

Editorial

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Corresponding author:

Inez Myin-Germeys;

Email: inez.germeys@kuleuven.be

The experience sampling methodology as a digital clinical tool for more person-centered mental health care: an implementation research agenda

Inez Myin-Germeys¹ , Anita Schick^{2,*} , Thomas Ganslandt^{3,*} , Michal Hajdúk^{4,5,*} , Anton Heretik^{4,*} , Ine Van Hoyweghen^{6,*} , Glenn Kiekens^{1,7,8,*} , Georgia Koppe^{9,10,11,*} , Luca Marelli^{6,12,*} , Iveta Nagyova^{13,*} , Jeroen Weermeijer^{1,*} , Michel Wensing^{14,*} , Maria Wolters^{15,*} , Joanne Beames¹ , Manuela de Allegri¹⁶ , Simona di Folco¹⁷ , Daniel Durstewitz^{9,18,19} , Zuzana Katreniaková¹³ , Elisa Lievevrouw^{6,20} , Hoa Nguyen¹⁶ , Jan Pecenak⁵ , Islay Barne¹⁷ , Rafael Bonnier¹ , Manuel Brenner^{9,19} , Natália Čavojská⁵ , Daniel Dancik^{4,5} , Adam Kurilla⁴ , Erica Niebauer¹⁷ , Koraima Sotomayor-Enriquez¹⁷ , Julia Schulte-Strathaus² , Lena de Thurah¹ , Lotte Uyttebroek¹ , Matthias Schwannauer^{17,†}  and Ulrich Reininghaus^{2,21,22†} 

Abstract

This position paper by the international IMMERSE consortium reviews the evidence of a digital mental health solution based on Experience Sampling Methodology (ESM) for advancing person-centered mental health care and outlines a research agenda for implementing innovative digital mental health tools into routine clinical practice. ESM is a structured diary technique recording real-time self-report data about the current mental state using a mobile application. We will review how ESM may contribute to (1) service user engagement and empowerment, (2) self-management and recovery, (3) goal direction in clinical assessment and management of care, and (4) shared decision-making. However, despite the evidence demonstrating the value of ESM-based approaches in enhancing person-centered mental health care, it is hardly integrated into clinical practice. Therefore, we propose a global research agenda for implementing ESM in routine mental health care addressing six key challenges: (1) the motivation and ability of service users to adhere to the ESM monitoring, reporting and feedback, (2) the motivation and competence of clinicians in routine healthcare delivery settings to integrate ESM in the workflow, (3) the technical requirements and (4) governance requirements for integrating these data in the clinical workflow, (5) the financial and competence related resources related to IT-infrastructure and clinician time, and (6) implementation studies that build the evidence-base. While focused on ESM, the research agenda holds broader implications for implementing digital innovations in mental health. This paper calls for a shift in focus from developing new digital interventions to overcoming implementation barriers, essential for achieving a true transformation toward person-centered care in mental health.

Over the last decade, mental health care transitioned from hospital-focused to community-based services and shifted its treatment objectives from mere symptom reduction to personally defined recovery (Slade *et al.*, 2014). Despite these advancements, mental health care has yet to fully embrace a person-centered approach, which advocates for ‘the provision of holistic, biopsychosocial, or integrative care that is responsive to people’s needs and values, ..., that empowers them and offers choice, involvement and a partnership approach’ (Boardman & Dave, 2020). However, service users of mental health care are often treated as passive recipients of care and shared decision-making practices remain limited (Slade, 2017). This is problematic, given that similar to what is expected in somatic health care (McMillan *et al.*, 2013; Santana *et al.*, 2018), engaging service users as active partners in their treatment will improve engagement with their care, help them manage their mental health problems better, and help

clinicians target the treatment closer to the needs of the individual service user, while jointly deciding the next steps in the treatment.

Digital health technologies could facilitate the transition to person-centered mental health care (Leonardsen, Bååth, Helgesen, Grøndahl, & Hardeland, 2023), although empirical research in this domain remains sparse (Ibrahim *et al.*, 2022). Moreover, despite the rapid evolution of digital mental health innovations, their clinical adoption in psychiatry and a clear understanding of the barriers to implementation and use remain limited (Torous *et al.*, 2021). This position paper by the international IMMERSE (Implementing Mobile MEntal health Recording Strategy for Europe) consortium aims to review the evidence of a digital mental health solution based on Experience Sampling Methodology (ESM) for advancing person-centered mental health care and outline a research agenda for implementing innovative digital mental health tools into routine clinical practice.

How can digital technology based on ESM advance person-centered mental health care?

The core of distress and impaired functioning related to mental health problems lies in individuals' personal subjective experiences such as feelings of depression or anxiety, difficulties falling asleep, or hearing voices. These experiences and behaviors are situated in, and interact with, the context of individuals' daily lives, implying that experience and behavior are most amenable to change precisely in this context (Myin-Germeys *et al.*, 2018; Reininghaus & Myin-Germeys, 2023). However, both clinicians and service users lack comprehensive, qualitative insights into these real-life experiences. What are the intensity and variability of these experiences over time, what are the real-time moments of risk or resilience, and how are treatment goals effectively integrated into individuals' daily routines? Insights into these daily life processes are essential for effectively (self)managing the illness course and treatment, and making informed and shared decisions. Digital tools can help bridge these gaps by facilitating the collection of relevant real-life information and supporting insight and understanding for services and their users.

In this paper, we will focus on digital tools that are based on ESM (Hektner, Schmidt, & Csikszentmihalyi, 2007; Myin-Germeys & Kuppens, 2021) (also known as Ecological Momentary Assessment [EMA] [Stone & Shiffman, 1994]). ESM is a structured self-report diary technique where service users actively gather real-time information about themselves in their natural environment using a mobile application. Service users are prompted with brief, in-the-moment questionnaires regarding their key problems, symptoms, mood, and context multiple times per day over several consecutive days. These data therefore offer insights into the individual's current mental state and patterns of risk and resilience (Myin-Germeys *et al.*, 2018). Moreover, by actively engaging the service user in the monitoring process, they underscore the potential of ESM to augment person-centered care.

ESM as a digital tool for enhancing person-centered clinical practice: what is the evidence?

Over the past two decades, research has accumulated evidence that using ESM in clinical mental health care may contribute to (1) service user engagement and empowerment, (2) self-

management and recovery, (3) goal direction in clinical assessment and management of care, and (4) shared decision-making.

