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Digital Interventions for Psychosis: A Decade in Review (2015–2025)

Introduction

Over the past decade, digital health tools have emerged as promising adjuncts to traditional care for psychosis. **Digital interventions** – including mobile apps, web-based platforms, and virtual reality therapies – offer new ways to engage patients in managing symptoms and accessing support outside clinical settings. This trend has been driven by rising smartphone ownership and internet access even among people with serious mental illness [1] [2]. Importantly, individuals with psychotic disorders often struggle with engagement in care; for example, up to **50% of first-episode psychosis patients drop out** from services, and poor engagement heightens relapse risk [3]. Digital tools hold potential to bridge this gap by providing flexible, on-demand support that can augment treatment as usual. In the last ten years, research on these **non-pharmacological interventions** has accelerated, though it remains less developed than digital mental health for common disorders like depression [4]. This report presents a comprehensive literature review of digital interventions for psychosis (2015–2025), focusing on mobile and online tools for patient engagement, symptom management, and crisis support. We summarize evidence of their effectiveness in reducing psychotic symptoms, improving functional outcomes, and preventing relapses. We also evaluate user engagement metrics, real-world implementation feasibility, and global developments. Key findings, recurring challenges, and research gaps are discussed to inform the design and deployment of a hypothetical digital mental health tool like **MindGuard**.

Categories of Digital Interventions

Digital interventions for psychosis encompass a range of technologies. Broadly, these include **mobile applications** for self-management, **online platforms** that facilitate therapy or peer support, and **immersive technologies** like virtual reality (VR). Many tools incorporate evidence-based psychosocial strategies (e.g. cognitive-behavioral therapy principles, skills training) in a more accessible format. Below, we outline the main categories and their features:

Mobile Apps for Symptom Management and Self-Care

Mobile health applications (“apps”) on smartphones have been a major focus of psychosis intervention research. These apps typically provide a combination of active and passive features for **illness self-management**. Common functionalities include daily symptom tracking (often via **ecological momentary assessment** prompts), medication reminders, mood and stress monitoring, and libraries of coping strategies or psychoeducation content [5] [6]. Many apps use **ecological momentary interventions (EMI)**, sending prompts or therapeutic messages at the moment they are needed [7] [8]. For example, the **FOCUS** app was designed to deliver real-time prompts for managing hallucinations, mood, sleep, and social functioning; users could access on-demand exercises and tips based on cognitive-behavioral therapy (CBT) techniques [9] [10]. Other apps like **Actissist** target early warning signs of relapse by prompting users to

reflect on triggers such as perceived criticism or medication adherence, offering brief therapeutic guidance in response [11].

A consistent finding is that such apps are **feasible and acceptable** to people with psychosis across various studies. Participants are generally able to use smartphone interventions independently despite cognitive impairments or symptoms, with high ratings of usability and satisfaction [12] [13]. For instance, in a 2014 pilot, patients used the FOCUS app on **86% of days** (averaging 5 uses per day), and about 90% rated it as highly acceptable [12]. Key advantages reported include the convenience of **24/7 support** in one's pocket and the ability to self-monitor symptoms in real time [14] [15]. Mobile apps thus serve as patient engagement tools, encouraging **active self-management** outside clinic visits. Early studies also show that they can yield clinical benefits such as reduced symptom severity (discussed later), although maintaining engagement over longer periods is an ongoing challenge.

Online Platforms and Social Engagement Tools

Beyond stand-alone apps, more **comprehensive digital platforms** have been developed to support individuals with psychosis. One notable example is the **Moderated Online Social Therapy (MOST)** model, which underpins platforms like *Horyzons*. These web-based platforms (accessible via computer or phone) combine **structured therapy** modules with a **secure social network** where users can interact with peers and clinicians [8] [16]. Horyzons, developed in Australia, targets youths (typically ages 16–25) in the early stages of psychosis. It offers interactive psychosocial interventions (e.g. CBT exercises, strengths-building activities) alongside a moderated peer forum, aiming to sustain recovery and social functioning after initial treatment [17] [18]. During the COVID-19 pandemic, such online social therapy platforms scaled up rapidly in some regions, demonstrating the flexibility of digital care delivery [19].

These engagement-focused tools leverage young people's familiarity with social media to **reduce isolation and stigma**. Users report that connecting with others who have similar experiences provides a sense of community and enhanced communication in managing mental health [20] [21]. Clinicians moderate discussions to ensure safety and to offer guidance, creating a hybrid model of peer support and professional input. Early trials of Horyzons and similar platforms show **high user retention** over months, with many participants remaining active for a year or longer [22] [23]. Participants appreciated features like the ability to reflect on their experiences, set personal recovery goals, and access help discreetly [20] [21]. Some platforms also integrate direct communication channels for **crisis support** – for example, an app might include an "urgent help" button or messaging to contact the clinical team. Indeed, one study of a mobile platform reported that 31% of users used the app to request an urgent consultation during the trial [24], highlighting the role of digital tools in facilitating timely help-seeking.

