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Immersive Prevention Centers for Mental Health: Secondary and Tertiary Prevention in the Metaverse

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ABSTRACT

Mental health systems across Europe face persistent challenges in accessibility, resource limitations, and stigma. Vulnerable populations such as adolescents with neurodevelopmental disorders and older adults at risk of depression often fall through the cracks of existing care structures. The IPC4MH (Immersive Prevention Centers for Mental Health) project proposes an innovative solution: immersive prevention centers built within the Metaverse, designed for secondary and tertiary mental health prevention. Through interdisciplinary collaboration, the project aims to co-design, implement, and evaluate scalable, engaging, and inclusive virtual environments that support early intervention and long-term mental health care. This paper presents the conceptual foundation, objectives, research direction, and methodological approach of IPC4MH.

Keywords: immersive technology, virtual reality, mental health prevention, Metaverse, co-design, digital health, neurodevelopmental disorders, aging

1 INTRODUCTION

Mental health services across Europe are struggling to keep pace with the rising burden of psychological disorders. Limited availability of professionals, logistical barriers to in-person care, and widespread stigma result in significant disparities in access—particularly among youth with neurodevelopmental conditions and seniors facing isolation or cognitive decline. These challenges demand innovative responses that leverage emerging technologies while remaining grounded in evidence-based care practices.

Virtual reality (VR) has already demonstrated clinical efficacy for applications such as cognitive training, exposure therapy, and rehabilitation (Maples-Keller et al., 2017; Freeman et al., 2017). A growing body of research confirms its utility in reducing anxiety, improving cognitive performance, and fostering behavioral change across clinical populations (Romero-Ayuso et al., 2021). More recently, the evolution of social VR and the broader Metaverse has introduced novel opportunities for healthcare delivery—providing persistent, shared, and interactive environments that overcome traditional barriers such as geographic isolation or stigma (Cerasa et al., 2024). Notably, we have introduced the idea of teleclinics in the Metaverse, implementing an example of a teleclinic for neuro-psychological assessment Vigier et al. (2024). The IPC4MH project builds upon this technological and empirical foundations by designing and evaluating immersive prevention centers that enable both early intervention and sustained therapeutic engagement for populations often underserved by conventional services.

2 FRAMING THE NEED: PREVENTION IN MENTAL HEALTH

In public health, mental health prevention is typically structured into three levels: primary (avoiding onset), secondary (early identification and intervention), and tertiary (managing existing conditions to prevent deterioration) Baumann and Ylinen (2020). IPC4MH focuses on the latter two.

Secondary prevention addresses the early signs of mental distress—such as anxiety, withdrawal, or difficulties in social interaction—before they evolve into diagnosable conditions. Immersive prevention centers might be especially relevant for adolescents who may struggle with communication or behavioral issues that are not yet formally recognized. For example, a teenager exhibiting signs of social withdrawal or concentration difficulties in a school setting might participate in a VR-based screening activity followed by a series of interactive group sessions designed to foster self-expression and social confidence. Similarly, older adults experiencing mild forgetfulness or increased isolation may benefit from cognitive stimulation exercises within immersive environments, combined with gentle mood assessments and social interaction features to support early detection of cognitive decline or depression.

Tertiary prevention, meanwhile, focuses on patients with known diagnoses, offering structured support that reduces the risk of relapse and improves quality of life. An adolescent diagnosed with an autism spectrum disorder might for example engage in immersive role-playing scenarios that help build emotional regulation and social interaction skills under the supervision of a therapist. Older adults with a history of major depressive episodes or diagnosed mild cognitive impairment could benefit from long-term participation in guided group activities, memory games, and virtual peer support meetings, helping to reinforce emotional wellbeing, cognitive function, and a sense of connectedness.

By embedding both prevention levels into immersive, user-friendly platforms, IPC4MH aims to make proactive care not only accessible, but appealing and engaging.

3 EXISTING INITIATIVES

While immersive technologies are increasingly explored in mental health, few initiatives have targeted prevention with the same focus and transnational scope as IPC4MH. However, several existing projects and platforms offer valuable context.

One notable example is XRHealth, which offers virtual reality therapy platforms for pain management, rehabilitation, and mental health, including anxiety and stress relief (<https://xr.health>). Their clinical VR

applications are used primarily in therapeutic settings with healthcare professionals and do not yet extend to public prevention or peer-led support.

Another significant effort is that of C2Care, a French company and IPC4MH partner, which provides VR-based exposure therapy environments for phobias, depression, and cognitive training Cerda et al. (2021). These environments are already used in over 500 clinics but are currently deployed in isolated clinical contexts rather than networked prevention centers. IPC4MH builds on this by transforming such tools into socially connected, preventive, and multi-user platforms.

Tecnis, a recent French project led by Nantes University, created a prototype of an immersive teleclinic for neuropsychological assessment Prié et al. (2025). While pioneering in its design and testing, it focused on individual diagnostics rather than ongoing preventive care. IPC4MH uses Tecnis as a foundation and extends its functionality toward collaborative, preventive, and long-term interventions.

In the realm of social VR, projects like VR4REHAB Green et al. (2019), AccessVR or Bridges El Raheb et al. (2021) have also investigated the use of immersive environments for rehabilitation and emotional regulation. These initiatives have demonstrated the feasibility and acceptability of virtual therapies but have not yet addressed structural integration into public health prevention strategies.

