



EUROPEAN PSYCHIATRIC ASSOCIATION

The future of **digital mental health** for the care of people with **schizophrenia**

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Summary

Introduction

Digital mental health care is moving at a rapid pace. It has the potential to address a range of interventions, including promoting mental health and wellbeing, self-care, targeted treatments and improving access to care. The types of digital mental health interventions (DMHIs) are expanding all the time, with over 300.000 developed in 2022 alone.

The majority of these digital tools, however, have focused on mood, anxiety, substance use and traumatic stress disorders. Few have been developed for major mental health conditions like schizophrenia.

The technology uses smartphones, virtual reality, artificial intelligence, machine learning and other technology to deliver these digital interventions. With them, however, come huge challenges such as privacy, data protection and security, and ethical, legal and regulatory issues that require urgent attention.

This project aimed to explore these challenges by looking at the:

- 1 Current use and future of digital mental health
- 2 Experience of DMHIs for patients, carers, clinicians and app developers
- 3 Impact of DMHIs on patient-clinician relationships and treatment

Methods

The following methods were used to meet the project aims:

- A narrative review of the latest developments in DMH interventions for patients with schizophrenia, including the use of artificial intelligence (AI);
- Workshops with patients, carers, and clinicians (psychiatrists and psychologists) and depth interviews, including with an app developer.

Findings

The narrative review found that DMHIs are showing promise as valuable tools for people with schizophrenia, addressing gaps in traditional treatments by managing symptoms, preventing relapses, and improving overall wellbeing. Trials indicate high user engagement and satisfaction, particularly with virtual reality applications.

Patients, carers, and clinicians acknowledge the benefits of DMHIs, such as convenient communication and enhanced access to interventions, but emphasise the importance of maintaining face-to-face care. Key challenges include ensuring the safety, privacy, and quality of DMHIs, especially those on the open market, and the slow integration of these tools into clinical practice. Collaborative development involving patients, clinicians, carers, and developers is crucial for successful DMHI implementation. While DMHIs offer a revolutionary approach to mental health care, they should complement, not replace, traditional treatments.

Conclusion

While DMHIs offer promising solutions to the treatment gaps in mental health care for people with schizophrenia, there is a pressing need to ensure their safety, privacy, security, accountability and quality.

Moving forward, continued research, collaborative development, and thoughtful

implementation will be essential to harness the full potential of DMHIs in improving the lives of individuals with schizophrenia while ensuring safe and effective integration into existing care models.

Recommendations

Based on the findings of this report and the literature reviewed, we make the following recommendations for patients with schizophrenia, clinicians, carers and policymakers:

Patients with Schizophrenia

- Engage with DMHIs that are safe to use and ideally recommended by clinicians or trusted sources (e.g. NGOs or government organisations) to help manage symptoms and prevent relapse.
- Avoid using open-market digital tools that worsen your symptoms at your most vulnerable time.
- Consider using smartphone-based therapies, which are practical and acceptable for most patients.
- Participate in the development and testing of DMHIs to ensure they meet your needs and preferences where the opportunity occurs.
- Be aware that while DMHIs can be helpful, they are meant to augment, not replace, face-to-face clinical care.

Recommendations for Clinicians

- Familiarize yourself with the latest DMHIs recommended for use in clinical services, such as AVATAR therapy for voice-hearing and SloMo for managing paranoia.
- Integrate DMHIs into your practice to enhance medication adherence and symptom management for patients with schizophrenia.

- Collaborate with patients to personalize digital interventions and ensure they complement existing treatment plans.
- Participate in multidisciplinary collaborations to develop and implement DMHIs in real-world settings.

Recommendations for Carers

- Learn about available DMHIs to support your relatives or friends with schizophrenia in their day-to-day symptom management.
- Encourage and assist patients in using recommended digital tools as part of their overall care plan.
- Provide feedback on the usability and effectiveness of DMHIs from your perspective as a carer.
- Explore what digital tools can help support you as a carer, such as psychoeducation apps (where available) and tools to help promote your physical and mental health.

Recommendations for Developers

- Complement care by designing DMHIs to enhance symptom management and self-care alongside traditional treatments for people with schizophrenia.
- Ensure safety and privacy by implementing robust safety measures and data privacy for all apps, especially those on open markets.
- Co-develop with stakeholders by involving patients, carers, clinicians, and developers in the design process to meet user needs.
- Enhance user engagement by using strategies like personalization and gamification to improve engagement and ensure accessibility.
- Continuously improve by conducting ongoing research to evaluate efficacy and incorporate innovations in digital mental health.

Recommendations for Policymakers

- Support the implementation of NICE-recommended digital health technologies within mental health services to improve care for people with psychosis.
- Invest in research and development of DMHIs, focusing on areas such as data sharing, measuring harms, and prevention strategies.
- Develop clear regulatory frameworks for digital mental health tools to ensure safety, privacy, accountability and quality assurance.
- Promote organisational changes that facilitate true coproduction with those who have lived experience of schizophrenia in the development of DMHIs.
- Allocate funding for training healthcare professionals in the use and integration of digital mental health tools.

Introduction and context

Introduction

The rapid advancement of digital health is transforming the mental health landscape. Digital technology in mental health holds great promise to provide interventions that can help promote well-being and self-management, enable more effective prevention, early intervention, targeted treatment, and improvements to services by enhancing accessibility to mental health services through better patient flow.¹

Recent technological advances have led to the development of digital mental health interventions (DMHIs). These interventions use web-based platforms, mobile apps, and technologies like virtual reality to provide health care education, self-management tools, and remote therapy, either as a self-guided intervention or with varying levels of guidance by health providers.²

Because it is so multi-functional, digital mental health technology has become essential for addressing many of the vast challenges seen over the past decade in delivering quality mental health services, further heightened by the COVID-19 pandemic and limited resources. Its potential includes bridging the ever-increasing demand for mental health services and providing support groups and peer-to-peer platforms.

A vast array of digital mental health technologies exists for different purposes. As of 2022, over 300.000 DMHIs have been developed for diverse health conditions, offering accessible and acceptable alternatives or complements to traditional face-to-face health care.³ DMHIs hold promise for improving the accessibility, attractiveness, quality, cost-effectiveness, and precision of mental health services.

However, the majority of research on DMHIs has focused on common disorders such as substance use, mood, anxiety, and traumatic stress disorders,⁴ with less attention given to major mental health conditions like schizophrenia. Consequently, while a recent meta-analysis of over 9000 participants of randomized controlled trials (RCTs) showed that both guided and self-guided DMHIs are effective for depression,⁵ yet meta-analytic

evidence for schizophrenia is limited due to the scarcity of such trials.⁶

There are DMHIs for promoting mental health and prevention, smartphone apps (e.g., for mood tracking, peer support), virtual reality (VR) (e.g. for exposure therapy), or the application of artificial intelligence (AI) (e.g. chatbots, typed therapy), machine learning (to predict patient outcomes), digital phenotyping (generating and collecting real-time patient data), and synchronous (telepsychiatry), and asynchronous (non-real-time) guided DMHI. Several DMHIs can be used simultaneously (e.g., by channel switching from digital to face-to-face interventions or poly-digital ecosystem and digital glue connecting users with therapists.

While DMHIs hold great potential, significant challenges need to be addressed. Among many, ensuring privacy and establishing ethical, legal, regulatory, and quality assurance standards are pressing issues. The European Psychiatric Association has developed an important set of practical recommendations to assist clinicians in adopting DMHIs.⁷ Very challenging issues include digital exclusion for those unable to use or access digital technology (e.g., older people) and user retention, where dropouts are high because of poor quality DMHIs (e.g., smartphone apps). Some people may be fearful of using digital technology, especially those who may be experiencing symptoms of psychosis.

Equally important is ensuring DMHIs are patient- and carer-centred and maintain a 'human touch.'⁸ One fear of DMHIs is that they will replace human contact entirely, although this is perceived as unlikely. While much of the literature suggests AI can potentially improve access, accuracy, and efficiency of healthcare delivery, there is some concern as to whether it can adversely influence the patient-

clinician relationship, perhaps making it more challenging to build and maintain relationships and trust.⁹ Non-verbal communication through body language is integral to any therapeutic relationship and could be missing when treatment is delivered using digital technology.

There is an emphasis that the development of DMHIs must be designed in close liaison with relevant stakeholders, particularly users and clinicians, and evaluated to confirm their effectiveness.³

This project aimed to explore this important and topical theme and address the imbalance of DMHIs available for people diagnosed with schizophrenia.

Project objectives

The project objectives and key questions were to explore the:

- 1 **Current use and future of digital mental health** – how is it currently being used and prescribed, what is likely to emerge in the next few years (including the use and development of AI), what further developments are required to help meet the needs of people with schizophrenia and the implications for clinical care?
- 2 **Experience of DMHIs for patients, carers, and clinicians** – their hopes, fears and expectations, and the experience of developers of DMHIs.
- 3 **Impact of DMHIs** on patient-clinician relationships and treatment

What we did

To address our project aims we conducted:

- A narrative review of the latest developments in DMHIs for patients with schizophrenia, including the use of AI;
- Workshops with patients, carers, and clinicians,
- Semi-structured depth interviews with relevant stakeholders.

More details of the methods can be found in Appendix 1.

The current landscape - key findings of the narrative review

Seventeen research trials were identified during this current evidence review, which focused on three main areas for digital mental health interventions for people with schizophrenia: symptom management, relapse prevention and recovery, and cardiometabolic health and nicotine dependence.