Virtual Reality Therapies and Innovative Tools

Innovative technologies such as **virtual reality (VR)** have opened new avenues for psychosis treatment in the past decade. VR interventions create simulated environments or avatars to deliver therapy in ways not possible in vivo. A landmark example is **Avatar Therapy** for auditory hallucinations: patients work with a therapist to create a computer-generated avatar representing the voice they hear, then engage in guided dialogues with this avatar. In a randomized trial, **avatar therapy (6 sessions)** led to a rapid and large reduction in the frequency and distress of voices compared to supportive counseling [25] [26]. Patients learned to stand up to the avatar (and by extension, their hallucinated voice) in a controlled simulation, which translated to sustained improvements up to six months post-intervention [25]. This approach, first

tested in the UK, exemplifies how digital technology can facilitate novel **face-to-face interactions** between a patient and their symptoms (via the avatar) that would be impossible otherwise. It represents a promising **non-pharmacological therapy** for medication-resistant voices.

Another major development is the use of automated VR **exposure therapy** to address psychosis-related anxieties. The **gameChange** trial in 2022 tested a fully automated VR cognitive therapy for patients with schizophrenia who had severe agoraphobic avoidance (fear of public places often due to paranoid ideation). Over six VR sessions, patients practiced entering virtual simulations of everyday situations (such as a bus or café) and learned to manage anxiety with minimal clinician assistance. The multicenter randomized controlled trial found that gameChange VR **significantly reduced anxious avoidance and distress**, especially in those with the most severe baseline avoidance [27] [28]. Qualitative feedback indicated that patients felt VR gave them a **"safe place to practice"** real-world situations: they could face triggers (like a crowded room) in the virtual world, gain confidence, and then carry these gains to real life [28] [29]. Notably, the VR program was automated and delivered on commercially available VR headsets, suggesting potential for scalable implementation. These successes illustrate how immersive technology can extend evidence-based psychotherapy (e.g. graded exposure) to psychosis populations who might otherwise avoid therapy due to paranoia or anxiety.

Beyond VR, other digital tools include **computerized cognitive training programs** and **wearable sensor platforms**. Computerized cognitive remediation has a longer history (pre-dating smartphones) but continues to evolve with gamified training exercises delivered via tablets or computers. Such programs aim to improve neurocognitive deficits (memory, attention, social cognition) in schizophrenia; meta-analyses confirm small but significant benefits to **neurocognitive performance and social cognition** from technology-based cognitive training [30] [31]. Meanwhile, wearable and smartphone sensors are being explored for **passive symptom monitoring** (for example, tracking speech patterns, sleep, or movement as early warning signs). Though still experimental, these sensor-based approaches could eventually enable "just-in-time" interventions — the system detects signs of relapse or crisis (e.g. increased isolation or disturbed sleep) and then proactively offers support or alerts providers [32] [33]. In summary, the landscape of digital interventions is diverse, ranging from simple apps to complex VR therapies, all sharing the goal of supporting patients in real time with personalized, non-pharmacological strategies.

Effectiveness in Symptom Reduction and Clinical Outcomes

A crucial question is how effective these digital tools are in achieving core clinical goals: reducing psychotic symptoms, improving functional outcomes, and providing crisis support or relapse prevention. Research over the last ten years, while still emerging, provides encouraging evidence that digital interventions can complement standard treatments. Table 1 summarizes selected studies of digital interventions for psychosis and their key outcomes.

Table 1. Selected digital interventions for psychosis (2014–2024) and key outcomes in clinical trials or studies.

Intervention (Year)	Modality & Features	Study Population/ Design	Key Outcomes	User Engagement & Notes
FOCUS (Ben-Zeev et al., 2014) [9] [10]	Smartphone app with CBT-based self-management (symptom check-ins, coping exercises, prompts)	33 adults with schizophrenia; 1-month feasibility trial (pre-post)	↓ **Psychotic symptoms and depression** after 1 month (significant pre-post reductions) [10]. Improved general psychopathology.	High engagement: used on **86% of days**, ~5 uses/day [12]. ~90% found it easy and helpful [13].
Actissist (Bucci et al., 2018) [34] [35]	Smartphone CBT app targeting relapse indicators (e.g. social stress, voices) vs. symptom-monitoring app (ClinTouch)	36 young adults with recent psychosis; 12-week RCT (Actissist+TAU vs ClinTouch+TAU)	↓ **Symptoms:** Actissist group had greater improvement in **negative symptoms** and total symptom scores (PANSS) versus active control [34]. Also improved mood (depression scores). Gains persisted (no relapse of benefits) by 22-week follow-up [35].	Acceptable engagement: >70% of participants met app use targets [36]. Some attenuation of effects by 22 weeks, suggesting need for continued use.