Service user engagement and empowerment

A critical consideration for integrating self-report data into routine healthcare practices pertains to the willingness and capability of service users to engage in self-reporting, along with achieving acceptable compliance levels. A series of studies, including pooled data sets and meta-analytic approaches, have demonstrated that service users can reliably provide self-reports in the flow of daily life using ESM, irrespective of their diagnosis (Myin-Germeys *et al.*, 2009), reaching an average response rate in research studies of 78% (Vachon, Viechtbauer, Rintala, & Myin-Germeys, 2019) and of 70% in people with a diagnosis of psychosis (Rintala, Wampers, Myin-Germeys, & Viechtbauer, 2019). Although compliance may decrease when applied clinically, a pilot study still achieved an acceptable 50% compliance rate in routine mental health care (Weermeijer *et al.*, 2023). Moreover, findings from an app-based study focusing on monitoring early signs to enhance well-being, engagement, and recovery in psychosis, revealed that 91% of service users randomized to the app-based monitoring actively engaged with the app, with observed improvements in mental health outcomes and treatment adherence (Gumley *et al.*, 2020). These data substantiate the potential of ESM for actively engaging individuals in their care.

Furthermore, ESM has been proposed to enhance individuals' insight, understanding, and empowerment. As our ability to report on our emotional and mental states is dependent on our capacity to understand and recognize our internal experiences, self-monitoring enhances our sensitivity to recognize different mood and cognitive states and what may influence them. Qualitative studies with clinicians (Bos, Snippe, Bruggeman, Wichers, & van der Krieke, 2019; Weermeijer, Kiekens, Wampers, Kuppens, & Myin-Germeys, 2024), and service users (de Thurah *et al.*, 2023) have supported this notion. One quantitative study tested this in a clinical trial in individuals with a diagnosis of depression and demonstrated that engaging in daily self-monitoring increased feelings of empowerment (Simons *et al.*, 2015).

Self-management and recovery

Numerous studies have demonstrated that longitudinal self-report data collected through ESM are exceptionally adept at elucidating meaningful patterns of associations, helping service users to better self-manage their mental health problems. For example, these momentary data provide more accurate information compared to retrospective reports and clinical interviews, concerning mood instability (Solhan, Trull, Jahng, & Wood, 2009), relapse (Gumley *et al.*, 2020), functioning (Schneider, Reininghaus, van Nierop, Janssens, & Myin-Germeys, 2017), and quality of life (Leendertse *et al.*, 2018). Furthermore, the iterative nature of assessment enables the identification of dynamic patterns in the variation and co-variation of mood, cognition, behavior, and context over time (Myin-Germeys *et al.*, 2018). For example, in the field of psychosis, real-life increases in anxiety, and decreases in self-esteem have been linked to increases in the intensity of paranoia (Thewissen *et al.*, 2011). However, a closer examination at the individual level revealed that these group findings may not uniformly apply to each individual (Oorschot, Lataster, Thewissen, Wichers, & Myin-Germeys, 2012), underscoring the

importance of adopting a person-centered approach that facilitates the individual-level understanding of these associations in each person's context. Similarly, ESM research identified altered stress reactivity (Reininghaus et al., 2016), delayed stress recovery (Vaessen et al., 2019), and poor sleep quality as important targets for treatment (Kasanova, Hajdúk, Thewissen, & Myin-Germeys, 2020). These examples underscore how offering personalized feedback on individual patterns of risk and behavior represents a unique tool for personalized psycho-education, insight, and self-management (van Os et al., 2017). Findings from a randomized clinical trial involving patients with chronic depression have demonstrated that providing feedback on specific patterns of behavior can effectively reduce depressive symptoms (Kramer et al., 2014) and induce lasting behavioral changes (Snippe et al., 2016). In another cluster randomized controlled trial involving service users with a psychotic disorder, app-based self-monitoring significantly reduced relapse rates and facilitated symptomatic recovery when compared to routine monitoring (Gumley et al., 2020).

Goal direction in clinical assessment and management of care

The detailed information elucidating the crucial associations among symptoms, key problem areas, and their context, as described above, can also help clinicians tailor treatments towards specific and personalized goals. Nevertheless, there is limited research on its actual application in clinical practice.

In addition, this detailed and fine-grained information may contribute to better management of care, by providing more comprehensive assessments of treatment outcomes, encompassing not only symptom management but also overall well-being and functioning, while facilitating a more nuanced evaluation of possible side effects. Two studies directly comparing ESM measures to retrospective questionnaires in assessing treatment outcomes, found ESM measures to outperform conventional clinical measurements, both among individuals with depression (Moore, Depp, Wetherell, & Lenze, 2016), and psychosis (So, Peters, Swendsen, Garety, & Kapur, 2013). Moreover, ESM data have been shown instrumental in identifying early processes of change that may bear relevance for the further course of treatment. For instance, early improvements in positive affect as measured with ESM during the first week of antidepressant treatment, were found to predict the depression severity and remission after 6 weeks (Geschwind et al., 2011). Additionally, ESM enables a more accurate assessment of treatment side effects, for example by demonstrating a dampening effect of antipsychotic medication on psychotic symptoms and mood in individuals with psychosis (Lataster et al., 2011).

Shared decision-making

A cornerstone of the shared decision-making process is situational diagnosis (Wieringa et al., 2019), wherein the service user's situation is elucidated, and both the service user and clinician reach a mutual understanding of the treatment focus. In mental health care practice, this requires a comprehensive insight into moments of mental risk and resilience by both parties, aiding in the joint identification of indicators of distress and (mal)adaptive patterns of behavior (Slade, 2017). Since ESM can provide relevant and qualitative day-to-day information on key problem areas and pertinent contextual factors essential for treatment decisions and evaluating treatment progress, using ESM would foster

agency and true collaborative care driven by the needs of patients (Simblett et al., 2019). Despite some evidence in chronic somatic patients, showing that self-monitoring increased patients' understanding of the illness (Mamykina et al., 2017), scientific evidence for the role of ESM in improving shared decision-making processes is lacking.

Overall, a growing body of evidence demonstrates the value of ESM-based approaches in enhancing person-centered mental health care. However, ESM is hardly integrated into clinical practice. It is crucial to examine the reasons behind this discrepancy. What are the primary barriers and facilitators for the integration of ESM into routine mental health care and how can we harness the full potential of ESM to promote truly person-centered mental health care?

Identifying barriers and facilitators: the role of implementation research

Numerous prior efforts to implement evidence-based digital mental health approaches in clinical settings have encountered setbacks (Mohr, Riper, & Schueller, 2018). There is a growing consensus attributing these failures to a lack of understanding regarding the vast research-to-practice gap and a dearth of targeted research aimed at bridging this gap. The average timeframe for the implementation of evidence-based approaches into clinical (mental) health care spans 15–20 years (Proctor et al., 2009). This underscores the challenge of translating digital interventions in mental health, which demonstrate promising outcomes in efficacy studies conducted in controlled research settings, into sustainable clinical practices (Mohr, Weingardt, Reddy, & Schueller, 2017).