Figure 1 shows the number of trials of DMHIs for people with schizophrenia, eight of which were for managing symptoms, such as auditory hallucinations, paranoia and anxious avoidance.

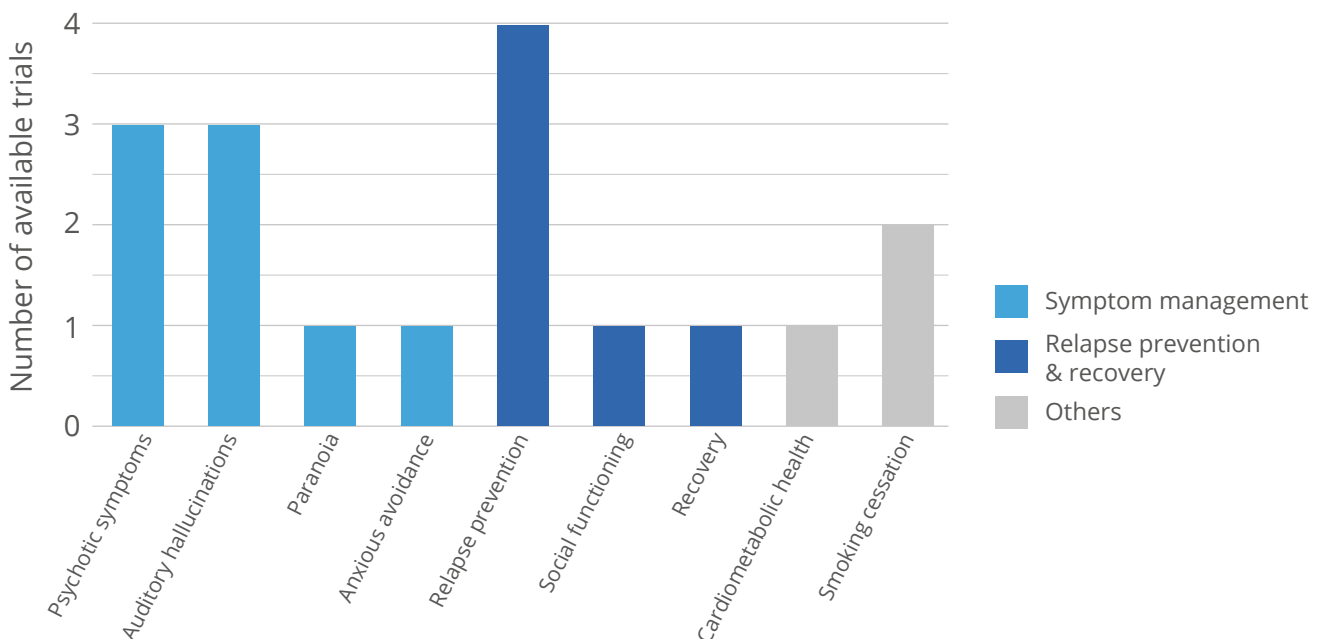


Figure 1: Number of research trials of digital mental health interventions for people with schizophrenia by symptom management, relapse prevention and recovery and others

Symptom management

Several DMHIs for managing symptoms for people with schizophrenia have been developed, which use psychological strategies such as cognitive behavioural therapy through smartphones or other digital technologies.

Table 1 lists the details of DMHIs trials, where most show promising results in improving symptoms and their management, such as auditory and visual hallucinations and paranoia. Most DMHIs in Table 1 are solely digitally based except the Mobile Interventionist which is partly

delivered via members of a community mental health team (blended care). Some DMHIs target general positive symptoms, usually multi-component (e.g. providing daily notifications and reminders, CBT strategies, and mindfulness exercises) (e.g. PEAR-004 see Table 1).

Other DMHIs focus on specific experiences of psychosis or resulting avoidant behaviours and involve blended care (e.g. virtual-assisted exposure therapy / between-session exercises – gameChange and SlowMo, see Table 1).

Table 1 Trials evaluating DMHIs for symptom management

Name of DMHI	Aim and use	Intervention	Result
PEAR-004 Digital Therapeutic RCT ¹⁰	Evaluate if PEAR-004 could improve schizophrenia symptoms when used alongside standard treatments.	PEAR-004 smartphone app providing therapeutic content through daily notifications and on-demand modules across ten skill categories.	Despite high user engagement and satisfaction, the primary outcome showed no significant difference in symptoms of schizophrenia between the PEAR-004 app and the sham control.
Mobile Interventionist Pilot RCT ¹¹	Assess training psychiatric community care team members as “mobile interventionists” for patients with serious mental illness.	Daily text support over 12 weeks, including reminders, information, cognitive challenges, and social skills training.	High initiation rates (95%) and satisfaction (91%) were reported, with no adverse events. Exploratory analyses suggested reductions in paranoid thoughts and depression, as well as improvements in illness management and recovery.

Name of DMHI	Aim and use	Intervention	Result
CORE ¹²	Counteract maladaptive thoughts and enhance cognitive flexibility in bipolar disorder, major depression, and schizophrenia/schizoaffective disorder.	Smartphone intervention with brief daily game-like exercises.	Rated as highly usable and acceptable, with large improvements in measures of depression, recovery, and self-esteem.
Ecological Momentary Assessment (EMA) and Ecological Momentary Intervention (EMI) for voice-hearing ¹³	Enhance coping-focused therapy for voice-hearing.	Smartphone-based EMA and EMI with high-frequency symptom monitoring.	Supported feasibility and acceptability with good engagement and satisfaction, but no significant difference in voice-hearing between groups.
Temstem ¹⁴	Reduce voice-hearing distress and improve social functioning in people with auditory/visual hallucinations.	Smartphone app with “in-the-moment” digital interventions to improve control over voices.	No differences between groups in voice-hearing distress and social functioning.
VRT for AVH ¹⁵	Treat treatment-resistant schizophrenia with auditory/visual hallucinations.	Virtual reality-assisted therapy (VRT) creates personalized avatars for immersive dialogue.s	Significantly improved AVH severity and depressive symptoms, with VRT showing larger, but non-significant effects on AVH compared to CBT.

Name of DMHI	Aim and use	Intervention	Result
SlowMo ¹⁶	Targeting paranoid thoughts in schizophrenia-spectrum disorders.	Digitally supported cognitive-behavioural therapy with 8 face-to-face sessions, web app, and synchronized mobile app.	No significant difference in the reduction of primary outcome paranoia at 24 weeks, but significant improvements in secondary paranoia measures at 12 weeks and in observer-rated persecutory delusions and belief flexibility at 24 weeks.
gameChange ¹⁷	Address difficulties going outside due to anxiety in patients with psychosis.	Automated virtual reality (VR) cognitive therapy consisting of six sessions over six weeks.	Significant reductions in agoraphobic avoidance and distress compared to usual care-alone group. Effectiveness due to reductions in threat cognitions and defensive behaviours.

Aiding recovery and preventing relapse

Other recent DMHIs have aimed to improve long-term care for people with schizophrenia after treatment for initial acute symptoms.⁹⁻¹³ These interventions, delivered through app- or browser-based platforms, combine various components such as educational materials, tools for symptom and medication monitoring, communication services, and CBT-based therapeutic modules. These DMHIs are

typically incorporated within established care services, which include varying degrees of clinician engagement, from basic support to active participation in using digital content.

Table 2 lists the DMHIs evaluated in recent trials. Three of these - the HORYZONS trial, the m-RESIST and the ICRC studies - combine digital and in-person support (known as blended care) and have shown some successful outcomes.¹³

Table 2: Recovery and relapse prevention DMHIs

Name	Aim and use	Intervention	Result
ARIES trial ¹⁸	Implement the My Journey 3 app for users with first-time psychosis.	App allowing users to set personal goals, track mood, symptoms, and medication adherence.	<ul style="list-style-type: none"> • Good retention rates (83% at 4 months, 75% at 12 months) • Low user engagement (median 16.5 uses, 26.8 minutes spent on app) • No significant difference in clinical outcomes between intervention and control groups.
HORYZONS trial ¹⁹	Enhance social functioning and vocational recovery for people in clinical remission from first-episode psychosis.	Comprehensive digital platform integrating peer-to-peer networking, therapeutic interventions, and expert support.	<ul style="list-style-type: none"> • No significant improvement in social functioning • Increased vocational engagement • Reduced emergency hospital visits.
m-RESIST study ²⁰	Support patients with treatment-resistant schizophrenia (TRS).	Multi-faceted intervention with smartwatches, mobile apps, and web-based platforms, supported by mental health professionals.	<ul style="list-style-type: none"> • 18% dropout rate due to social stigma and physical discomfort • High ratings of usability and satisfaction • Improved control over illness and easier communication with clinicians reported by most patients.
ICRC study ²¹	Evaluate technology-enhanced relapse prevention program for patients with schizophrenia or other psychotic disorders post-discharge.	Digital tools (clinical decision support system, interactive smartphone app) combined with in-person visits to develop individualized relapse prevention plans.	<ul style="list-style-type: none"> • Significant reduction in rehospitalization rates • Fewer hospital days for the intervention group compared to the control group.

Name	Aim and use	Intervention	Result
Buck et al. study ²²	Detect early warning signs of psychotic relapse.	Brief, high-frequency digital assessments of symptoms.	<ul style="list-style-type: none"> Increases in persecutory ideation and hallucinations could serve as early indicators of relapse.
EMPOWER trial ²³	Predict and prevent psychotic relapses.	CareLoop smartphone app with daily 22-item questionnaire, tailored self-management messages, and alerts for clinical teams.	<ul style="list-style-type: none"> Feasible implementation Potential to significantly reduce relapse rates Enhanced patient engagement and proactive health-seeking behaviours.