Intervention (Year)	Modality & Features	Study Population/ Design	Key Outcomes	User Engagement & Notes
Horyzons (Alvarez-Jimenez et al., 2022) [37] [38]	Moderated online social platform + therapy content for relapse prevention and social functioning	170 youth (16–27) in remission from first-episode psychosis; 18-month RCT (Horyzons + TAU vs TAU alone)	**No significant change in psychotic symptoms** or hospitalization rates versus TAU [37]. However, the Horyzons group had **fewer emergency department visits** over 18 months (19% vs 39%, $p = 0.03$) [39]. Trend toward lower relapse-related hospitalizations (13% vs 27%, not statistically significant) [40]. Demonstrated **cost-effectiveness** in improving social functioning (better social outcome at lower cost) [41] [42].	Moderate engagement: participants logged in and interacted regularly; active engagement was linked to improved well-being and positive emotions [43] [44]. The platform was broadly acceptable, though some users were less active over time.
ReMindCare (Bonet et al., 2020) [45] [22]	Smartphone app for continuous symptom monitoring, relapse alerts, and clinician connection (in Early Intervention Program)	115 patients in early psychosis program (Spain); 19-month naturalistic trial (ReMindCare + standard care vs standard care)	↓ **Relapse:** 19-month relapse rates were **20% with app vs 58% TAU** ($\chi^2 = 13.7$, $p = 0.001$) [45]. Fewer urgent care visits ($p = 0.006$) and fewer hospitalizations ($p = 0.03$) than TAU [45]. Indicates improved long-term outcomes with digital monitoring.	Long-term use feasible: **63%** continued using the app through 19 months [46]. Dropouts due to suspicion about technology (33% of those who stopped) or finding it unhelpful [46]. A minority (8%) developed paranoid delusions involving the app [47], underscoring the need for careful user support.

Intervention (Year)	Modality & Features	Study Population/ Design	Key Outcomes	User Engagement & Notes
EMPOWER (Gumley et al., 2022) [48] [49]	Blended relapse prevention: smartphone early warning signs app + peer support + clinician monitoring (blended care)	73 adults with schizophrenia (multi-site: UK & Australia); 12-month cluster-RCT (EMPOWER vs TAU) – Feasibility trial	↓ **Relapse risk:** 12-month relapse incidence **24% EMPOWER vs 46% TAU** (Relative Risk 0.50, 95% CI 0.26–0.98) [48]. **Longer time to relapse** (HR 0.32) in intervention [50]. Participants also reported less **fear of relapse** than controls [51]. *Note:* As a pilot, not powered for definitive efficacy, but results suggest a meaningful reduction in relapse.	High engagement: **91%** of users met predefined engagement threshold (≥33% of daily self-monitoring) [52]. Median app use sustained for 32 weeks before significant drop-off [53]. Intervention was acceptable and considered cost-effective per quality-adjusted life year gained [54].
Avatar Therapy (Craig et al., 2017) [25] [26]	Computer-assisted therapy using a digital avatar to represent patient's persecutory voice (therapist facilitates live dialogue)	150 adults with schizophrenia and persistent auditory hallucinations; 12-week RCT (Avatar therapy + TAU vs supportive counseling + TAU)	↓ **Auditory hallucinations:** Avatar therapy produced a **greater reduction in frequency and distress of voices** at 12 weeks compared to supportive counseling (large effect size) [55] [25]. Many patients experienced improvement within a few sessions. Effects maintained at 6-month follow-up for many [56].	Therapy was well-tolerated; most patients completed all 6 sessions. Some found confronting the avatar empowering. Requires trained therapists and specialized software – implementation beyond trial settings is in progress [57] [58].

Intervention (Year)	Modality & Features	Study Population/ Design	Key Outcomes	User Engagement & Notes
gameChange VR (Freeman et al., 2022) [27] [28]	Automated VR cognitive therapy for persecutory anxiety: patients navigate simulations of everyday situations with virtual coach	346 adults with psychosis and severe agoraphobic avoidance; 6-week multi-site RCT (VR therapy + TAU vs TAU)	↓ **Avoidance and anxiety:** VR therapy led to **significant reductions in avoidance of everyday situations and related distress**, especially in patients with the highest baseline anxiety [27] [28]. Participants built confidence to face real environments, and secondary analyses noted reductions in paranoia severity among the most anxious subgroup (*Lancet Psychiatry* 2022).	High acceptability: most found the VR sessions engaging and felt safe practicing in VR. Minimal adverse events were reported. Implementation is promising since the program is automated; only brief staff support was needed. Scalability will depend on VR hardware access and training staff to facilitate initial sessions.

Key: ↓ = reduction; TAU = treatment-as-usual; RCT = randomized controlled trial; PANSS = Positive and Negative Syndrome Scale (schizophrenia symptom scale).

As shown in Table 1, diverse digital interventions have demonstrated positive outcomes in recent studies. Below we analyze these findings in terms of symptom reduction, functional improvements, and crisis management, drawing from both individual trials and broader reviews.

Impact on Psychotic Symptoms

Digital tools have had **mixed but generally positive effects** on psychotic symptom severity. In many cases, the addition of a digital intervention to usual care yields modest improvements in overall symptoms compared to control conditions. A 2023 systematic review and network meta-analysis of 58 trials concluded that technology-based interventions, when added to standard treatment, were **at least as effective as traditional face-to-face interventions** for symptom management [30] [59]. The meta-analysis found no significant difference in aggregate "symptomatology" outcomes between tech-supported care and face-to-face therapy alone, but certain specific approaches stood out. Notably, **digital CBT interventions** showed the strongest association with symptom reduction (particularly in early psychosis samples) [60] [61]. For example, internet- or phone-delivered CBT led to greater symptom improvements than conventional psychotherapy in some trials [62]. In one analysis, a digital CBT program emerged as the top-ranked intervention for reducing overall symptoms, with efficacy most evident in first-episode psychosis patients (though effects on chronic patients' symptoms were smaller) [61] [63]. Consistent with this, the Actissist mobile app (a CBT-informed intervention) significantly reduced **negative symptoms** and general symptom

scores versus an active control app [34]. Participants using Actissist reported fewer hallucinations and delusional thoughts over 3 months, indicating that **targeted digital self-management can attenuate psychotic experiences** in the short term.