To effectively integrate ESM into routine mental health practice, we need implementation science, to develop, refine, and evaluate implementation strategies specific to ESM. Implementation science in healthcare constitutes an interdisciplinary field of research that complements basic and clinical health studies by prioritizing the translation of evidence-based interventions into healthcare practice (often referred to as the journey 'from bench to bed to practice'). The successful implementation of innovations into (routine) healthcare practice is shaped by a multitude of factors (Striffler et al., 2018), underscoring the inherent complexity involved in introducing novel methodologies such as ESM into real-world clinical settings. Barriers and facilitators for implementation may stem from various sources, including the nature of the intervention itself, the characteristics of the targeted users, and the broader organizational and societal context. Understanding these factors is crucial for developing or selecting dedicated implementation strategies that are tailored and responsive to these contextual nuances (Wensing & Grol, 2019).

A research agenda for implementing ESM in routine mental health care

In the remainder of the paper, we propose a global research agenda for implementing ESM in routine mental health care that targets six key challenges that need to be addressed: (1) the motivation and ability of service users to adhere to the ESM monitoring, reporting and feedback, (2) the motivation and competence of clinicians in routine healthcare delivery settings to integrate ESM in the workflow, (3) the technical requirements and (4) governance requirements for integrating these data in the clinical workflow, (5) the financial and competence related

resources related to IT-infrastructure and clinician time, and (6) implementation studies that build the evidence-base.

Understanding and improving the motivation and ability of service users to adhere to the ESM intervention

The successful implementation of novel digital innovations hinges on the willingness and capability of service users to adopt the methodology. Previous research on the broader use of health-related mobile applications indicated that service users are open to adopting a new digital tool if they perceive it as personally relevant (Greer *et al.*, 2019), and seamlessly integrated into their daily routine without imposing stigma (Simblett *et al.*, 2019; Torous, Nicholas, Larsen, Firth, & Christensen, 2018). Crucially, service users must feel that the app empowers them to comprehend and manage their illness (Mamykina, Smaldone, & Bakken, 2015), which can be achieved by providing them with meaningful access to their own data (Ancker *et al.*, 2015). Two qualitative studies with service users on the 'hypothetical' use of ESM in clinical practice, indicated empowerment, shared decision-making, and self-awareness as main advantages, whereas burden, negative impact on symptoms and well-being, and validity were seen as main limitations (Bos *et al.*, 2019; de Thurah *et al.*, 2023). This was corroborated by one implementation pilot study, showing that improved self-insight and self-awareness are clear strengths, whereas burden and lack of personalization are the key caveats (Weermeijer *et al.*, 2023, 2024). Engaging service users more in the development and implementation of ESM-based digital tools is needed to develop a balanced clinical ESM tool that combines the strengths of active engagement and collecting high-frequency data while reducing participant burden and achieving a high level of personalization.

Understanding and improving the motivation and competence of clinicians in routine healthcare settings to integrate ESM into the workflow

The effectiveness of technological advancements in healthcare is intricately linked to the readiness of healthcare professionals to adopt them. Clinicians are more inclined to embrace digital innovations when they are designed as technology-enabled services rather than stand-alone products (Mohr *et al.*, 2017). This approach shifts the focus from the technology to how it integrates within the broader context of the healthcare ecosystem. Clinicians exhibit favorable attitudes towards using digital technology when they contribute to an improvement in the quality of care, without a significant increase in workload (Kerst, Zielasek, & Gaebel, 2020). Notably, one survey study (Piot *et al.*, 2022), and two qualitative studies involving clinicians (Bos *et al.*, 2019; Weermeijer *et al.*, 2023, 2024) identified gaining relevant insights and monitoring the clinical process and treatment as assets of clinically implementing ESM. The interactive use together with the service users was recognized as a notable strength, while challenges such as inadequate training, lack of guidelines, and time constraints were identified as significant obstacles. Interestingly, although personalization was identified as an important requirement (Piot *et al.*, 2022), an implementation pilot study revealed that only a minority of clinicians personalized the ESM approach (Weermeijer *et al.*, 2023, 2024). This underscores the imperative for employing mixed-method approaches to develop comprehensive strategies together with clinicians for integrating ESM and other digital technologies into the clinical workflow.

Identifying the technical requirements

To make ESM clinically actionable, it is essential to derive clinically meaningful insights from the wealth of real-life data. This is not an easy task as the numerous ESM variables can be correlated with themselves and across time, depending on the individual's characteristics and context. Therefore, the development of personalized user-friendly and practical methods for clinical data interpretation is crucial. This entails the creation of a platform capable of running algorithms to extract relevant information for each individual, along with a dashboard presenting easy-to-understand visualizations. Basic, robust, evidence-based statistics can illuminate fundamental properties of both mental health states and the environment, such as the intensity and variability of symptoms, frequency of social isolation, or the allocation of time towards productive goal-directed activities. While more complex statistical methods like network modeling (Epskamp *et al.*, 2018) have been proposed to elucidate intricate patterns, concerns about their validity have been raised by clinicians (Weermeijer *et al.*, 2023, 2024). Indeed, a recent report highlighted significant variability in outcomes when the same data were analyzed using network models by different teams (Bastiaansen *et al.*, 2020), emphasizing the risks of prematurely applying new statistical models in clinical practice. On the other hand, ML solutions that make optimal use of data, e.g. by integrating across data modalities or group-level information can reduce such overfitting phenomena (Koppe, Meyer-Lindenberg, & Durstewitz, 2021). For instance, multi-modal ML models for dynamical systems reconstruction that integrate across time series modalities, have already proven to benefit the discovery of mechanisms and improve time series forecasting (Kramer, Bommer, Tombolini, Koppe, & Durstewitz, 2022). Since passive sensor data has repeatedly been demonstrated to be predictive of mental health (Torous *et al.*, 2021), the integration of active and passive data with advanced ML models has the potential to enhance the precision and personalization of ESM in clinical practice. However, the integration of passive and active data into personalized ML models for single patient predictions remains to be demonstrated.

To effectively convey ESM data in a comprehensible manner, easy-to-understand visualizations are crucial. While clinicians have identified the use of visualizations as a strength (Bos *et al.*, 2019), there is limited research on optimizing visualizations of real-life data. A qualitative study with clinicians identified time series, bar charts, and pie charts as usable visualizations, showcasing fluctuations in relevant psychological outcomes (e.g. positive or negative affect), emotions in different contexts, and the frequency of engaging in certain (social) activities (Weermeijer *et al.*, 2023, 2024). However, these are static and aggregate representations. Bringmann, van der Veen, Wichers, Riese, & Stulp (2021) developed a moving presentation of raw data to capture the dynamics in ESM data, but this approach has not been extensively investigated yet. More research is needed to develop intuitive and optimal ways for visualizing dynamic, real-life ESM data.