Other DMHIs for preventing relapse have focused on digital assessments of early warning signs such as negative affect, anxiety, hallucinations, and persecutory ideation and whether they could predict psychotic relapses in people with schizophrenia-spectrum disorders. Some findings suggest that increases in persecutory ideation and hallucinations could serve as early indicators of relapse.

These DMHIs collect data from questionnaires completed by patients, but some smartphone sensors and wearable digital devices can passively collect other data such as geolocation, communication patterns, social media behaviour, activity levels, and environmental sensors which some studies suggest could be put into predictive models that could detect subtle, moment-to-moment changes that signal an increased risk for psychosis relapse.¹⁵⁻¹⁷

DMHI design and development

Several of the DMHIs described so far have received input from experts by experience during their design and development phases

through feedback rounds, focus groups,^{9,11,14,16} and field studies.⁹ However, many of the multiple outcomes used to evaluate these DMHIs, such as relapse rates, symptom severity, quality of life, and social functioning, were not generally informed by experts by experience. For studies involving passive data collection, developers implemented automated pipelines to de-identify (or depersonalize) highly sensitive data, such as GPS information and provided participants with opt-out options.^{22,28,29} However, these studies did not report whether experts by experience were involved in the design and testing of these data safety and protection processes.

While some studies required participants to have a basic familiarity with information technology, as assessed through a simple questionnaire, for study eligibility¹², other studies did not impose restrictions based on digital literacy. Instead, these studies implemented training phases at the beginning of the interventions to ensure participants were adequately prepared.^{9,10,11}

Cardiovascular risk and tobacco smoking

Some DMHI research has focused on promoting healthy living, given the increased risk of heart disease for people with schizophrenia.²⁴ DMHs for weight, cardiorespiratory fitness and reducing cardiovascular disease risk usually involve multiple components such as weekly exercise sessions, dietary guidance and peer support.

Those targeting tobacco smoking often include motivational decision support.

Table 3 lists the trials that focused on weight and tobacco smoking. While these have not shown significant improvements compared to control groups, they have demonstrated high usability for these DMHs.

Table 3: List of identified trials for weight and smoking cessation

Name	Aim and use	Intervention	Result
PeerFIT vs BEAT ²⁵	To compare group lifestyle intervention with one-on-one mHealth coaching for young adults with a major mental health condition who are overweight or obese.	PeerFIT: 12-month group intervention with mHealth, including group meetings, exercise sessions, dietary guidance, and peer support via Facebook, Fitbit, and text messages. BEAT: One-on-one mHealth coaching.	Both groups achieved significant improvements in weight, cardiorespiratory fitness and cardiovascular disease risk reduction with no significant differences between them.
Let's Talk About Smoking ²⁶	To evaluate an interactive digital motivational decision support system for smoking cessation in people with schizophrenia who smoke.	Interactive digital motivational decision support system vs NCI educational pamphlet.	No significant differences in treatment initiation, quit attempts, or abstinence. Higher satisfaction and usability for the digital system.
Learn to Quit vs QuitGuide ²⁷	To compare a smoking cessation app with a general population app in daily smokers with a major mental condition.	Learn to Quit: Smoking cessation app for SMI. QuitGuide: General population smoking cessation app.	Learn to Quit users had more app interactions, longer use durations, higher usability scores, and greater cigarette reductions per day. Higher abstinence rates at 16 weeks, although these were not statistically significant.

Ongoing trials

Table 4 lists 13 of the 16 ongoing trials for people with schizophrenia. These trials provide an interesting and diverse range of potential future DMHs. Their focus is on remediation strategies and incorporating virtual reality technology to enhance symptom management

(e.g. negative symptoms and auditory hallucinations), improve social cognitive function, treatment engagement, relapse prevention, increase caregivers' knowledge and skills, enhance daily living skills and reduce stigma and increase empathy towards people with schizophrenia.

Table 4: Ongoing trials of DMHs for people with schizophrenia

Name (Trial ID)	Aim and use	Intervention
CONVOKE Study (NCT05838625)	Evaluate the efficacy and safety of two prescription digital therapeutics for experiential negative symptoms in schizophrenia.	Two smartphone apps as an adjunct to standard care.
Avatar Therapy Studies (NCT04099940, NCT04054778)	Compare VR-based Avatar Therapy to CBT for auditory verbal hallucinations in schizophrenia.	VR-based Avatar Therapy vs. CBT.
VR Social Skills Training (NCT04005794)	Investigate if VR-based social skills training improves social cognitive functions and negative symptoms.	VR-based social skills training.
Digital Care for FEP (NCT06071858)	Evaluate if digital care elements increase treatment engagement in coordinated speciality services for FEP.	App-based digital outreach, reminders, and activities.
Recovery-Oriented App (NCT04657380)	Improve personal and social functioning in FEP.	Smartphone app with modules for patient priorities and treatment objectives.
Online Intervention for FEP (NCT03161249)	Reduce relapses and rehospitalizations in adolescents with FEP.	Online intervention for community functioning, quality of life, and treatment adherence.
MI-CBT for Veterans (NCT06138054)	Improve community integration for Veterans with a major mental health condition who experienced homelessness.	Combined Motivational Interviewing and CBT, delivered in-person and via mobile phone.

Name (Trial ID)	Aim and use	Intervention
mHealth for At-Risk Youth (NCT05905601)	Improve wellness and treatment engagement for young people at risk for psychosis.	Self-guided mobile health intervention.
Caregiver mHealth Intervention (NCT04949542)	Improve caregivers' knowledge and skills, reduce distress, and enhance family communication.	Mobile health intervention with interactive cognitive-behavioural modules.
VR Cognitive Remediation (NCT06038955)	Improve cognition and functional capacity in mood or psychosis spectrum disorders.	Four-week intensive VR-based cognitive remediation program.
VR Daily Living Skills (NCT04011774)	Enhance daily living skills in people with schizophrenia.	VR simulation of everyday life in a virtual town.
VR Cognitive Remediation for Social Deficits (NCT05017532, NCT05973110)	Improve social cognitive deficits and functional outcomes in schizophrenia.	Remote VR-based cognitive remediation therapy.
VR Stigma Reduction (NCT05982548)	Reduce stigma and improve empathy towards people with mental disorders, including schizophrenia.	VR intervention.

Source: clinicaltrials.gov (accessed February 2025)

Experience of digital mental health

Patient experiences

Participating patients were generally open to using DMHIs but were cautious about how this could work in practice alongside the care and treatment they receive. Many prefer face-to-face meetings but like the convenience of online sessions.

Patients were interested in exploring what apps could offer them, especially if they had not tried them before.

"... this is powerful testimony [from other patients of some apps]. I'm going to hopefully try some and see what they're like."

(Patient, male, Sweden)

Generally, DMHIs, whether suggested by their clinician or downloaded from the open market, were considered an addition to rather than a substitute for face-to-face care with a clinician. Patients compared online meetings with those that were in-person. Some have adapted to these, but others prefer face-to-face meetings.

"I like the face-to-face better; it's more real, you see the people you're talking to discuss things. It's a different experience than sitting at your house in your room with an iPad and just seeing the faces. It's not the same as it is with personal contact, I guess".

(Patient, male, Sweden)

With that in mind, many patients saw the benefits of DMHIs for targeting specific areas, such as managing social anxiety, paranoid thoughts, auditory hallucinations and assisting with the recovery process. Others were less convinced DMHIs could help with hallucinations and distinguishing what is real and not real but felt there could be some value in it.

"If I trust an app which shows me the acoustic movements in room and it says zero then I would know that this is different to what I'm perceiving. Then I'd think, 'Okay, today is a bad day, and my perceptions are very different to what's happening."

(Patient, male, Austria)

Some patients were quite selective about what apps they used (on the open market) and tested some until they found one that worked for them. Those with AI characters or avatars were not always appealing.

"I found AI tools on the internet with AI avatars speaking to me, which I found horrible. I'm talking to a bot, and there are even Ads around for AI girlfriends. It's uncontrolled, and it's really not helpful. What I found most helpful is the Plum Village app (based on Buddhism), which has a lot of things rooted in reality. It's totally unstigmatizing as it isn't on mental health, and that's quite important. The app gives me freedom from many bad thoughts and feelings about big data and confidentiality. If privacy is not in place, this opens the door to paranoia."

(Patient, male, Austria)

Accountability, trust in clinicians and stigma are other important areas to consider for DMIHs.

"Luckily, I have doctors I trust and if they say, 'I need your data please, your biomarkers for the next month or six months'. I say, 'It's fine, but it must be within a confined time frame,' so I don't have the feeling I'm giving myself to the devil."

(Patient, male, Austria)

Apps that give their users the ability to self-direct their activities make it a more personalized experience, for example setting goals or areas to focus on that they consider important, such as concentration.

"Concentration is a huge thing now. If you're confused and out of your mind, then anchors of concentration can help you to survive and not to drift. If you put your hand on your belly and breathe into your diaphragm, which is this easy. I need another person to remind me of this, and it's better if it's not a bot."

(Patient, male, Austria)

Patient vulnerabilities, the internet and social media

The Internet, unregulated open-market apps, and social media present certain challenges for people with schizophrenia, particularly if they experience symptoms such as paranoia or require immediate support at their most vulnerable. Digital mental health apps may not always be appropriate, and human contact may be the best option.