Digital interventions have also shown efficacy for **specific symptom domains**. For instance, VR-based therapy targeting auditory hallucinations (Avatar Therapy) led to **substantial reductions in voice frequency and distress** in patients with long-standing hallucinations [25]. The effect size was large compared to supportive counseling, suggesting this digital technique can achieve what lengthy conventional therapies often cannot (many participants had failed to respond to years of medication and standard CBT) [26] [25]. Similarly, VR exposure therapy (gameChange) primarily addressed **anxiety and paranoid avoidance**, but it also had a secondary benefit of reducing paranoid delusions for those with severe baseline paranoia, as patients learned to enter feared scenarios without harm [27] [28]. This indicates that **virtual environments can be used to safely challenge persecutory beliefs**, leading to symptom relief.

That said, not all studies find major symptom changes. The Horyzons RCT in youth, for example, reported **no significant difference in psychotic symptom scores (PANSS)** between the digital platform group and controls over 18 months [37]. In that trial, participants were already in remission, so the goal was maintenance rather than symptom reduction – indeed, both groups remained relatively stable symptomatically. More broadly, meta-analyses suggest that digital interventions *alone* have limited impact on **acute positive symptoms** like hallucinations or delusions when patients are already receiving medication and standard care [64] [65]. A sub-analysis across studies found essentially **no overall effect on positive symptoms and only a tiny non-significant effect on negative symptoms** when pooling all digital interventions vs controls [64]. This implies that while individual studies show benefits, the average effect on core psychotic symptoms is small. Improvements often manifest in **general mental health measures** (mood, stress, insight) rather than dramatic reductions in hallucinations/delusions beyond what usual treatment achieves.

In summary, digital interventions can aid symptom management, particularly by reinforcing therapeutic strategies (like CBT) and addressing comorbid issues (depression, anxiety) that contribute to overall suffering [10] [66]. They are not a replacement for antipsychotic medication, but a growing evidence base suggests they are effective *adjuncts*: helping to **maintain symptom stability** and occasionally producing additional symptom relief in areas that standard care does not fully reach (e.g. persistent voices or phobic avoidance). The heterogeneity of results points to the need for matching the intervention to the individual's needs (for example, using avatar therapy for refractory voices, or mobile CBT apps for those with lingering symptoms and stress).

Functional and Quality of Life Outcomes

A key motivation for digital tools is to improve patients' daily functioning, self-efficacy, and quality of life. Traditional outcome measures in psychosis often extend beyond symptom counts, encompassing social engagement, vocational functioning, and subjective recovery. Digital interventions have shown promise in this domain. In fact, some studies report **bigger impacts on functioning and quality of life than on symptoms**. The network meta-analysis mentioned earlier found that technology-based interventions were **superior to face-to-face intervention alone in improving functioning (g = 0.25)** and **social cognition (g = 0.32)**, with small-to-moderate effect sizes [30]. One specific finding was that a digital cognitive training program significantly enhanced **neurocognitive performance** (memory, attention) which likely translates

to better functional capacity [31]. Another was that digital CBT interventions had a notable effect on **quality of life** outcomes (one analysis estimated a large effect, g ~1.27, on QoL, though based on limited data) [31]. This suggests that engaging with therapeutic content via technology can improve how patients feel about their life and abilities, perhaps by increasing their skills or confidence in managing the illness.

Real-world trials echo these findings. The Horyzons project, while not reducing symptoms, demonstrated benefits in **social functioning**. Participants in the Horyzons platform had higher social and role functioning scores (measured by the Personal and Social Performance scale) at follow-up, and the intervention was deemed cost-effective largely because it helped maintain social/vocational recovery after early intervention services ended [41] [42]. Qualitative feedback indicated that being active on the platform (posting, doing therapy exercises) improved users' sense of social connectedness and confidence in social situations [43] [44]. In line with this, greater **online engagement was correlated with enhanced social integration and well-being** (including increased positive emotions and self-esteem) among Horyzons users [44]. This highlights how a digital intervention can support **recovery goals** like rebuilding one's social life or identity, beyond symptom control.

Functional gains are also seen in other interventions: For instance, users of the ReMindCare app in Spain not only avoided relapse but also had better outcomes in terms of employment and education re-engagement during the follow-up (one report noted a higher return to work or study rate in the app group) [67]. Additionally, digital monitoring and self-management can empower patients – EMPOWER trial participants reported feeling more in charge of their health and less worried about relapse, which can translate to greater confidence to pursue life activities [51]. Quality of life is a harder metric to move, but some evidence suggests **digital therapy users report higher satisfaction with care and daily life**. For example, participants in a smartphone intervention for schizophrenia described gaining **insight into their illness and a sense of achievement** from using the app, which can improve their outlook on life [14] [68].

