for mental health sensing and intervention.

In addition, this year we will solicit *demonstration papers* to facilitate authors demonstrating developed technologies and early systems at the workshop. As such, this year we will solicit three types of contributions:

- Regular scientific papers both in a short and long format.
- Challenge papers
- Demonstrations

All submitted papers will be reviewed and judged on originality, technical correctness, relevance, and quality of presentation. We explicitly invite submissions of papers that describe preliminary results or work-in-progress, including early clinical experience. The accepted papers will appear in the UbiComp supplemental proceedings and in the ACM Digital Library.

For the 2022 version, we plan to have an in-person workshop in Atlanta along with an online component to broaden participation for people who may not be able to travel.

2.2 Planned Activities

In addition to the paper presentations, this year we are planning for some additional proactive/hands-on activities for the participants. We are planning the following activities with the hybrid format in mind and hope to engage both in-person and remote attendees.

- Talks: regular presentations where authors present their findings followed by brief Q/A
- Group/Panel discussions: We are planning to invite academic and industry researchers to discuss challenges and potential future direction of mental health and wellbeing research.
- Grant/Project Ideation: We will group participants based on similar/complementary interests, and have a guided/mentored discussion where participants can come out with a potentially pursuable idea and a set of collaborators.
- Parallel mini-tutorials: We plan to have mini-tutorials, where participants might be able to learn about new tools or intervention design concepts that they can then potentially apply in their future projects.

2.3 Planned Schedule

Table 1 shows the tentative schedule of the workshop.

Morning Session	
Time (EDT)	**Activity**
09:00–10:00	Opening remarks, Keynote speaker
10:00–10:45	**Paper presentations**
10:45–11:00	Coffee break
11:00–12:30	**Parallel mini-tutorials** Potential topics: • Tools for intervention design • Clinical trial methodologies for mental and behavioral-health interventions • Tools for multi-modal data collection and analysis
12:30–14:00	Mentoring lunch with organizers and senior researchers
14:00–16:30	**Mentored group discussion and ideation** Potential themes: • Study design and evaluation • Integrating with clinical care • Long term engagement and adherence • Best practices for intervention design
17:00–18:00	**Panel discussion** Potential topics: • Interdisciplinary collaboration strategies • Technical and clinical challenges • Funding strategies, Publishing strategies • Entrepreneurship and commercialization
18:00–18:10	Closing Remarks
18:30	Dinner/Socialization

Table 1: Workshop schedule.

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