Another critical aspect of clinical implementation is interoperability, which involves integrating ESM data with existing electronic patient files or hospital systems and making them accessible for obtaining broad consent by service users and, thereby, harnessing this data at scale. Clinician dashboards should seamlessly integrate into existing IT tools and workflows, be easily interpretable, and align with clinicians' preferred treatment approaches (Burton *et al.*, 2016). Achieving this requires the cooperation of healthcare management and their IT services,

identifying them as significant stakeholders. Currently, most mobile apps are custom-made for specific studies or clinical settings (Miralles et al., 2020), and not apt for wider scale-up. Unlike in somatic medicine, where numerous countries have developed large-scale initiatives addressing interoperability (Cuggia & Combes, 2019), this is mostly lacking in mental health research, and even more so in mHealth approaches. To transition ESM from a research tool to a clinical device ready for scale-up in practice, specifications for interoperability with the international research community, such as Fast Healthcare Interoperability Resources (FHIR), and integration capabilities with hospital systems and electronic patient repositories need to be developed. This will facilitate the seamless transfer of ESM data within clinical and research settings, enhancing its utility in real-world mental health care scenarios and supporting their sustainable reuse under the FAIR guiding principles for scientific stewardship (van Damme, Löbe, Benis, de Keizer, & Cornet, 2024).

Identifying the anticipatory governance requirements

Several reports have raised significant concerns regarding data privacy, security, and confidentiality in numerous existing mental health apps (Miralles et al., 2020; Zhou, Bao, Watzlaf, & Parmanto, 2019). Recent European regulations, including the General Data Protection Regulation (Regulation (EU) 2016/679) and the Medical Device Regulation (Regulation (EU) 2017/745), have imposed stricter requirements on the technology transfer process to address these concerns (Marelli, Lievrouw, & Van Hoyweghen, 2020). However, the stricter data quality and safety requirements have complicated the translation of ESM-based apps from research to routine mental health care, due to increased regulatory complexity, but also to a misalignment between the existing regulations and the core values embedded in digital health technologies (Lievrouw, Marelli, & Van Hoyweghen, 2024). The recent implementation of these EU regulatory changes has therefore resulted in a regulatory grey zone, where existing (mental) health apps have to navigate between being considered 'lifestyle and wellbeing' apps and heavily regulated 'medical' digital applications (Lucivero & Prainsack, 2015). Developing increased reflexivity and awareness concerning the complex and scattered regulatory and policy landscape within which mobile technology operates is essential for realizing true clinical implementation. However, this task is challenging given that the European governance and regulatory framework remains a fragmented ethical, regulatory, and policy landscape, despite ongoing efforts for standardization (Marelli et al., 2020). Thus, understanding and navigating the regulatory and policy space is crucial for ensuring ESM's ethical and responsible use in mental health care.

Determining the economic value of implementing ESM in routine mental health care

An essential prerequisite for clinical implication is understanding the economic value and the financial requirements for the scale-up of the intervention. Clinicians have identified financial constraints as significant barriers to implementation with reimbursement from healthcare insurers potentially aiding the adoption of novel digital tools (Weermeijer et al., 2023, 2024). However, very few studies have evaluated the cost-effectiveness and the actual financial implications of implementing and scaling up ESM in routine mental care. One study suggested that utilizing ESM combined with weekly feedback on behavioral patterns is

cost-effective for service users with major depression, with a willingness-to-pay threshold of €50 000 for one additional Quality Adjusted Life Year (QALY) gained (Simons et al., 2017), which is at the lower limit of what is currently viewed as acceptable for gaining a QALY in people with severe mental disorder in Europe and the USA (Eichler, Kong, Gerth, Mavros, & Jönsson, 2004). However, more research is needed to assess the marginal cost of implementing ESM in clinical practice relative to its marginal benefit, expanding current evidence to include also cost-utility analyses (CUA) (Dernovsek, Prevolnik-Rupel, & Tavcar, 2007). This entails calculating the economic cost of delivering the intervention – representing the value of all resources consumed by the intervention, both within and beyond the health system – in relation to the benefits it produces, measured as QALYs. The incremental cost incurred by the intervention is related to QALYs gained attributable to the intervention to compute the incremental cost-effective ratio per QALY. This value can inform the decisions on reimbursements by healthcare insurers and public funders. Furthermore, a budget impact assessment should be conducted to provide policymakers with more meaningful information to assess the affordability and feasibility of scaling up the intervention.

Conducting implementation studies and developing an evidence-base

Despite the lack of evidence being a crucial barrier for clinicians to implement digital innovations in their clinical practice, there is a lack of rigorous testing of the usability and effectiveness of mobile mental health interventions (Miralles et al., 2020). Only 16% of all papers in the review by Miralles et al. (2020) reported findings from an RCT and only 36% of these RCTs (5.7% of total papers) were specifically focused on effect assessment. Thus, more rigorous and extensive testing of these approaches is needed, to provide service users and clinicians with a trustworthy product that they can safely use in clinical practice. There is also very little cross-validation, with only 14% of the apps being used in multiple studies, again pointing to the limited scale-up of existing mobile mental health apps, including the clinical use of ESM. More rigorous effect assessment is therefore needed if we want to transfer ESM from research into practice.

Furthermore, limited research has focused on implementing mobile health solutions in mental health (Proctor et al., 2009). While some studies have identified e-literacy, perspectives of service users and clinicians on app usage, user acceptance and usability, and cost-utility as potential barriers to further implementation and scale-up (Simblett et al., 2019), few studies have delved into strategies for overcoming these barriers.

Utilizing established implementation science frameworks will enable the optimization of implementation strategies and the investigation of implementation processes and outcomes within implementation studies that move beyond previous frameworks of developing and evaluating complex interventions (Skivington et al., 2021), and take the specific requirements of implementing novel technologies into account. In tailoring the ESM application for clinical practice, an initial assessment of anticipated barriers and facilitators influencing implementation can be conducted using the 'non-adoption, abandonment, scaleup, spread, and sustainability'(NASSS) implementation science framework (Greenhalgh et al., 2017). Specifically designed for the implementation of novel technologies, the NASSS framework addresses seven domains: the condition or illness, the technology, the

value proposition, the adopter system, the organizations, the wider (institutional and societal) context, and the interaction and mutual adaptation between all these domains over time. By leveraging the NASS framework, implementation strategies for novel technologies like ESM can be effectively optimized and tailored.