"There are a lot of rabbit holes on the internet and someone who's going through schizophrenia and becoming unwell may not want to be brought down into a phone [to use an app] but instead call for real support with real people..."

(Patient, male, Ireland)

Social media was considered potentially addictive and not felt to be a particularly safe space at times.

"I don't use social media... it's addictive. It's not the worst addiction of course but it is addiction. It's an echo chamber, and if you're sick [it's not good]."

(Patient, male, Sweden)

The ability to connect with others virtually helped some patients be less isolated when they did not wish to go out.

"If I'm in a bad mood or have psychosis, I don't like to go anywhere. Being in my room, on my computer, I can still keep in contact with people. For me, the Internet is very important. I listen to music on YouTube, and I think the internet is a window to the world."

(Patient, male, Hungary)

However, peer support via digital means is another way patients can connect and keep in touch with each other. Apps designed for this purpose avoid the pitfalls of social media and the wider internet.

Several patients reported using various apps and online tools to:

- Check their thoughts, identify cognitive errors, and help reframe these (e.g. Mindless)
- Aid recovery by focusing on specific goals (exercising, improving sleep) (e.g. SuperBetter), mindfulness (e.g. Compassion-Focused Therapy) and meditation
- Improve social and communication skills using Virtual Reality tools
- Addressing paranoid thoughts, auditory hallucinations and social anxiety using digital or text therapy (e.g. Voice Here in Hungary)
- Meet with peers and their clinicians for outpatient appointments.

Tables 5 and 6 list the benefits and challenges of DMHIs based on the findings from the workshops and interviews with patients and clinicians.

Table 5: Benefits of digital apps and tools for patients and clinicians

Digital tools	Patients	Clinicians
Online meetings with clinicians	A convenient communication tool that works well, reduces the need for travel to appointments and induces less social anxiety.	
Online peer and social support	Connecting online via private social media groups to share information and experiences and receive social support from peers.	
Apps – symptom management, recovery tools (open market)	Managing voices, support with setting goals to exercise, sleep, healthy eating, meditation.	
Apps for therapy and self-care available anytime (e.g. 24/7)	Complimentary to treatment and care from clinicians <i>but</i> not a replacement.	
Compassion-focused therapy (open market app)	Based on secular Buddhism. Considered helpful with recovery, calming when working through a psychotic episode, uses mindfulness and meditation.	

Digital tools	Patients	Clinicians
Virtual reality programmes (prescribed or recommended by a clinician)	For improving social interactions, mentalisation, paranoia and auditory hallucinations, such as avatar therapy.	
Widens access to psychosocial support		Many patients with schizophrenia do not receive integrated psychosocial and pharmacological treatment, which limits their exposure to evidence-based interventions. Digital tools could bridge this gap, but they still need to be accessible to this vulnerable population.

Table 6: Challenges of digital apps and tools for patients and clinicians

Digital tools	Patients	Clinicians
Online meetings	Not suitable during a relapse or when in crisis.	
e-health app or chat/therapy bot	The interaction feels less personal and less genuine if communication follows a set pattern or script.	
Open market apps and tracking tools)	Some, especially free apps, are rudimentary or basic and are potentially inappropriate. Tracking tools (e.g. cookies) can record how people use apps and the internet.	
Security issues, privacy and data hacking risks	Storing sensitive healthcare data, including personal details (e.g. on the Cloud), can be open to security breaches by hackers.	

Digital tools	Patients	Clinicians
Dependency or problematic relationships with virtual agents or bots	Artificial intelligence tools create characters or agents that can converse with people and develop 'social relationships'.	
Affordability of smartphones, internet access, and fees for apps	Not all patients can afford or have access to smartphones to download and use DMHIs or have access to the internet or WIFI in a private space.	
Digital exclusion	Some patients, especially seniors, may lack digital literacy to access and use DMHIs. The costs of apps can also be difficult.	
Risk of unregulated (open market) apps or AI chats or video call apps increasing symptoms	Apps or digital tools downloaded from the open market may put patients at risk by worsening paranoia through algorithms and targeted adverts.	
Role of funding and lack of reimbursements for DMHIs		The cost and availability of funding for digital health tools present significant barriers. In some regions, funding is readily available for such tools, but the lack of resources limits their use in others. The inclusion of DMHIs in health guidelines is important to ensure that they can be prescribed and reimbursed.
Resistance towards and barriers to the widespread adoption/implementation of DMHIs and new technology to deliver care and treatment	Some people with schizophrenia may be fearful of using computers and other DMHIs to manage their condition.	Some clinicians prefer traditional face-to-face methods and feel more comfortable treating anxiety or depression with digital tools, and are more hesitant with schizophrenia due to the complexity of psychosis.

Digital tools	Patients	Clinicians
Cognitive impairment		Cognitive impairments in schizophrenia can make it harder for patients to engage with digital tools effectively.
Limited number of evidence-based DMHIs and good quality studies		Good quality evidence from randomised control trials is difficult to achieve, which means few DMHIs will be recommended by national institutes such as NICE.
Lack of e-health data alerts		E-health data/records such as blood results or symptoms do not always include pop-ups or notifications for the clinician. This requires clinicians to check for results, which is time-consuming.
Concerns about app data collection, storage and use	Some patients are concerned about where the data they input into an app goes (e.g. symptoms), how this is used and stored.	

Carers and DMHIs

Carers described challenging situations with the relative they cared for, which need to be considered if they are to collaborate in the use of DMHIs. Knowing how a relative was regarding their symptoms is important information for carers.

"We are in contact when he [the patient] is well, but we don't speak very much about his illness. Sometimes, he contacts me when he's not very stable, then I email his treatment team saying that he has symptoms."

(Carer, female, Sweden)

Awareness and understanding of their relative's symptoms are an important part of managing these. This indicates how DMHIs might help carers support their relative. However, it is not without its difficulties. Parents caring for young people under 18 years at risk of psychosis who use DMHIs are likely to be given access to their children's data, which may be challenging. Some DMHIs can be part of a psychoeducation programme for patients, which might include carers. This may not always be welcome or practical. Clinicians need to reassure and guide carers about the benefits psychoeducation programmes can bring, even if they are not digital.

"Sometimes I see parents, they are almost overwhelmed, and I would not like them to feel that [the DMHI programme] is something else they should worry about, but to see the digital approach as something easier to cope with."

(Psychiatrist, male, Belgium)

Understanding their relative's illness is crucial for carers, and access to the latest up-to-date information from research would be an asset.

"I think that the main issue is to understand what happens from the perspective of my relative, and the research... I'm not sure what kind of apps or support or whatever it should be for that."

(Carer, female, Sweden)

A digital tool can be another means by which to deliver psychoeducation both for patients and carers. It needs to be thought through, however, so that it is accessible and includes the right level of information. But DMHIs that carers could make use of probably need to do more.

"What I need is easy access to professionals to say what I have seen or recognised [in my relative]. I find it quite difficult as when I communicate the early warning signs, it's always too early, and now it means that I don't communicate them...it has worsened my relationship with my relative. I would like a digital tool to help my relative understand the early warning signs better."

(Carer, female, Sweden)

Apps that can detect early warning signs before a relapse have been developed, but implementing these starts with ensuring patients and carers are aware of these tools and give them the option to use them or not.

Confidentiality is an important consideration when exchanging information about a patient's symptoms. Carers may be less inclined to submit information into an app that relates more to their emotional rather than physical health. There is less familiarity with this and a reluctance to disclose how they might be feeling.

"I don't like to provide information [about how I'm feeling]. It's easier to measure things like my heart rate, something physical. But if it's more emotional, I don't know... it feels more personal. I don't know if it's the stigma...or I don't have experience with it."

(Carer, female, Sweden)

Carers use apps to improve their own mental and physical health, for example, meditation or exercise apps. But there was a preference for walking in nature, reading or going to an exhibition to promote their mental well-being rather than using apps.

Peer support for carers is another important way for carers to connect, gain knowledge and share experiences. Older carers may find meeting face-to-face with peers preferable. Whereas younger people may prefer meeting via apps.

"I know carers are a bit older, and they prefer to meet face-to-face. That's my feeling. Maybe younger people are more comfortable meeting via apps... I've not considered DMHIs for carers before, but I found talking about it very interesting."

(Carer, female, Sweden)

Clinicians' perspectives

Clinicians described some of the DMHIs they use in their clinical practice. Several were part of clinical trials to test apps and tools for people without schizophrenia. The DMHIs used were mostly symptom monitors to detect the early signs of relapse, and one focused on cognitive remediation.

Treating depression and anxiety was considered easier with DMHIs and more challenging for psychosis, which partly explains the shortage of DMHIs designed for people with schizophrenia. However, some mental health services are introducing DMHIs. For example, in some parts of Italy, digital tools for assessing people with schizophrenia and addressing cognitive remediation using virtual reality are being explored.

In Brussels, Belgium, one child and adolescent mental health service is using a DMHI for adolescents at high risk of psychosis. Robin-Z was created by the University of Zurich, where adolescents can rate their symptoms or sleep quality. This provides a useful way for them to record their symptoms from the previous weeks without recalling them.

Gathering the evidence

Other examples of DMHIs within clinical practice are still being trialled, so it is too early to understand the full impact these will have on patient outcomes. One major setback concerns the lack of quality studies to demonstrate the effectiveness of DMHIs. Randomised control trials (RCTs) are expensive, time-consuming, and complex and require large samples to generate good-quality evidence.