Nonetheless, not all studies have measured or found significant functional benefits, and some short trials may be underpowered to detect changes in social outcomes. The Frontiers review of mobile apps in early psychosis noted that **no program had yet demonstrated a clear improvement in formal functioning or social outcome scales** in those short-term studies [67]. It may be that longer follow-up is required, or that digital tools need to be better integrated with rehabilitation services to affect concrete functional milestones (like getting a job or improving self-care skills). Overall, the trend is optimistic: digital interventions tend to maintain or modestly improve functioning, and users often subjectively value the **autonomy and support** these tools provide in daily living. This aligns with the recovery-oriented approach in psychosis care, focusing on personal goals and quality of life – areas where digital tools can provide continuous coaching and reinforcement.

Relapse Prevention and Crisis Support

One of the most impactful roles for digital interventions is in **preventing psychotic relapses and managing crises**. Psychosis relapse (often evidenced by re-emergence of severe symptoms requiring hospitalization) is common and costly, and early warning signs can sometimes be detected days or weeks in advance. Digital technologies are well-suited to continuously monitor for such warning signs and prompt early intervention. Studies in the past decade indicate that apps which include relapse prevention components have achieved considerable success in reducing relapse rates.

The ReMindCare study is a striking example: over 19 months, patients using the relapse-monitoring app had a **relapse rate of only 20% compared to 58% in treatment-as-usual** [45]. This is a dramatic reduction, suggesting the app's combination of self-monitoring and rapid clinical response to alerts helped many patients avert full-blown relapse. In the same study, urgent care visits and hospitalizations were significantly fewer in the digital intervention group [45]. Similarly, the EMPOWER trial (though a pilot) found the risk of relapse was **halved (24% vs 46%)** when patients had a smartphone early warning system plus peer/clinical support [48]. Importantly, EMPOWER also extended time to relapse – those with the app went longer without relapse on average [50]. These findings underscore that **continuous engagement and early intervention via technology can keep people stable longer**, likely by prompting self-management or timely clinical action when early signs (like sleep disturbance or mild symptoms) appear. It's worth noting that in EMPOWER, the app was part of a **"blended" care approach**: data from the app were reviewed by clinicians and peer workers who could reach out, thus bridging digital monitoring with human support [69] [70]. This highlights that the most effective relapse prevention may involve both automated and human elements.

In terms of **crisis support**, digital tools offer new channels for help. Many mental health apps now include crisis information or even direct linkages to crisis lines. For psychosis specifically, interventions like Horyzons allowed users to signal distress; interestingly, the Horyzons trial found the intervention group had only half the rate of emergency department (A&E) visits compared to controls (19% vs 39%) [39]. This suggests that the online support may have helped users manage issues before they escalated to emergencies, or encouraged them to seek help earlier in less acute settings. Although the hospitalization difference in that study did not reach statistical significance, a trend toward fewer psychosis-related hospitalizations was observed (13% vs 27%) [40]. Even modest reductions in hospitalization can be meaningful for patients and health systems, given the trauma and cost associated with psychiatric hospital stays.

Additionally, digital tools can act as a **safety net** by providing coping strategies in moments of crisis. For example, a user experiencing rising paranoia at midnight might use a mobile app's grounding exercise or read peer advice on hearing voices, potentially preventing panic or self-harm. Some apps include emergency call buttons or predefined crisis plans. The American Psychiatric Association released *My Mental Health Crisis Plan*, a mobile app that lets individuals with serious mental illness create a digital crisis plan to guide treatment if they decompensate [71]. While not specific to psychosis, it exemplifies how patients can use technology to assert their preferences and have a ready plan during crises. There are also widely used **crisis text lines** and chat services (e.g. Crisis Text Line, Shout) that anyone in crisis (including those with psychosis) can use for immediate support via text messaging [72]. These services have been life-saving in some cases, though formal evaluations in psychosis sub-populations are lacking.

One cautionary finding is that **not all digital relapse systems are accurate or anxiety-free**. An algorithm-based warning system (as in an earlier ClinTouch study) had high false-positive rates – one report noted only 8% specificity in its relapse alerts [73], meaning many "alerts" did not correspond to actual relapses. False alarms can unnecessarily worry patients and clinicians, and even contribute to paranoia (as seen in ReMindCare where 8% developed delusional ideas about the app [47]). This underlines the importance of refining detection algorithms and ensuring **human oversight** to interpret data. Nevertheless, the overarching picture is that digital tools, especially those involving active monitoring and integrated care, have made headway in reducing crises. By engaging patients continuously and catching deterioration early, these interventions help shift care from reactive (after a full relapse) to proactive (preventing relapse). This is a significant advance for a condition like schizophrenia where each relapse can be a major setback.

User Engagement and Acceptability

User engagement is a cornerstone of digital intervention success – a tool can only help if people use it regularly. Psychosis presents unique challenges to engagement (symptoms like paranoia or avolition can interfere with app use), yet studies show that **patients with psychosis can and do engage well with digital tools**, given the right support. Most research trials report **moderate to high engagement rates** during the study periods [36]. For example, in at least six different psychosis app studies, over 70% of participants met predefined engagement criteria (such as using the app at least a certain amount) [36]. In the EMPOWER trial, as noted, 91% had acceptable engagement over many months [52]. These figures are quite encouraging, especially when contrasted with general mental health apps in the commercial marketplace: one review found that **only ~4% of users open a mental health app 15 days after download** [74]. By comparison, the structured and supported interventions in clinical studies achieve far better retention. This implies that tailoring apps to the needs of people with psychosis and integrating them with care (including initial training and human encouragement) can overcome some adherence barriers.