The RE-AIM framework encompasses key aspects relevant to evaluating the implementation of novel interventions such as ESM across individual and various ecological levels (e.g. staff, setting, system) (Holtrop et al., 2021). Specifically, this framework assesses Reach (extent of service user participation), Effectiveness (interaction between efficacy and implementation in real-world settings), (c) Adoption in routine clinical care settings, (d) Implementation (delivery of the intervention as intended by clinicians), and (e) Maintenance (integration of ESM into routine care). This, in turn, allows for establishing the public health impact as a central aspect for decision-makers and potential adopters of ESM and, hence, may serve as a direct bridge across the research-to-practice gap (Holtrop et al., 2021).

Alongside the RE-Aim framework, a detailed process evaluation could provide in-depth insight into the implementation and sustainability of ESM in routine clinical care pathways and establish what works, for whom, in what circumstances, in what respects, to what extent, and why, using a realist evaluation framework. The realist evaluation framework allows us to identify configurations of contexts, mechanisms of change, and how these are associated with outcomes of implementation and intervention. It combines the strengths of quantitative and user-based experiences to produce a coherent and plausible explanation. This process evaluation is optimally conducted within existing pathways to care and treatment frameworks, attending to person-, system-, and context-based factors that influence or determine the effective use, implementation, and maintenance of ESM within existing pathways to care and treatment frameworks across different mental health settings.

Conclusion

This position paper highlights the potential of actively monitoring real-life experiences and symptoms using ESM to significantly advance person-centered mental health care, by enhancing empowerment, self-management and recovery, tailoring treatment to individual needs, and goals while promoting shared-decision making. Furthermore, the paper outlines an extensive research agenda, addressing the complexity, and diversity of issues necessary to progress toward true implementation. This research agenda is developed by the IMMERSE consortium, as part of the IMMERSE project, an EU-funded Horizon2020 project (<https://immerse-project.eu/>). In IMMERSE, we will investigate strategies, processes, outcomes, and costs of implementing ESM-based monitoring in routine mental health care in four European countries, while taking the user and clinician perspective and the regulatory framework into account, in addition to creating the necessary technological innovations. IMMERSE is tailored toward the clinical implementation of ESM in routine mental health care. However, the proposed research agenda holds broader global implications as it applies to the implementation of all kinds of mobile and digital innovations in mental health. This paper serves as a call to action, advocating for a shift in focus from continuously developing new digital interventions to actively addressing barriers and bolstering facilitators for the successful implementation of these interventions in routine

mental health care. This shift is essential for achieving a true transformation towards person-centered care in mental health.

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¹Center for Contextual Psychiatry, Department of Neuroscience, KU Leuven, Leuven, Belgium; ²Department of Public Mental Health, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany; ³Chair of Medical Informatics, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany; ⁴Department of Psychology, Faculty of Arts, Comenius University Bratislava, Bratislava, Slovakia; ⁵Department of Psychiatry, Faculty of Medicine, Comenius University Bratislava, Bratislava, Slovakia; ⁶Life Sciences & Society Lab, Centre for Sociological Research, KU Leuven, Belgium; ⁷Research Group Clinical Psychology, Faculty of Psychology and Educational Sciences, KU Leuven, Leuven, Belgium; ⁸Department of Medical and Clinical Psychology, Tilburg University, Tilburg, Netherlands; ⁹Department of Theoretical Neuroscience, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany; ¹⁰Clinic for Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty, Heidelberg University, Mannheim, Germany; ¹¹Medical Faculty, Hector Institut for AI in Psychiatry, Central Institute of Mental Health, Mannheim, Germany; ¹²Department of Medical Biotechnology and Translational Medicine, University of Milan, Italy; ¹³Department of Social and Behavioural Medicine, Faculty of Medicine, Pavol Jozef (PJ) Safarik University in Kosice, Kosice, Slovakia; ¹⁴Heidelberg University, Heidelberg, Germany (Prof. Michel Wensing PhD), Department General Practice and Health Services Research, Heidelberg University Hospital, Heidelberg, Germany; ¹⁵OFFIS Institute for Information Technology, Oldenburg, Germany; ¹⁶Heidelberg Institute of Global Health, University Hospital and Faculty of Medicine, University of Heidelberg, Heidelberg, Germany; ¹⁷Department of Clinical Psychology Doorway 6, University of Edinburgh, Elsie Inglis Quad, Teviot Place Edinburgh, Edinburgh, EH8 9AG, UK; ¹⁸Interdisciplinary Center for Scientific Computing, Heidelberg University, Heidelberg, Germany; ¹⁹Faculty of Physics and Astronomy, Heidelberg University, Heidelberg, Germany; ²⁰Meaningful Interactions Lab (MintLab), Institute for Media Studies (IMS), KU Leuven, Belgium; ²¹Centre for Epidemiology and Public Health, Health Service and Population Research Department, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, UK and ²²German Center for Mental Health (DZPG), Partner Site Mannheim-Heidelberg-Ulm, Germany

References

- Ancker, J. S., Witteman, H. O., Hafeez, B., Provencher, T., de Graaf, M. V., & Wei, E. (2015). "You Get Reminded You're a Sick Person": Personal data tracking and patients with multiple chronic conditions. *Journal of Medical Internet Research*, 17(8), e4209. doi: 10.2196/jmir.4209
- Bastiaansen, J. A., Kunkels, Y. K., Blaauw, F. J., Boker, S. M., Ceulemans, E., Chen, M., ... Bringmann, L. F. (2020). Time to get personal? The impact of researchers choices on the selection of treatment targets using the experience sampling methodology. *Journal of Psychosomatic Research*, 137, 110211. doi: 10.1016/j.jpsychores.2020.110211
- Boardman, J., & Dave, S. (2020). Person-centred care and psychiatry: Some key perspectives. *British Journal of Psychiatry International*, 17(3), 65–68. doi: 10.1192/bji.2020.21
- Bos, F. M., Snippe, E., Bruggeman, R., Wichers, M., & van der Krieke, L. (2019). Insights of patients and clinicians on the promise of the