"...We need to have new kinds of assessments, or studies, RCTs are too costly, and they take too long..."

(Psychiatrist, male, Germany)

This means that relevant health institutes will struggle to find DMHIs with a sufficient evidence base to be recommended for clinical practice. For example, the National Institute for Care Excellence (NICE) in the UK only lists three DMHIs: Careloop, SlowMo and Avatar, indicating that implementing these tools into clinical practice is still very much in its early stages. Yet, the open market is flooded with digital tools and developments. One way forward is to develop adaptive designs for trials.

"There is a lot of talk about adaptive trials, and this is something that comes from psychotherapy research, and I think it's really promising to have larger platforms which provide digital infrastructure to test different interventions against each other, and then step by step try to optimize treatments."

(Psychiatrist, male, Germany)

Slow implementation

Gaining approval to use novel treatments in clinical practice can be frustratingly long. New digital tools, such as the Avatar for people with psychosis, can be difficult to implement in practice. The costs for these new interventions may not be covered by insurance companies, approved by health ministers or included in treatment guidelines.

As found in the narrative review, research broadly suggests that DMHIs are largely beneficial for people with schizophrenia and effective for treating symptoms such as paranoia (SlowMo study). Part of the problem appears to lie with psychiatrists who may be more wary about introducing DMHIs to treat people with psychosis.

"I don't think the patients are the problem, I think it's us [clinicians]. I think we don't do the studies, and we don't do the implementation... We are very active with psychosis, but it took us a while to get it started with DMHIs. Someone like Phillipa Garety needed to come along to say, 'By the way, Avatar psychotherapy works... I think we should, with these kinds of digital devices, put more pressure to use it in mental health interventions now."

(Psychiatrist, male, Germany)

Cognitive impairment for people with schizophrenia may hamper efforts to implement DMHIs but can potentially increase access to psychosocial rehabilitation if people are assisted in using technology to improve these and other symptoms.

"John Torous in the US proposed the introduction of a digital navigator, someone who can assist patients in maximizing their use of this kind of new tools. This offers a way forward and can also overcome cognitive impairments."

(Psychiatrist, male, Italy)

The implementation of DMHIs appears slow and bureaucratic even for those targeting depression and anxiety, which has a larger evidence base compared to DMHIs for psychosis.

"The really bad rates of prescriptions for interventions are stagnating, and developers are now focusing on directly marketing their tools to patients and going around clinicians... If clinicians are hard to motivate to use such tools, maybe a strategy is to actively involve patients with schizophrenia in more collaborations."

(Psychiatrist, male, Germany)

Crucially, the implementation of DMHIs requires funding, which may well need to come from various sources.

"We [clinicians] need funds; otherwise, you cannot implement [DMHIs]. You are privileged if you have a lot of funds from your department, from your Ministry and so forth. But [if not] there are several costs which is a major barrier from the clinician side."

(Research psychiatrist, female, Germany)

Collaboration and co-creation

Collaboration with patients to co-create and help develop DMHIs presents a major step forward in making these acceptable and easy to use for patients.

"In Germany, the Centre for Mental Health has included patient developers from the beginning. I've found it very helpful. A lot of things I wouldn't have thought of came along."

(Psychiatrist, male, Germany)

Safety, privacy and data protection

Issues of security, privacy and safety of DMHIs in terms of their use and data collection are of the utmost importance for all stakeholders. From the perspective of clinicians and especially patients who use DMHIs, the threat of cyber-attacks is a possibility that needs to be tackled urgently before these interventions are fully implemented.

"In the UK, there was a cyber-attack, and there was a privacy issue. This is an important issue that needs to be addressed by all treatments and technology. It should be discussed with groups of core designers, patients, and clinicians as part of designing these interventions."

(Psychiatrist, female, Germany)

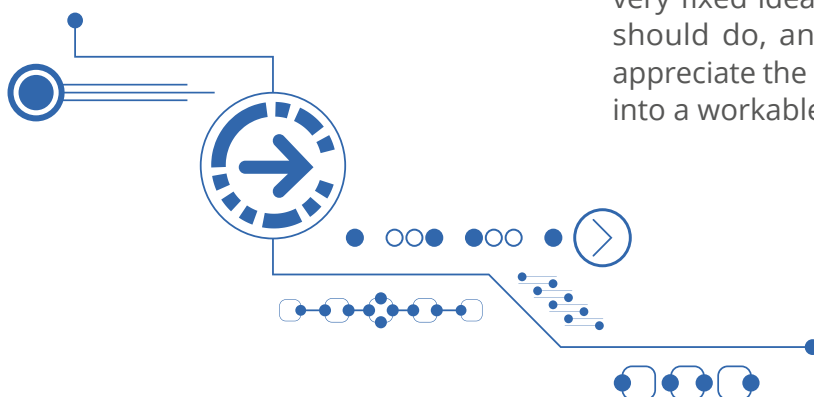
Data protection issues may arise when patients use mental health apps downloaded from the internet and share the feedback with their psychiatrist. Some patients, especially young patients, are keen to share information with their clinician about their mood. This also opens questions about quality assurances of apps, and clinicians may not know which ones to recommend.

'I never tell my patients, 'This app is good or bad', because I tend to let them choose what they prefer. Often, I don't know the app they're using, so I cannot reassure them about the data protection.'

(Psychiatrist, S, male, Belgium)

Mental health app developer

One of the primary considerations for a mental health app developer is looking at the different patient perspectives to see how an app could help support them.



"Our job was to come in and understand from a user perspective what that could translate into [for an app]. We were fortunate enough to be able to run sessions with young people who had experienced mental health issues and their views on what would be helpful. Patients were directive in how they should experience the app, like being able to change the colours to suit their mood and reflect this into the digital tool..."

(App developer, female, UK)

A collaborative approach between patients, clinicians and the developers helped ensure an app had the right ideas, look and feel.

"We included the clinicians' expertise to see what they did in their normal clinical setting and whether we could translate these activities into a digital tool. So, how could we make these activities, games and questions interactive in a way that would engage the audience, but also being quite mindful that actually if you were doing it in a session with a clinician, it would be quite a different experience to a patient doing it on their own."

(App developer, female, UK)

Working with clinicians

From a developer's perspective, working with clinicians was varied. There were those with very fixed ideas about what they felt an app should do, and others found it difficult to appreciate the challenge of putting their ideas into a workable and engaging app for users.

"I think with clinicians, sometimes they can have a real specific view on what it is they want to do. So, they can be quite linear in their thinking in terms of this work in practice; we want to put that in an app, 'Go for it...'. Or there's the other end of it where clinicians are kind of like, 'how hard can it be?', and there is a 'I can do it in an Excel spreadsheet, so why can't you do it in an app?'"

(App developer, female, UK)

Digital tools require a great deal of programming and code, making their development complicated. It can be difficult for clinicians to see the challenges of translating their clinical ideas into an app.

Developers have to manage clinicians' expectations and explain the feasibility and accessibility of what can and cannot be achieved with an app, especially regarding the language to be used.

"Clinicians can very much stay in their own space, where they feel most comfortable in terms of language and not understand that there's a requirement to use plain English that much more. And be sure that you are communicating what you want the user to do to be able to do an activity."

(App developer, female, UK)

Developers and clinicians also need to consider how people will use the app in the real world, as turning a particular therapy into an app can present unanticipated risks. Clinicians and developers need to be aware of the user's mental status when using the app.

"When we are thinking of doing mental health apps and websites, we are much more conscious of the emotional state a person is going to arrive at...so, in the apps we tend to have something called a "safety net" where you have information straight away of all the people you need to contact if you need urgent help. This hasn't necessarily come from clinicians in the first instance, but it comes from user feedback."

(App developer, female, UK)

The developer's journey and costs of app development

Developing an app involves a series of processes. This usually starts with several focus groups with the group of interest, with developers being mindful of what activities are included in an app and if users understand the ideas.

App developers are typically commercial businesses, and generally, the costs for developing apps are not cheap. Clinicians with a very limited budget and tight deadline will struggle to achieve an app that is workable in practice.

"Clinicians tend to have a fixed budget or a fixed deadline, which makes it very difficult to get patient input because of these [restrictions]... it means you can kind of only work to the budget that you've got..."

(App developer, female, UK)

Building an app is one thing, but then it requires maintenance and updates to ensure its sustainability, which also incur costs.

"...we start to build 'a minimum viable product' for about £50,000. Once you've got those elements, then you've got to think about what the hosting is going to be, how you're going to update it, and how you're going to manage software updates. This type of commercial model could be quite difficult for charities who get funding to start but no [additional funding] if they need to add new bits of functionality and updates..."

(App developer, female, UK)

"We are relying on that individual to process that information and for it to feel relevant to them. If you take a condition like schizophrenia, then there's a way that that content could be misconstrued, and that would have a negative impact. So actually, it's just being clear in the language... to tone it down rather than make more complicated..."

(App developer, female, UK)

Patient safety and quality assurances

Careful consideration needs to be given to the content and information included within an app or DMHI. Users may interpret the language or the content of an app in many different ways, and sometimes, this may have negative consequences. Developers and clinicians alike need to be mindful of this.

Part of patient safety includes ensuring that apps provide advice that has clinical and research efficacy. Apps could include Bonafide advice and strategies from a patient's perspectives, but these too would need some verification.