By contrast, IPC4MH aims to institutionalize immersive prevention by creating modular, evidence-based platforms deployed in both home and public spaces and evaluated through mixed-method clinical trials. Its dual focus on underserved populations and the integration of secondary and tertiary prevention makes it a novel and impactful initiative in the evolving landscape of digital mental health.

4 PROJECT OBJECTIVES

IPC4MH seeks to create, validate, and prepare for scale-up immersive prevention centers deployed within the Metaverse. To achieve this vision, the project aims to develop a flexible digital platform that incorporates existing VR therapeutic content into user-friendly teleclinics, complete with social and therapeutic functionalities. These centers will be specifically designed for two key target groups—adolescents and older adults—through a collaborative and inclusive co-design process involving clinicians, researchers, and end users. Implementation will take place across three European countries—Switzerland, France, and Poland—allowing for comparative evaluation of usability, clinical impact, and user satisfaction in varied socio-cultural contexts. A rigorous mixed-methods framework will be used to assess clinical efficacy, combining quantitative and qualitative data to capture both measurable outcomes and user experiences. In parallel, the project will produce guidelines and scalable business models to facilitate long-term integration into national health systems and public spaces, ensuring both sustainability and broader impact.

5 RESEARCH DIRECTION

The project's research agenda spans four interdependent axes: technological infrastructure, human-centered design, clinical validation, and policy integration.

On the technological front, IPC4MH will define and implement a modular architecture based on open standards (e.g., OpenXR) to ensure interoperability across devices and platforms. The system will include secure communication tools, user monitoring systems, and interfaces for integrating diverse therapeutic content. The goal is to create an extensible platform where practitioners can meet with users, guide sessions, and monitor progress.

Within IPC4MH, artificial intelligence (AI) serves as a decision-support layer by analyzing structured interaction data—such as session frequency, duration, and trajectories of improvement in standardized clinical scores (e.g., PHQ-9, GAD-7). Rather than replacing human judgment, AI models will synthesize these usage patterns to generate interpretable insights, which are integrated directly into therapist dashboards. This allows clinicians to monitor individual progress, detect early signs of disengagement or stagnation, and tailor intervention strategies accordingly. The focus on transparent, explainable outputs ensures that AI serves to augment—not obscure—clinical reasoning. This integration supports a hybrid model of care, where immersive environments and professional supervision are dynamically coordinated to maximize the effectiveness and responsiveness of prevention efforts.

From a design perspective, immersive scenarios and environments will be co-designed with input from stakeholders, using ethnographic methods and participatory design workshops. Care workflows will be based on activities that are carried out both in virtual (immersive center) and in real (physical prevention hubs) world, be it solo activities, peer-supported interactions, supervised group therapy, meetings with practitioners, etc.

Clinically, the project aims to measure how IPCs affect mental health literacy and user engagement. Metrics will include validated psychological scales (e.g., PHQ-9, GAD-7), behavioral analytics, and analysis of qualitative interviews. Evaluations will compare different usage patterns (e.g., home-based vs. onsite), prevention levels (secondary vs. tertiary), and demographic subgroups.

Finally, IPC4MH examines the socio-economic, ethical, and regulatory dimensions of deploying virtual prevention centers at scale. It will develop frameworks for integration into national health systems and explore sustainable public-private models for ongoing delivery and support.

6 METHOD

The project adopts a multi-phase, interdisciplinary methodology.

Phase 1: Co-Design and Prototyping — Initial work will involve mapping out user journeys, defining clinical and technical requirements, and adapting existing VR content for shared use. Iterative prototyping with feedback loops from patients and professionals will drive continuous refinement.

Phase 2: Implementation and Evaluation — Prevention centers will be rolled out across three pilot sites, with 20–30 participants per site engaged in either secondary or tertiary prevention activities. Evaluation will cover usability (System Usability Scale), acceptability (Technology Acceptance Model), clinical outcomes (standardized scales), and engagement (interaction logs).

Phase 3: Scale-Up and Dissemination — Lessons from the evaluation phase will inform the design of integration pathways, economic models, and policy recommendations. Open-access tools, datasets, and documentation will ensure reproducibility and impact beyond the project consortium.

7 EARLY RESULTS

Preliminary activities carried out during the first project phase have yielded promising insights. A co-design workshop held in France (3-4 April 25) with consortium members provided early reflections on the concept of immersive prevention centers. Participants expressed enthusiasm about the potential for peer interaction and creative self-expression in virtual environments. Discussions also highlighted the necessity

of structured, clinically validated content and raised important concerns related to data protection and ethical oversight.

Initial technical assessments of partner VR platforms, including those from DiverSSity and C2Care, indicated that existing tools could be adapted to suit group-based use cases. Usability testing on early prototypes demonstrated acceptable user performance on navigation and task completion tasks across both target demographics. Participants appreciated the calming environment designs and the ability to personalize avatars, which contributed to perceived presence and comfort.

These early findings confirm both the feasibility and the relevance of IPC4MH's core hypothesis: that immersive virtual environments can serve as effective platforms for mental health prevention. The team is now moving forward with refining the system's architecture and preparing for full-scale pilot evaluations.

8 CONCLUSION

The IPC4MH project represents a bold step toward the future of preventive mental health care. By merging immersive technologies with inclusive design and rigorous clinical evaluation, it aims to create prevention pathways that are engaging, scalable, and equitable. As health systems seek new strategies to meet rising mental health needs, IPCs may offer a replicable model for delivering care across digital and physical boundaries—reaching people where they are, before it's too late.

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