- Experience Sampling Method for psychiatric care. *Psychiatric Services*, 70(11), 983–991. doi: 10.1176/appi.ps.201900050
- Bringmann, L. F., van der Veen, D. C., Wichers, M., Riese, H., & Stulp, G. (2021). ESMvis: A tool for visualizing individual Experience Sampling Method (ESM) data. *Quality of Life Research*, 30(11), 3179–3188. doi: 10.1007/s11136-020-02701-4
- Burton, C., Szentagotai Tatar, A., McKinsty, B., Matheson, C., Matu, S., Moldovan, R., ... Wolters, M. (2016). Pilot randomised controlled trial of Help4Mood, an embodied virtual agent-based system to support treatment of depression. *Journal of Telemedicine and Telecare*, 22(6), 348–355. doi: 10.1177/1357633X15609793
- Cuggia, M., & Combes, S. (2019). The French health data hub and the German medical informatics initiatives: Two national projects to promote data sharing in healthcare. *Yearbook of Medical Informatics*, 28(1), 195–202. doi: 10.1055/s-0039-1677917
- de Thurah, L., Kiekens, G., Sips, R., Teixeira, A., Kasanova, Z., & Myin-Germeys, I. (2023). Using experience sampling methods to support clinical management of psychosis: The perspective of people with lived experience. *Psychiatry Research*, 324, 115207. doi: 10.1016/j.psychres.2023.115207
- Dernovsek, M. Z., Prevolnik-Rupel, V., & Tavcar, R. (2007). Cost-Utility analysis. In M. S. Ritsner & A. G. Awad (Eds.), *Quality of life impairment in schizophrenia, mood and anxiety disorders: New perspectives on research and treatment* (pp. 373–384). Dordrecht: Springer Netherlands. doi: 10.1007/978-1-4020-5779-3_20
- Eichler, H.-G., Kong, S. X., Gerth, W. C., Mavros, P., & Jönsson, B. (2004). Use of cost-effectiveness analysis in health-care resource allocation decision-making: How are cost-effectiveness thresholds expected to emerge? *Value in Health: The Journal of the International Society for Pharmacoeconomics and Outcomes Research*, 7(5), 518–528. doi: 10.1111/j.1524-4733.2004.75003.x
- Epskamp, S., van Borkulo, C. D., van der Veen, D. C., Servaas, M. N., Isvoranu, A.-M., Riese, H., & Cramer, A. O. J. (2018). Personalized network modeling in psychopathology: The importance of contemporaneous and temporal connections. *Clinical Psychological Science: A Journal of the Association for Psychological Science*, 6(3), 416–427. doi: 10.1177/2167702617744325
- Geschwind, N., Nicolson, N. A., Peeters, F., van Os, J., Barge-Schaapveld, D., & Wichers, M. (2011). Early improvement in positive rather than negative emotion predicts remission from depression after pharmacotherapy. *European Neuropsychopharmacology*, 21(3), 241–247. doi: 10.1016/j.euroneuro.2010.11.004
- Greenhalgh, T., Wherton, J., Papoutsis, C., Lynch, J., Hughes, G., A'Court, C., ... Shaw, S. (2017). Beyond adoption: A new framework for theorizing and evaluating nonadoption, abandonment, and challenges to the scale-up, spread, and sustainability of health and care technologies. *Journal of Medical Internet Research*, 19(11), e8775. doi: 10.2196/jmir.8775
- Greer, B., Robotham, D., Simblett, S., Curtis, H., Griffiths, H., & Wykes, T. (2019). Digital exclusion among mental health service users: Qualitative investigation. *Journal of Medical Internet Research*, 21(1), e11696. doi: 10.2196/11696
- Gumley, A., Bradstreet, S., Ainsworth, J., Allan, S., Alvarez-Jimenez, M., Beattie, L., ... Gleeson, J. (2020). Early signs monitoring to prevent relapse in psychosis and promote well-being, engagement, and recovery: Protocol for a feasibility cluster randomized controlled trial harnessing mobile phone technology blended with peer support. *Journal of Medical Internet Research Research Protocols*, 9(1), e15058. doi: 10.2196/15058
- Hektner, J. M., Schmidt, J. A., & Csikszentmihalyi, M. (2007). *Experience sampling method: Measuring the quality of everyday life*. Thousand Oaks, Calif: Sage Publications.
- Holtrop, J. S., Estabrooks, P. A., Gaglio, B., Harden, S. M., Kessler, R. S., King, D. K., ... Glasgow, R. E. (2021). Understanding and applying the RE-AIM framework: Clarifications and resources. *Journal of Clinical and Translational Science*, 5(1), e126. doi: 10.1017/cts.2021.789
- Ibrahim, M. S., Mohamed Yusoff, H., Abu Bakar, Y. I., Thwe Aung, M. M., Abas, M. I., & Ramli, R. A. (2022). Digital health for quality healthcare: A systematic mapping of review studies. *Digital Health*, 8, 205520762210858. doi: 10.1177/20552076221085810
- Kasanova, Z., Hajdúk, M., Thewissen, V., & Myin-Germeys, I. (2020). Temporal associations between sleep quality and paranoia across the paranoia continuum: An experience sampling study. *Journal of Abnormal Psychology*, 129(1), 122–130. doi: 10.1037/abn0000453
- Kerst, A., Zielasek, J., & Gaebel, W. (2020). Smartphone applications for depression: A systematic literature review and a survey of health care professionals' attitudes towards their use in clinical practice. *European Archives of Psychiatry and Clinical Neuroscience*, 270(2), 139–152. doi: 10.1007/s00406-018-0974-3
- Koppe, G., Meyer-Lindenberg, A., & Durstewitz, D. (2021). Deep learning for small and big data in psychiatry. *Neuropsychopharmacology*, 46(1), 176–190. doi: 10.1038/s41386-020-0767-z
- Kramer, D., Bommer, P. L., Tombolini, C., Koppe, G., & Durstewitz, D. (2022). Reconstructing nonlinear dynamical systems from multi-modal time series. Proceedings of the 39th International Conference on Machine Learning, 11613–11633. PMLR. Retrieved from <https://proceedings.mlr.press/v162/kramer22a.html>
- Kramer, I., Simons, C. J. P., Hartmann, J. A., Menne-Lothmann, C., Viechtbauer, W., Peeters, F., ... Wichers, M. (2014). A therapeutic application of the experience sampling method in the treatment of depression: A randomized controlled trial. *World Psychiatry*, 13(1), 68–77. doi: 10.1002/wps.20090
- Lataster, J., Myin-Germeys, I., Wichers, M., Delespaul, P. A. E. G., van Os, J., & Bak, M. (2011). Psychotic exacerbation and emotional dampening in the daily life of patients with schizophrenia switched to aripiprazole therapy: A collection of standardized case reports. *Therapeutic Advances in Psychopharmacology*, 1(5), 145–151. doi: 10.1177/2045125311419552
- Leendertse, P., Myin-Germeys, I., Lataster, T., Simons, C. J. P., Oorschot, M., Lardinois, M., ... Reininghaus, U. (2018). Subjective quality of life in psychosis: Evidence for an association with real world functioning? *Psychiatry Research*, 261, 116–123. doi: 10.1016/j.psychres.2017.11.074
- Leonardsen, A.-C. L., Bååth, C., Helgesen, A. K., Grøndahl, V. A., & Hardeland, C. (2023). Person-centeredness in digital primary healthcare services – A scoping review. *Healthcare*, 11(9), 1296. doi: 10.3390/healthcare11091296
- Lievevrouw, E., Marelli, L., & Van Hoyweghen, I. (2024). Weaving EU digital health policy into national healthcare practices. The making of a reimbursement standard for digital health technologies in Belgium. *Social Science & Medicine*, 346, 116620. doi: 10.1016/j.socscimed.2024.116620
- Lucivero, F., & Prainsack, B. (2015). The lifestyle of healthcare? 'Consumer genomics' and mobile health as technologies for healthy lifestyle. *Applied & Translational Genomics*, 4, 44–49. doi: 10.1016/j.atg.2015.02.001
- Mamykina, L., Heitkemper, E. M., Smaldone, A. M., Kukafka, R., Cole-Lewis, H. J., Davidson, P. G., ... Hripcsak, G. (2017). Personal discovery in diabetes self-management: Discovering cause and effect using self-monitoring data. *Journal of Biomedical Informatics*, 76, 1–8. doi: 10.1016/j.jbi.2017.09.013
- Mamykina, L., Smaldone, A. M., & Bakken, S. R. (2015). Adopting the sense-making perspective for chronic disease self-management. *Journal of Biomedical Informatics*, 56, 406–417. doi: 10.1016/j.jbi.2015.06.006
- Marelli, L., Lievevrouw, E., & Van Hoyweghen, I. (2020). Fit for purpose? The GDPR and the governance of European digital health. *Policy Studies*, 41(5), 447–467. doi: 10.1080/01442872.2020.1724929
- McMillan, S. S., Kendall, E., Sav, A., King, M. A., Whitty, J. A., Kelly, F., & Wheeler, A. J. (2013). Patient-centered approaches to health care: A systematic review of randomized controlled trials. *Medical Care Research and Review*, 70(6), 567–596. doi: 10.1177/1077558713496318
- Miralles, I., Granell, C., Díaz-Sanahuja, L., Van Woensel, W., Bretón-López, J., Mira, A., ... Casteleyn, S. (2020). Smartphone apps for the treatment of mental disorders: Systematic review. *Journal of Medical Internet Research mHealth and uHealth*, 8(4), e14897. doi: 10.2196/14897
- Mohr, D. C., Riper, H., & Schueller, S. M. (2018). A solution-focused research approach to achieve an implementable revolution in digital mental health. *JAMA Psychiatry*, 75(2), 113. doi: 10.1001/jamapsychiatry.2017.3838
- Mohr, D. C., Weingardt, K. R., Reddy, M., & Schueller, S. M. (2017). Three problems with current digital mental health research... and three things we can do about them. *Psychiatric Services*, 68(5), 427–429. doi: 10.1176/appi.ps.201600541