Incorporating DMHIs into mental health care

Trust between patients and their clinicians is a fundamental part of that relationship working well, whether meetings are online or face-to-face.

Some patients received their talking therapy online, while the general preference was for in-person meetings for some types of talking therapy, such as psychodynamic therapy or psychoanalysis. Cognitive behaviour therapy was seen as suitable to receive via an app.

"I don't think you can do psychoanalysis on your smartphone...because psychoanalysis is also a way to bond together, you and your therapist. I can't see how you can do that on a mobile. It needs human contact, but cognitive behavioural therapy is much more cognitively oriented, and you can do that with an app."

(Patient, male, The Netherlands)

Fair choices

Digital therapy sooner or a longer waiting time for in-person talking therapy has become a reality for many patients seeking treatment from mental health services. This choice, however, is not ideal.

"It's not a fair choice if you say, 'Oh you will be a year on the waiting list with no care, or we have this great app for you where you get some care.' That's not a fair choice, and you see that all the time."

(Patient, male, The Netherlands)

The option to choose whether to have an online or an in-person meeting was important for some patients, especially if they were experiencing more symptoms than usual.

"I didn't want to go in person to meet the psychiatrist when I experienced a lot of symptoms because I was paranoid about being immediately hospitalized, but I agreed to speak to her online..."

(Patient, male, Hungary)

Patients were not keen on having DMHIs as their only form of care and felt it was important to enable patients the choice between digital, in-person treatment or a combination of the two.



Artificial intelligence in the mix

Tools powered by AI are now being developed for the treatment of psychosis. Chatbots and avatars are becoming increasingly common within digital tools. For example, SlowMo DMHIs, listed in Table 1, use AI to predict the signs of relapse and alert the clinician when these are identified.

Some companies use AI tools to listen in on talking therapy, which then makes notes within the electronic patient system. Developers look at ways AI can be used in digital tools for mental health and how they can help.

"We [as developers] were testing chatbots and feeding them all kinds of different scenarios, like 'Oh, I'm feeling quite stressed as I'm getting married, blah blah, and this is what's going on for me.' Then the bot had straight away gone into symptoms of mental health conditions that the person could have, but it hadn't picked up that he was getting married. The context was missing."

(Developer, female, UK)

Ongoing work is attempting to improve AI to avoid some of the pitfalls of digital tools, particularly concerning patient safety.

"Our team of developers are looking into the ways that we could use AI better, but we are looking more in terms of process rather than in delivery of apps because of the concerns around the clinical safety. If a person is starting to get hallucinations and experiencing a potential relapse, how is a digital tool going to make sure that it doesn't contribute to that relapse?"

(Developer, female, UK)

Future of digital mental health for people with schizophrenia

An ideal world for patients

Patients identified several designs for future apps and tools that would help their specific experiences of schizophrenia. One suggested an app to make symptoms of paranoia, hallucinations and other psychotic experiences less scary.

“You could design a gaming app, for example, with an avatar that reduces how scary symptoms can be. It could make symptoms diminish and then make them go away and reduce the anxiety that goes with these symptoms.”

(Patient, female, Hungary)

“People with schizophrenia should be involved early in the process...It should be based on what the users think is important, and people with schizophrenia should be with the team from start to implementation and when they release the game or the app.”

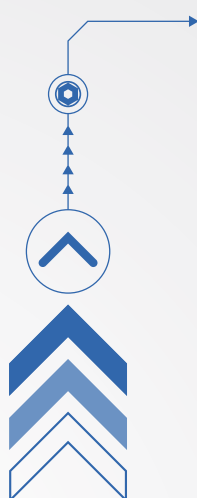
(Patient, male, Sweden)

DMHI design and development

Engagement at every stage

The inclusion of experts by experience and people with lived experience of schizophrenia in the design and development of DMHIs is essential.

User input and perspectives provide important insights, including those from neurodivergent networks and groups. It helps provide different perspectives and lateral thinking to DMHI projects and a meaningful way to improve treatment. This collaborative process also needs to include clinicians and other important stakeholders, such as carers.



App development case example

The Voice Here app was designed for people with schizophrenia, given the lack of apps for this group. Its design and development began in 2018 and included a team of people – patients (from the Awakenings Foundation, Hungary), carers/relatives, clinicians (psychiatrists and psychologists), an expert in communications and a programmer for the coding. The timeline for the app development was a year. Regular meetings were convened to discuss the features of the app and its content. The app was tested with patients and clinicians. It is provided for free and available in Hungarian. Updates of the app have stopped but are due to commence again.

An ideal world for clinicians

Several ideal DMHIs were described. One clinician felt a tool designed to manage delusions, voices or residual symptoms would be useful and that it could provide some feedback on how beneficial it was for the patient before appointments.

"If I can dream... then I'd come to my treating psychiatrist [as a patient], and /she just clicks on one of those devices, and sends me the link, and as a patient, I can download it on my app and use it. And then, each time I come back to my psychiatrist, I can tell whether it works or whether it didn't work."

(Psychiatrist, male, Germany)

But even these ideal tools would require patients willing to accept and be able to use them, which again points to the importance of co-developing DMHIs.

Another suggestion is an app to alert the clinician if a patient is completing a safety plan to prevent suicide.

"If we want to prevent something and it's quite delicate [like suicide prevention], it could be a nice application, but we need some backup that is relying on mental health professionals. There are apps or websites which have a trigger alert; they send the phone number of, for example, the suicidal crisis here in Brussels and we have one, but it is still up to the individual to do the action (e.g. go to the emergency room or alert a clinician)."

(Psychiatrist, male, Belgium)

The same clinician was keen to see apps to assist patients in managing their medication and dosage, as setting phone alarms is not always appropriate.

"I tell my patients, 'I know that you can forget to take your medication, so let's set your alarm now because you can forget, and if you do, then we are not advancing.'"

(Psychiatrist, male, Belgium)

Changing relationship between patients and clinicians

Digital tools have the power to change the way patients and clinicians relate to each other. DMHIs enable patients to self-manage their condition and their symptoms in some ways independently. While DMHIs are not a full replacement for clinical care, they can empower patients by giving them more control in managing their condition and in the quality of their conversations with their clinician.

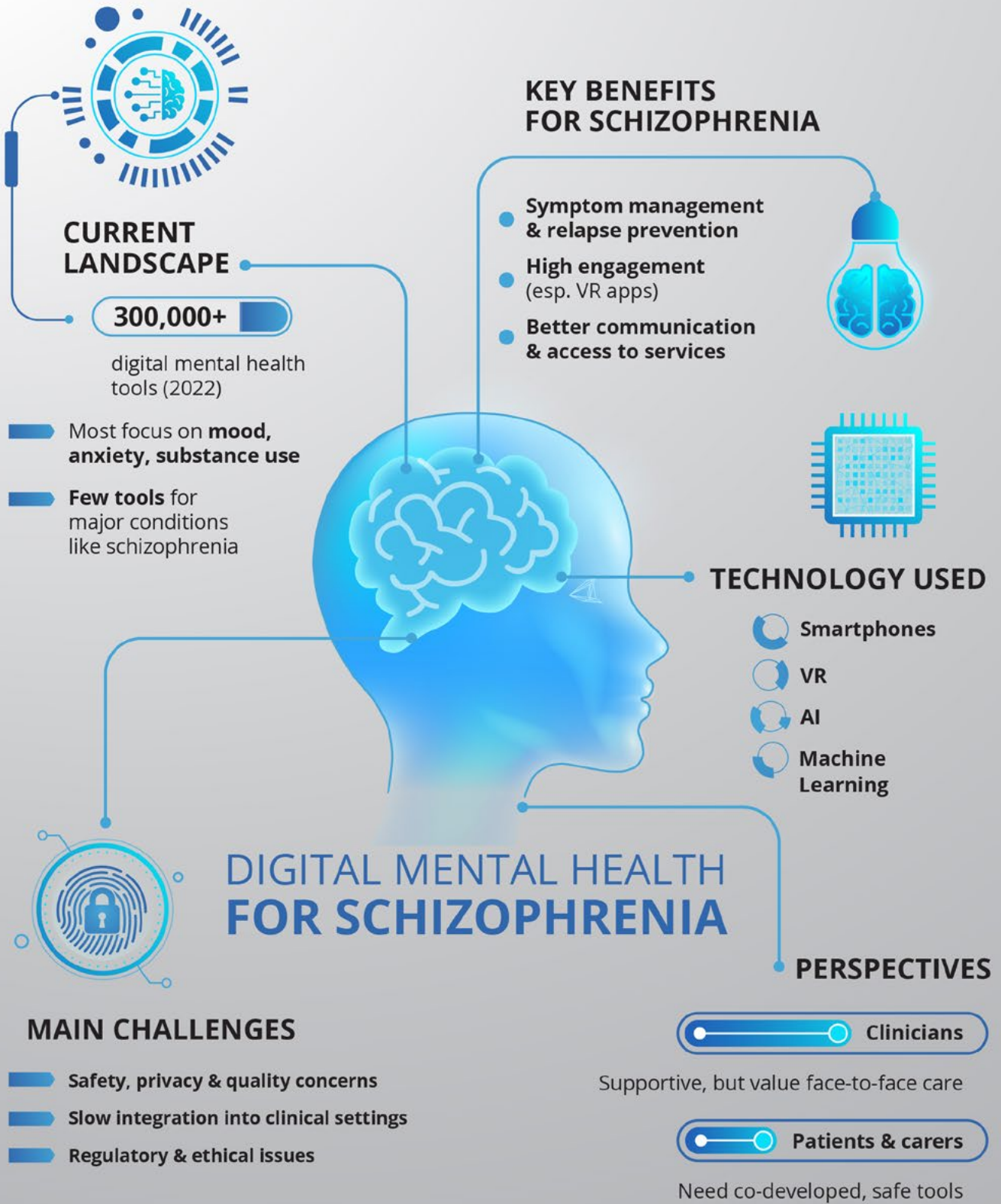
"The use of apps is changing the patient and clinician dynamic, and it is changing the conversation, because if you [as a patient] can hold that information yourself, if you can take some control, you can evidence that back [to the clinician]. The quality of the conversation [between the clinician and the patient] is going to be better because you can discuss the app feedback and say whether the app worked or not."