That said, **sustaining long-term engagement** remains difficult. Even in successful trials, usage tends to decline over time. The median time to significant dropout in EMPOWER was 32 weeks [53], after which many stopped using the app frequently. In the ReMindCare program, about 63% continued at 19 months, meaning roughly one third discontinued early [46]. Reasons for disengagement vary: some users become **wary or suspicious of technology**, particularly if psychotic symptoms flare (indeed, paranoia about the app was cited by a subset who quit ReMindCare) [46]. Others simply **lose interest or perceive insufficient benefit** – 40% of those who stopped ReMindCare said it was "boring" or not useful to them [75]. Negative symptoms like apathy can reduce motivation to keep up with regular self-tracking. Additionally, if an app successfully helps someone stabilize, they might feel they no longer need to use it daily (a paradox of success that interventions must navigate by remaining engaging and relevant).

Another engagement factor is **ease-of-use and accessibility**. Patients have noted that good initial training and simple interfaces help them build a habit of app use [76] [68]. In China, users of the YouXin monitoring app attributed their sustained use to the thorough onboarding they received and found the app **easy to use despite limited tech experience** [14] [77]. On the other hand, complex multi-step apps or those requiring extensive typing might deter those with cognitive challenges. Ensuring the content is **personalized and meaningful** is also critical. People are more likely to engage if the app addresses their immediate concerns (e.g. how to sleep better tonight, how to cope with a voice right now) rather than generic advice. The success of interventions like FOCUS, which saw frequent self-initiated usage, likely stems from its responsiveness to users' daily needs and its mix of scheduled and on-demand support [78] [79].

A recurring challenge discussed in the literature is the lack of **standard metrics for engagement** [80] [81]. Studies measure it differently – some use frequency of logins, others completion of modules, others duration of use – making comparisons difficult. Nonetheless, all agree that **low engagement (poor adherence)** is a major barrier to real-world impact [82]. Researchers are experimenting with ways to boost engagement: **financial incentives** have been tried (paying participants for usage in some feasibility studies) [80], though this may not be sustainable outside research. More promising is the idea of *passive sensing* to reduce user burden – instead of expecting users to input data constantly, apps can gather information passively (steps, phone usage, speech patterns) to infer states and only prompt the user when necessary [32]. This could make interventions less obtrusive and more acceptable long-term.

In terms of **acceptability**, most qualitative studies indicate that patients appreciate these tools. They often describe feeling "empowered" by tracking their own progress and having a toolbox at their fingertips [14]. Privacy concerns surprisingly tend to be low among users who opt into these studies – for instance, Chinese patients using YouXin trusted their clinicians and had minimal data security worries [83]. However, for broader deployment, privacy and data protection will be key to acceptance (people will need assurance their sensitive data is safe and not misused). Another acceptability consideration is **symptom fluctuations**: when acutely unwell, a person might not use an app at all. Thus, digital interventions must be seen as supports during **periods of relative stability or as adjuncts to early intervention**, rather than a sole resource in acute crisis (in a crisis, many will revert to calling a provider or emergency services directly).

In summary, engaging individuals with psychosis in digital health is feasible, with many showing enthusiasm and sustained use when the intervention is well-designed. The biggest hurdles are keeping that engagement over the long haul and avoiding dropout due to distrust or waning interest. Solutions likely lie in **user-centered design** (involving patients in co-design to ensure the tool is appealing and relevant), adaptive intervention models (adjusting frequency and content as the person's needs change), and integrating digital tools seamlessly into patients' care routines rather than treating them as separate add-ons.

Implementation Feasibility and Global Perspectives

As digital psychosis interventions move from trials to real-world settings, questions of implementation, scalability, and cultural context become paramount. **Real-world feasibility** has been demonstrated in several projects, but challenges remain in integrating these tools into healthcare systems. One encouraging example of implementation is how the **MOST/Horyzons platform was adopted in clinical practice**. After successful trials, the Australian Orygen youth mental health service scaled up its online platform for wider use, especially during the pandemic when face-to-face contact was limited [19]. Clinicians were trained to become online moderators, and the platform served as an extension of care for discharged youth. This suggests that digital interventions can be embedded into standard care pathways (e.g., as part of step-down care after hospitalization or specialty programs). The cost-effectiveness analysis of Horyzons further supported its adoption by showing potential **cost savings alongside improved outcomes** [41] [42].

However, implementing digital tools in routine practice requires addressing practical issues: ensuring **device access**, providing technical support, and adjusting clinician workflows to include digital monitoring. In many trials, participants are given smartphones or data plans if needed – in routine care, funding such resources is a consideration, particularly for lower-income patients. Clinicians also need training not only in using the technology but in interpreting the data (for instance, knowing when an app alert warrants a clinical intervention). The EMPOWER study's blended model required coordination between an app dashboard and a peer support worker who could reach out to patients on early signs [69] [70]. This kind of human infrastructure is vital but has costs and requires service redesign. Yet, feasibility trials have generally found that mental health staff and patients are willing to engage with these innovations, seeing them as enhancing (not replacing) therapeutic relationships [69].