- Moore, R. C., Depp, C. A., Wetherell, J. L., & Lenze, E. J. (2016). Ecological momentary assessment versus standard assessment instruments for measuring mindfulness, depressed mood, and anxiety among older adults. *Journal of Psychiatric Research*, *75*, 116–123. doi: 10.1016/j.jpsychires.2016.01.011
- Myin-Germeys, I., Kasanova, Z., Vaessen, T., Vachon, H., Kirtley, O., Viechtbauer, W., & Reininghaus, U. (2018). Experience sampling methodology in mental health research: New insights and technical developments. *World Psychiatry*, *17*(2), 123–132. doi: 10.1002/wps.20513
- Myin-Germeys, I., & Kuppens, P. (Eds.). (2021). *The open handbook of experience sampling methodology: A step-by-step guide to designing, conducting, and analyzing ESM studies*. Deutschland, Amazon.
- Myin-Germeys, I., Oorschot, M., Collip, D., Lataster, J., Delespaul, P., & van Os, J. (2009). Experience sampling research in psychopathology: Opening the black box of daily life. *Psychological Medicine*, *39*(9), 1533–1547. doi: 10.1017/S0033291708004947
- Oorschot, M., Lataster, T., Thewissen, V., Wichers, M., & Myin-Germeys, I. (2012). Mobile assessment in schizophrenia: A data-driven momentary approach. *Schizophrenia Bulletin*, *38*(3), 405–413. doi: 10.1093/schbul/sbr166
- Piot, M., Mestdagh, M., Riese, H., Weermeijer, J., Brouwer, J. M. A., Kuppens, P., ... Bos, F. M. (2022). Practitioner and researcher perspectives on the utility of ecological momentary assessment in mental health care: A survey study. *Internet Interventions*, *30*, 100575. doi: 10.1016/j.invent.2022.100575
- Proctor, E. K., Landsverk, J., Aarons, G., Chambers, D., Glisson, C., & Mittman, B. (2009). Implementation research in mental health services: An emerging science with conceptual, methodological, and training challenges. *Administration and Policy in Mental Health and Mental Health Services Research*, *36*(1), 24–34. doi: 10.1007/s10488-008-0197-4
- Reininghaus, U., Kempton, M. J., Valmaggia, L., Craig, T. K. J., Garety, P., Onyejiaka, A., ... Morgan, C. (2016). Stress sensitivity, aberrant salience, and threat anticipation in early psychosis: An experience sampling study. *Schizophrenia Bulletin*, *42*(3), 712–722. doi: 10.1093/schbul/sbv190
- Reininghaus, U., & Myin-Germeys, I. (2023). Mental health reform, ecological translation and the future of public mental healthcare. In M. Wensing & C. Ullrich (Eds.), *Foundations of health services research: Principles, methods, and topics* (pp. 223–233). Cham: Springer International Publishing. doi: 10.1007/978-3-031-29998-8_18
- Rintala, A., Wampers, M., Myin-Germeys, I., & Viechtbauer, W. (2019). Response compliance and predictors thereof in studies using the experience sampling method. *Psychological Assessment*, *31*(2), 226–235. doi: 10.1037/pas0000662
- Santana, M. J., Manalili, K., Jolley, R. J., Zelinsky, S., Quan, H., & Lu, M. (2018). How to practice person-centred care: A conceptual framework. *Health Expectations: An International Journal of Public Participation in Health Care and Health Policy*, *21*(2), 429–440. doi: 10.1111/hex.12640
- Schneider, M., Reininghaus, U., van Nierop, M., Janssens, M., Myin-Germeys, I., & GROUP Investigators. (2017). Does the social functioning scale reflect real-life social functioning? An experience sampling study in patients with a non-affective psychotic disorder and healthy control individuals. *Psychological Medicine*, *47*(16), 2777–2786. doi: 10.1017/S0033291717001295
- Simblett, S., Matcham, F., Siddi, S., Bulgari, V., Barattieri di San Pietro, C., Hortas López, J., ... RADAR-CNS Consortium. (2019). Barriers to and facilitators of engagement with mHealth technology for remote measurement and management of depression: Qualitative analysis. *Journal of Medical Internet Research mHealth and uHealth*, *7*(1), e11325. doi: 10.2196/11325
- Simons, C. J. P., Drukker, M., Evers, S., van Mastrigt, G. A. P. G., Höhn, P., Kramer, I., ... Wichers, M. (2017). Economic evaluation of an experience sampling method intervention in depression compared with treatment as usual using data from a randomized controlled trial. *BioMed Central Psychiatry*, *17*(1), 415. doi: 10.1186/s12888-017-1577-7
- Simons, C. J. P., Hartmann, J. A., Kramer, I., Menne-Lothmann, C., Höhn, P., van Bommel, A. L., ... Wichers, M. (2015). Effects of momentary self-monitoring on empowerment in a randomized controlled trial in patients with depression. *European Psychiatry*, *30*(8), 900–906. doi: 10.1016/j.eurpsy.2015.09.004
- Skivington, K., Matthews, L., Simpson, S. A., Craig, P., Baird, J., Blazeby, J. M., ... Moore, L. (2021). A new framework for developing and evaluating complex interventions: Update of medical research council guidance. *British Medical Journal*, *374*, n2061. doi: 10.1136/bmj.n2061
- Slade, M. (2017). Implementing shared decision making in routine mental health care. *World Psychiatry*, *16*(2), 146–153. doi: 10.1002/wps.20412