(App developer, female, UK)

Some patients are keen to monitor their mood with an app and share the feedback with their psychiatrist.

"Mood is the one thing that adolescents are assessing themselves. I never ask them to show me these, but some of them spontaneously send me screenshots by email. They want to share"

(Psychiatrist, male, Belgium)



FUTURE DIRECTIONS



Digital tools **should complement, not replace** traditional care

Focus on **safety, security, and quality**

More **research & clinical integration** needed

Discussion

The narrative review shows a small but growing increase in DMHIs for people with schizophrenia, which has helped address critical gaps in current pharmacotherapeutic and psychotherapeutic treatments, particularly in managing persistent symptoms of psychosis, preventing relapses, and improving general health and substance use disorders.

DMHIs in the trials reviewed have revealed high user engagement and satisfaction and the feasibility of virtual reality, which is suited to addressing symptoms that are otherwise hard to observe. Ongoing DMHIs trials are focusing on cognitive remediation, which further advances the field.

A wealth of insights was gathered to help guide the future developments of DMHIs. The workshops and interviews with patients, carers and clinicians demonstrate the key challenges to be addressed in the development, use and adoption of DMHIs into practice. Patients highlight the importance of face-to-face care but welcome the opportunity to use apps and digital tools to help manage their symptoms of schizophrenia day to day. Some have found and use apps from the open market, but care needs to be taken when selecting these apps for those who are more vulnerable. Recommended apps by clinicians and peers can be useful in terms of guiding patients towards trusted DMHIs.

The benefits and the challenges of DMHIs are numerous, and this report touches on several key ones for those participating in the project. For patients, the convenience of communication with clinicians and managing symptoms are important.

For carers, DMHIs appear less well known, but these present the opportunity for better access to psychoeducation and information about schizophrenia. For clinicians, enabling access to more psychosocial interventions to address cognitive remediation, for example,

is important. The challenges highlighted by clinicians include the slow implementation of DMHIs into clinical practice and the need for more trials to generate the evidence base.

Involving patients in the whole development process of DMHIs is essential. Ensuring the safety, privacy, security, quality assurances and accountability of DMHIs need to be addressed urgently, particularly apps on the open market. App developers echo the importance of user engagement in the development process, along with app safety for vulnerable patients. The involvement of clinicians in the process is similarly important, although they may need to be guided in what apps can and cannot achieve.

Implementing DMHIs into mental health care has some way to go, but its future direction is important to guide well. Patients and clinicians have bold ideas about DMHIs in an ideal world, which should be embraced, particularly in the sharing of information between them. The co-development of DMHIs between patients and clinicians is vital to their success. Carers also need to be included as little is known about how DMHIs can best support them.

DMHIs have the potential to change the way patients and clinicians talk about symptoms and potential treatments. Patients could have more control regarding the data they input into an app, self-managing their symptoms and make use of the feedback regarding their symptoms – all of which could enrich conversations with their clinician.

A way forward

There is no stopping the current digital mental health revolution, but a great deal of groundwork remains to be done to ensure digital mental health tools, especially those available on the open market, are made safe and private. Many, if not all, DMHIs cannot be used as a total replacement for face-to-face clinical care and treatment. The participating

patients, clinicians and developers all agree on this. These tools have the potential to enhance the way patients can self-manage their symptoms day to day and receive care from their clinicians. It opens up new avenues to shape the future of mental health care, which can promote effective adjuncts and/or alternatives to psychopharmacological treatments and the sole reliance on these.

Conclusion

DMHIs for schizophrenia are showing promising potential in addressing critical gaps in current treatment approaches

- DMHIs are increasingly being developed and tested with positive results in user engagement and satisfaction.
- These interventions can complement traditional treatments, particularly in managing persistent symptoms, preventing relapses, and improving overall health.
- Patients, carers, and clinicians recognise both the benefits and challenges of DMHIs, emphasizing the importance of maintaining face-to-face care while leveraging digital tools for symptom management and self-care.
- The development and implementation of DMHIs require careful consideration of safety, privacy, and quality assurance, especially for apps available on the open market.
- Co-development involving patients, carers, clinicians, and app developers is crucial for the success and adoption of DMHIs.
- While DMHIs show great promise in revolutionising mental health care, they should be viewed as complementary to traditional treatments rather than replacements.
- Moving forward, continued research, collaborative development, and thoughtful implementation will be essential to harness the full potential of DMHIs in improving the lives of people with schizophrenia while ensuring safe and effective integration into existing care models.

Recommendations

Based on the findings of this report and the literature reviewed, we make the following recommendations for patients with schizophrenia, clinicians, carers and policymakers:

Patients with Schizophrenia

- Engage with DMHIs that are safe to use and ideally recommended by clinicians or trusted sources (e.g. NGOs or government organisations) to help manage symptoms and prevent relapse.
- Avoid using open-market digital tools that worsen your symptoms at your most vulnerable time.
- Consider using smartphone-based therapies, which are practical and acceptable for most patients.
- Participate in the development and testing of DMHIs to ensure they meet your needs and preferences where the opportunity occurs.
- Be aware that while DMHIs can be helpful, they are meant to augment, not replace, face-to-face clinical care.

Recommendations for Clinicians

- Familiarize yourself with the latest DMHIs recommended for use in clinical services, such as AVATAR therapy for voice-hearing and SloMo for managing paranoia.
- Integrate DHTs into your practice to enhance medication adherence and symptom management for patients with schizophrenia.
- Collaborate with patients to personalize digital interventions and ensure they complement existing treatment plans¹⁵.
- Participate in multidisciplinary collaborations to develop and implement DMHIs in real-world settings.

Recommendations for Carers

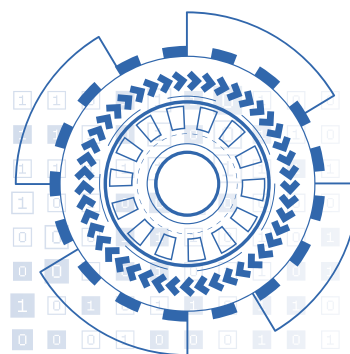
- Learn about available DMHIs to support your relatives or friends with schizophrenia in their day-to-day symptom management.
- Encourage and assist patients in using recommended digital tools as part of their overall care plan.
- Provide feedback on the usability and effectiveness of DMHIs from your perspective as a carer.
- Explore what digital tools can help support you as a carer, such as psychoeducation apps (where available) and tools to help promote your physical and mental health.

Recommendations for Developers

- Complement care by designing DMHIs to enhance symptom management and self-care alongside traditional treatments for people with schizophrenia.
- Ensure safety and privacy by implementing robust safety measures and data privacy for all apps, especially those on open markets.
- Co-develop with stakeholders by involving patients, carers, clinicians, and developers in the design process to meet user needs.
- Enhance user engagement by using strategies like personalization and gamification to improve engagement and ensure accessibility.
- Continuously improve by conducting ongoing research to evaluate efficacy and incorporate innovations in digital mental health.

Recommendations for Policymakers

- Support the implementation of NICE recommended digital health technologies within mental health services to improve care for people with psychosis.
- Invest in research and development of DMHIs, focusing on areas such as data sharing, measuring harms, and prevention strategies.
- Develop clear regulatory frameworks for digital mental health tools to ensure safety, privacy, accountability and quality assurance.
- Promote organisational changes that facilitate true coproduction with those who have lived experience of schizophrenia in the development of DMHIs.
- Allocate funding for training healthcare professionals in the use and integration of digital mental health tools.



Appendix 1 - Methods

Narrative review on DMHIs

The narrative review was conducted to delineate key uses of DMHIs for people with schizophrenia. This review aimed to highlight DMHIs that are a) available on app stores; b) supported by randomized-controlled trials (RCTs) published within the past five years; and c) accompanied by RCTs that have been pre-registered in clinical trial registries. The review will play a crucial role in identifying significant gaps in the availability and efficacy of DMHIs for patients with schizophrenia.

The review methodology included a) exploring the mindapps.org platform for relevant applications; b) conducting a rapid search of peer-reviewed RCTs in bibliographic databases like PubMed, using a targeted set of search terms and keywords; and c) examining the International Clinical Trials Registry Platform for pre-registered RCTs.

The outcomes of this review were synthesized to develop relevant inquiries for a series of workshops and in-depth interviews with relevant stakeholders, thereby enhancing our understanding of the needs and opportunities in DMHIs for schizophrenia.

Workshops

Two workshops were convened with patients and clinicians familiar with DMHIs. The workshops included up to 10 participants each to explore and discuss key questions developed in a topic guide to address the three main objectives. An experienced mental health facilitator moderated the workshops, which lasted between 90 and 120 minutes each.