From a **global perspective**, digital interventions hold great promise to expand access to psychosis care, especially in areas with scarce mental health professionals. Research has increasingly included diverse settings. For example, the development of the YouXin app in China shows how digital tools can be tailored to a non-Western context [84] [14]. Participants in that study valued the app's help in gaining insight and noted that smartphone-based monitoring filled a gap in their care [68]. In low- and middle-income

countries, where specialist psychotherapy for psychosis is rare, a mobile or web program could deliver psychoeducation or CBT techniques at scale. The **scalability** of digital interventions (once developed) is a major advantage – an app can be disseminated to thousands with relatively low marginal cost, compared to hiring thousands of clinicians. That said, cultural adaptation is crucial: content may need translation and adjustment for local idioms, health beliefs, and levels of digital literacy.

Different countries have started exploring digital mental health for serious mental illness with encouraging results. In Spain, the ReMindCare project was implemented within a national health service context, hinting that sustained use over 19 months is achievable in a public healthcare setting [45] [46]. The UK's NHS has also invested in digital innovation for psychosis (e.g. the gameChange VR trial was funded by the National Institute for Health Research, and there are efforts to make the VR therapy available through NHS clinics) [85]. In the U.S., the FDA approved a digital treatment (Pear Therapeutics' "reSET" app) for substance use and recently for insomnia, and while none is approved yet specifically for schizophrenia, it's plausible such digital therapeutics could gain regulatory clearance in coming years [86]. This would further facilitate implementation by allowing prescribing of apps as part of treatment.

One must also consider the **digital divide**: not everyone with psychosis has access to smartphones or the internet, especially among older patients or those in poverty. Studies around 2015 showed smartphone ownership among people with serious mental illness was lower in older age groups [87], but it has been rising steadily. By the early 2020s, a majority of patients with schizophrenia in many urban areas do own a mobile device [88]. For those who do not, clinics might provide devices on loan (as done in some trials). Additionally, some patients may prefer simpler technology like text messaging. Indeed, SMS reminder systems for medication and appointments have shown improved adherence in general psychiatry populations (though not psychosis-specific, they illustrate that even low-tech interventions can be beneficial). Any large-scale deployment of a tool like **MindGuard** should incorporate strategies to ensure **accessibility** – possibly offering a basic version via SMS/feature phone or offline use options for those with limited connectivity.

In terms of **policy and health system readiness**, countries like the UK and Australia are relatively ahead in integrating digital mental health (with national digital health strategies), whereas others are just beginning. The global perspective also raises issues of **language and localization**: e-mental health interventions need to be developed in local languages and tested in local contexts. We see initial steps – for example, some psychoeducational apps for psychosis have been created in languages like Mandarin and evaluated for feasibility [89] [90]. International collaboration can help share successful models (e.g., the Horyzons platform has been adapted for trials in Canada, the US, and several European countries). MindGuard, as a hypothetical tool, could be envisioned as a multilingual, culturally adaptable platform, drawing on the best practices identified globally.

Key Challenges and Gaps in Research

Despite the progress, there remain significant challenges and gaps in the evidence base. Addressing these will be critical for the next generation of digital mental health tools for psychosis. Key issues include:

- **Long-Term Engagement:** Maintaining user engagement beyond a few months is difficult. Many studies are short (under 6 months), and those that extend longer see attrition. Understanding how to keep interventions "sticky" – through personalization, gamification, social elements, or periodic

human check-ins – is an ongoing challenge [82] [53]. Future research should explore adaptive interventions that evolve with the user's stage of recovery to remain relevant.

- **Digital Literacy and Access:** Not all potential users are tech-savvy or have ready access to devices and the internet. Older adults with chronic schizophrenia, or people in low-resource settings, might be left behind. There is a gap in research on **geriatric psychosis populations** and digital tools, as most trials skew to younger demographics. Ensuring accessibility (simple interfaces, offline functionality) and providing digital skills training or devices when needed will be important for equity.

- **Symptom-Specific Efficacy:** While some tools target specific symptoms (voices, paranoia, cognitive deficits), more work is needed to optimize digital interventions for **negative symptoms and cognitive impairment**, which are less responsive to existing treatments. For instance, motivation and social withdrawal (negative symptoms) are challenging to improve; interventions like motivational reward features or virtual job coaches could be explored. Currently, evidence on substantially improving negative symptoms via technology is sparse (Actissist showed a short-term effect [34], but more confirmation is needed).

- **Safety and Risk Management:** Digital interventions must have robust safety protocols. The **reporting of adverse events** in these studies is inconsistent [81]. Potential risks include triggering anxiety, breaching privacy, or, rarely, exacerbating paranoia (as seen when a few patients became delusional about an app [47]). Research should establish best practices for monitoring safety – for example, setting up alerts to clinicians if a user reports severe suicidal ideation in an app, or if the app detects behavioral signs of crisis. A recent review noted that many digital mental health studies do not thoroughly report how they handle safety issues [91] [92]. This is a gap to fill, especially for a high-risk population.