- Slade, M., Amering, M., Farkas, M., Hamilton, B., O'Hagan, M., Panther, G., ... Whitley, R. (2014). Uses and abuses of recovery: Implementing recovery-oriented practices in mental health systems. *World Psychiatry*, *13*(1), 12–20. doi: 10.1002/wps.20084
- Snippe, E., Simons, C. J. P., Hartmann, J. A., Menne-Lothmann, C., Kramer, I., Booij, S. H., ... Wichers, M. (2016). Change in daily life behaviors and depression: Within-person and between-person associations. *Health Psychology*, *35*(5), 433–441. doi: 10.1037/hea0000312
- So, S. H., Peters, E. R., Swendsen, J., Garety, P. A., & Kapur, S. (2013). Detecting improvements in acute psychotic symptoms using experience sampling methodology. *Psychiatry Research*, *210*(1), 82–88. doi: 10.1016/j.psychres.2013.05.010
- Solhan, M. B., Trull, T. J., Jahng, S., & Wood, P. K. (2009). Clinical assessment of affective instability: Comparing EMA indices, questionnaire reports, and retrospective recall. *Psychological Assessment*, *21*(3), 425–436. doi: 10.1037/a0016869
- Stone, A. A., & Shiffman, S. (1994). Ecological momentary assessment (Ema) in behavioral medicine. *Annals of Behavioral Medicine*, *16*(3), 199–202. doi: 10.1093/abm/16.3.199
- Striffler, L., Cardoso, R., McGowan, J., Cogo, E., Nincic, V., Khan, P. A., ... Straus, S. E. (2018). Scoping review identifies significant number of knowledge translation theories, models, and frameworks with limited use. *Journal of Clinical Epidemiology*, *100*, 92–102. doi: 10.1016/j.jclinepi.2018.04.008
- Thewissen, V., Bental, R. P., Oorschot, M., à Campo, J., van Lierop, T., van Os, J., & Myin-Germeys, I. (2011). Emotions, self-esteem, and paranoid episodes: An experience sampling study: Emotions, self-esteem, and paranoia. *British Journal of Clinical Psychology*, *50*(2), 178–195. doi: 10.1348/014466510X508677
- Torous, J., Bucci, S., Bell, I. H., Kessing, L. V., Faurholt-Jepsen, M., Whelan, P., ... Firth, J. (2021). The growing field of digital psychiatry: Current evidence and the future of apps, social media, chatbots, and virtual reality. *World Psychiatry*, *20*(3), 318–335. doi: 10.1002/wps.20883
- Torous, J., Nicholas, J., Larsen, M. E., Firth, J., & Christensen, H. (2018). Clinical review of user engagement with mental health smartphone apps: Evidence, theory and improvements. *Evidence-Based Mental Health*, *21*(3), 116–119. doi: 10.1136/eb-2018-102891
- Vachon, H., Viechtbauer, W., Rintala, A., & Myin-Germeys, I. (2019). Compliance and retention with the experience sampling method over the continuum of severe mental disorders: Meta-analysis and recommendations. *Journal of Medical Internet Research*, *21*(12), e14475. doi: 10.2196/14475
- Vaessen, T., Viechtbauer, W., van der Steen, Y., Gayer-Anderson, C., Kempton, M. J., Valmaggia, L., ... Myin-Germeys, I. (2019). Recovery from daily-life stressors in early and chronic psychosis. *Schizophrenia Research*, *213*, 32–39. doi: 10.1016/j.schres.2019.03.011
- van Damme, P., Löbe, M., Benis, N., de Keizer, N. F., & Cornet, R. (2024). Assessing the use of HL7 FHIR for implementing the FAIR guiding principles: A case study of the MIMIC-IV emergency department module. *Journal of the American Medical Informatics Association Open*, *7*(1), ooae002. doi: 10.1093/jamiaopen/ooae002
- van Os, J., Verhagen, S., Marsman, A., Peeters, F., Bak, M., Marcelis, M., ... Delespaul, P. (2017). The experience sampling method as an mHealth tool to support self-monitoring, self-insight, and personalized health care in clinical practice. *Depression and Anxiety*, *34*(6), 481–493. doi: 10.1002/da.22647
- Weermeijer, J. D. M., Wampers, M., de Thurah, L., Bonnier, R., Piot, M., Kuppens, P., ... Kiekens, G. (2023). Usability of the experience sampling method in specialized mental health care: Pilot evaluation study. *Journal of Medical Internet Research Formative Research*, *7*(1), e48821. doi: 10.2196/48821
- Weermeijer, J., Kiekens, G., Wampers, M., Kuppens, P., & Myin-Germeys, I. (2024). Practitioner perspectives on the use of the experience sampling

- software in counseling and clinical psychology. *Behaviour & Information Technology*, 43(3), 540–550. doi: 10.1080/0144929X.2023.2178235
- Wensing, M., & Grol, R. (2019). Knowledge translation in health: How implementation science could contribute more. *BioMed Central Medicine*, 17(1), 88. doi: 10.1186/s12916-019-1322-9
- Wieringa, T. H., Rodriguez-Gutierrez, R., Spencer-Bonilla, G., de Wit, M., Ponce, O. J., Sanchez-Herrera, M. F., ... Snoek, F. J. (2019). Decision aids that facilitate elements of shared decision making in chronic illnesses: A systematic review. *Systematic Reviews*, 8(1), 121. doi: 10.1186/s13643-019-1034-4
- Zhou, L., Bao, J., Watzlaf, V., & Parmanto, B. (2019). Barriers to and facilitators of the use of mobile health apps from a security perspective: Mixed-methods study. *Journal of Medical Internet Research mHealth and uHealth*, 7(4), e11223. doi: 10.2196/11223