Depth or group interviews

Following the workshops, five depth interviews were conducted with patients (2), a clinician, carer (2) and app developer (1). These interviews further expanded on the key themes identified from the workshops to explore in more detail if and how DMHIs meet the needs of those who use them (patients, carers, and clinicians). And how this can be best achieved for people diagnosed with schizophrenia.

Sampling and recruitment

The project was focused primarily on adults above the age of 18 years, although some reference was made to DMHIs for young people at risk of psychosis. Recruitment of participants for the workshops and in-depth interviews was carried out by each partner organisation (GAMIAN-Europe, EUFAMI and the EPA), inviting their members to take part. Calls for participants were made through their social media networks and publicity on their respective websites.

Data analysis

Transcripts were produced for each workshop and in-depth interview and analysed to identify key themes and patterns from the discussion.

References

- ¹Bond RR, Mulvenna MD, Potts C, et al. Digital transformation of mental health services. *Perspective. Mental Health Research* (2023) 2:13 ; <https://doi.org/10.1038/s44184-023-00033-y>
- ²Naslund JA, Gonsalves PP, Gruebner O, Pendse SR, Smith SL, Sharma A, Raviola G. Digital Innovations for Global Mental Health: Opportunities for Data Science, Task Sharing, and Early Intervention. *Curr Treat Options Psychiatry*. 2019 Dec;6(4):337-351. doi: 10.1007/s40501-019-00186-8.
- ³Lattie EG, Stiles-Shields C, Graham AK. An overview of and recommendations for more accessible digital mental health services. *Nat Rev Psychol*. 2022 Feb;1(2):87–100.
- ⁴Philippe TJ, Sikder N, Jackson A, Koblanski ME, Liow E, Pilarinos A, et al. Digital Health Interventions for Delivery of Mental Health Care: Systematic and Comprehensive Meta-Review. *JMIR Ment Health*. 2022 May 12;9(5):e35159.
- ⁵Karyotaki E, Efthimiou O, Miguel C, Bermpohl FMG, Furukawa TA, Cuijpers P, et al. Internet-Based Cognitive Behavioral Therapy for Depression: A Systematic Review and Individual Patient Data Network Meta-analysis. *JAMA Psychiatry*. 2021 Apr 1;78(4):361–71.
- ⁶Clarke S, Hanna D, Mulholland C, Shannon C, Urquhart C. A systematic review and meta-analysis of digital health technologies effects on psychotic symptoms in adults with psychosis. *Psychosis*. 2019 Oct 2;11(4):362–73.
- ⁷Kalman JL, Burkhardt G, Samochowiec J, et al. Digitalising mental health care: practical recommendations from the European Psychiatric Association. *Eur Psychiatry*. 2023 Dec 13;67(1):e4. doi: 10.1192/j.eurpsy.2023.2466
- ⁸Van der Eycken, E. Person-based e-Mental Health Care. A view from users' and care givers' perspective. *Health Management*, 21 (3) (2021). Accessed on 18/9/2023 from: <https://healthmanagement.org/c/healthmanagement/issuearticle/person-based-e-mental-health-care>
- ⁹Nagy M and Sisk B. How will artificial intelligence affect patient-clinician relationships? *AMA J Ethics*. 2020;22(5):E395-400. doi: 10.1001/amajethics.2020.395.
- ¹⁰Ghaemi SN, Sverdlov O, van Dam J, Campellone T, Gerwien R. A Smartphone-Based Intervention as an Adjunct to Standard-of-Care Treatment for Schizophrenia: Randomized Controlled Trial. *JMIR Form Res*. 2022 Mar 28;6(3):e29154.
- ¹¹Ben-Zeev D, Buck B, Meller S, Hudenko WJ, Hallgren KA. Augmenting Evidence-Based Care With a Texting Mobile Interventionist: A Pilot Randomized Controlled Trial. *Psychiatr Serv*. 2020 Dec 1;71(12):1218–24
- ¹²Ben-Zeev D, Chander A, Tauscher J, Buck B, Nepal S, Campbell A, et al. A Smartphone Intervention for People With Serious Mental Illness: Fully Remote Randomized Controlled Trial of CORE. *J Med Internet Res*. 2021 Nov 12;23(11):e29201.
- ¹³Bell IH, Rossell SL, Farhall J, Hayward M, Lim MH, Fielding-Smith SF, et al. Pilot randomised controlled trial of a brief coping-focused intervention for hearing voices blended with smartphone-based ecological momentary assessment and intervention (SAVVy): Feasibility, acceptability and preliminary clinical outcomes. *Schizophr Res*. 2020 Feb;216:479–87.
- ¹⁴Jongeneel A, Delespaul P, Tromp N, Scheffers D, van der Vleugel B, de Bont P, et al. Effects on voice hearing distress and social functioning of unguided application of a smartphone app - A randomized controlled trial. *Internet Interv*. 2024 Mar;35:100717
- ¹⁵Dellazizzo L, Potvin S, Phraxayavong K, Dumais A. One-year randomized trial comparing virtual reality-assisted therapy to cognitive-behavioral therapy for patients with treatment-resistant schizophrenia. *NPJ Schizophr*. 2021 Feb 12;7(1):9.

- ¹⁶Garety P, Ward T, Emsley R, Greenwood K, Freeman D, Fowler D, et al. Effects of SlowMo, a Blended Digital Therapy Targeting Reasoning, on Paranoia Among People With Psychosis: A Randomized Clinical Trial. *JAMA Psychiatry*. 2021 Jul 1;78(7):714–25.
- ¹⁷Freeman D, Lambe S, Kabir T, Petit A, Rosebrock L, Yu LM, et al. Automated virtual reality therapy to treat agoraphobic avoidance and distress in patients with psychosis (gameChange): a multicentre, parallel-group, single-blind, randomised, controlled trial in England with mediation and moderation analyses. *Lancet Psychiatry*. 2022 May;9(5):375–88.
- ¹⁸Stear T, O'Hanlon P, Eskinazi M, Osborn D, Lloyd-Evans B, Jones R, et al. Smartphone-delivered self-management for first-episode psychosis: the ARIES feasibility randomised controlled trial. *BMJ Open*. 2020 Aug 26;10(8):e034927.
- ¹⁹Alvarez-Jimenez M, Koval P, Schmaal L, Bendall S, O'Sullivan S, Cagliarini D, et al. The Horyzons project: a randomized controlled trial of a novel online social therapy to maintain treatment effects from specialist first-episode psychosis services. *World Psychiatry*. 2021 Jun;20(2):233–43.
- ²⁰Grasa E, Seppälä J, Alonso-Solis A, Haapea M, Isohanni M, Miettunen J, et al. m-RESIST, a Mobile Therapeutic Intervention for Treatment-Resistant Schizophrenia: Feasibility, Acceptability, and Usability Study. *JMIR Form Res*. 2023 Jun 30;7:e46179.
- ²¹Homan P, Schooler NR, Brunette MF, Rotondi A, Ben-Zeev D, Gottlieb JD, et al. Relapse prevention through health technology program reduces hospitalization in schizophrenia. *Psychol Med*. 2023 Jul;53(9):4114–20.
- ²²Buck B, Hallgren KA, Campbell AT, Choudhury T, Kane JM, Ben-Zeev D. mHealth-Assisted Detection of Precursors to Relapse in Schizophrenia. *Front Psychiatry*. 2021 May 31;12:642200.
- ²³Gumley AI, Bradstreet S, Ainsworth J, Allan S, Alvarez-Jimenez M, Aucott L, et al. The EMPOWER blended digital intervention for relapse prevention in schizophrenia: a feasibility cluster randomised controlled trial in Scotland and Australia. *Lancet Psychiatry*. 2022 Jun;9(6):477–86.
- ²⁴Fan Z, Wu Y, Shen J, Ji T, Zhan R. Schizophrenia and the risk of cardiovascular diseases: a meta-analysis of thirteen cohort studies. *J Psychiatr Res*. 2013 Nov;47(11):1549–56.
- ²⁵Aschbrenner KA, Naslund JA, Gorin AA, Mueser KT, Browne J, Wolfe RS, et al. Group Lifestyle Intervention With Mobile Health for Young Adults With Serious Mental Illness: A Randomized Controlled Trial. *Psychiatr Serv*. 2022 Feb 1;73(2):141–8.
- ²⁶Brunette MF, Ferron JC, McGurk SR, Williams JM, Harrington A, Devitt T, et al. Brief, Web-Based Interventions to Motivate Smokers With Schizophrenia: Randomized Trial. *JMIR Ment Health*. 2020 Feb 8;7(2):e16524.
- ²⁷Vilardaga R, Rizo J, Palenski PE, Mannelli P, Oliver JA, McClernon FJ. Pilot Randomized Controlled Trial of a Novel Smoking Cessation App Designed for Individuals With Co-Occurring Tobacco Use Disorder and Serious Mental Illness. *Nicotine Tob Res*. 2020 Aug 24;22(9):1533–42.
- ²⁸ Henson P, D'Mello R, Vaidyam A, Keshavan M, Torous J. Anomaly detection to predict relapse risk in schizophrenia. *Transl Psychiatry*. 2021 Jan 11;11(1):28.
- ²⁹ Cohen A, Naslund JA, Chang S, Nagendra S, Bhan A, Rozatkar A, et al. Relapse prediction in schizophrenia with smartphone digital phenotyping during COVID-19: a prospective, three-site, two-country, longitudinal study. *Schizophrenia (Heidelb)*. 2023 Jan 27;9(1):6.



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