- **Integration into Care Models:** It's still unclear how to optimally blend digital tools with existing treatment workflows. Should apps be monitored by case managers? How often should clinicians review data? Who intervenes when an alert is raised at 3 AM? Trials like EMPOWER piloted a model with peer support workers handling some of this [69] [70], but scalability of that approach needs evaluation. Clear protocols for **clinical integration** and delineation of responsibility are needed for widespread adoption. Moreover, clinicians' attitudes can be a barrier – some may be skeptical of digital tools or concerned about being replaced. Education and demonstrating that these tools reduce their burden (e.g. fewer crisis calls because the app caught issues early) could help.

- **Lack of Co-Design and User Involvement:** Historically, many mental health apps were built without end-user input, but this is changing. A systematic review found that **co-production with people with lived experience** was rarely done in earlier app development, although it's crucial for usability [93] [94]. Involving patients (and families) in the design stage can ensure the tool truly meets their needs and addresses concerns (like privacy or stigma). Going forward, participatory design should be standard, but research on effective co-design processes for psychosis interventions is still emerging.

- **Generalizability and Publication Bias:** Many published studies are pilots with small samples; successful outcomes get reported, but there may be unpublished negative or neutral studies. We need larger, definitive trials (some are underway or recently completed, such as a large US trial of a

digital intervention for schizophrenia and comorbid health management). Also, most evidence comes from high-income countries. More research in diverse socio-economic contexts would ensure MindGuard and similar tools are **globally relevant**.

- **Regulatory and Privacy Frameworks:** Navigating regulatory approval (if the tool claims to treat a medical condition) and ensuring GDPR/HIPAA compliance for data is complex. These issues are more about deployment than research, but they influence what gets studied (e.g., whether an RCT requires a cleared device or if a research app can be used informally). Clarity in regulatory pathways for digital therapeutics in psychosis is still evolving, which is a gap that may need policy research and advocacy.

By acknowledging these challenges, stakeholders can take proactive steps in the next wave of development. For instance, MindGuard's design team should plan for rigorous user testing, build in safety nets (e.g. emergency contact integration), and consider a staged rollout where feedback is continually incorporated. Research funders are increasingly calling for studies on **implementation science** for digital health – that is, not just "does it work in ideal conditions?" but "how do we get it adopted in the wild and keep it working?". This focus will help close the gap between promising trials and everyday practice.

Conclusion and Future Directions

In the span of a decade, digital interventions for psychosis have moved from nascent pilots to evidence-backed tools that can enhance patient care. The literature reviewed shows that **mobile apps, online platforms, and VR therapies** can play a valuable role in comprehensive psychosis treatment. They have been associated with small-to-moderate improvements in symptoms (particularly negative symptoms, depression, and anxiety), meaningful gains in social functioning and self-management, and reductions in relapse rates and emergency interventions [45] [48]. These interventions empower patients by extending support beyond clinic walls – providing psychoeducation, coping strategies, social connection, and early crisis alerts at the touch of a button.

For a hypothetical digital tool like **MindGuard**, the key lessons from current research are clear. **First**, MindGuard should be built on evidence-based therapeutic techniques (for example, CBT for psychosis modules, illness self-management strategies) since these have shown the most benefit in reducing symptoms and improving quality of life [62] [31]. **Second**, it must prioritize user engagement and usability – employing co-design with patients, personalization, and perhaps gamified or peer support elements to keep users interested over the long term. Given that engagement tends to wane, MindGuard could incorporate adaptive reminders or check-ins and allow flexibility in use (to avoid user fatigue) [82] [53]. **Third**, integration with real-world care is vital: MindGuard should include features for communication with clinicians or caregivers (with user consent), and a plan for responding to red flags (like connecting users to a 24/7 support line or crisis service if needed). The success of interventions like EMPOWER and ReMindCare was largely due to their **blended approach**, combining digital monitoring with human follow-up [69] [95]. MindGuard can emulate this by not operating in isolation but as part of a network of care.

Looking ahead, research gaps provide a roadmap for innovation. Future digital tools may leverage **artificial intelligence** to personalize interventions (for example, adapting content based on a user's patterns or predicting relapse risk more accurately from sensor data). There is also potential for **expanding to new populations**: for instance, developing digital supports for adolescents at ultra-high risk of psychosis (to possibly prevent onset) or for older patients in maintenance phases. Additionally, **peer-led and**

community-driven digital interventions could flourish – moderated by people who have recovered from psychosis, creating a relatable support system online. Ensuring accessibility will remain paramount: features like multi-language support, low-bandwidth functionality, and simple interface design can help MindGuard benefit users across different regions and demographics.

In conclusion, the past decade's global research illustrates both the promise and the challenges of digital interventions for psychosis. They are not a panacea, but as part of a multimodal treatment approach, they can significantly **improve patient engagement and extend care** to moments and places previously out of reach. Recurring challenges such as user engagement, privacy, and integration are being actively addressed through iterative design and larger implementation trials. The field is progressing from proof-of-concept toward real-world application, guided by the principle that technology should augment, not replace, the human touch in mental health care. **MindGuard**, informed by this rich body of knowledge, could be envisioned as a comprehensive, user-friendly tool that empowers individuals with psychosis to guard their minds – helping them monitor wellness, weather crises, and achieve personal recovery goals with greater confidence and support. With ongoing research and thoughtful design, such digital tools are poised to become a staple of psychosis care in the years to come, fostering a future where help is always just a tap away.

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