

Visualisation of Experience Sampling Method Data in Mental Health: A Qualitative Study of the Physicians' Perspective in Germany

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Table of Contents

Original Manuscript..... 5

Supplementary Files..... 29

 TOC/Feature image for homepages 30

 TOC/Feature image for homepage 0..... 31



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Abstract

Background: Although the integration of self-monitored patient data into mental health care offers potential for advancing personalised approaches, its application in clinical practice remains largely underexplored. Capturing individuals' mental health outside the therapy room using Experience Sampling Methods (ESM) may bridge this gap by supporting shared decision-making and personalised interventions.

Objective: This qualitative study investigated the perspectives of German mental health professionals regarding prototypes of ESM data visualisations designed for integration into a digital mental health tool.

Methods: Semi-structured interviews were conducted with clinicians on their perceptions of such visualisations in routine care.

Results: Using reflexive thematic analysis, three key findings were: (1) visualisations were seen as valuable tools for enhancing patient motivation and engagement; (2) simplicity and clarity of visual formats were crucial for usability; and (3) practical concerns, such as integration into clinical workflows, influenced perceived utility. Challenges, including the risk of cognitive overload, were also highlighted.

Conclusions: These findings underline the importance of designing digital tools that align with clinical needs while addressing potential barriers to implementation by exploring the opportunities and challenges associated with ESM visualisations.

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Original Manuscript

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Abstract

Background: Although the integration of self-monitored patient data into mental health care offers potential for advancing personalised approaches, its application in clinical practice remains largely underexplored. Capturing individuals' mental health outside the therapy room using Experience Sampling Methods (ESM) may bridge this gap by supporting shared decision-making and personalised interventions. **Objective:** This qualitative study investigated the perspectives of German mental health professionals regarding prototypes of ESM data visualisations designed for integration into a digital mental health tool. **Methods:** Semi-structured interviews were conducted with clinicians on their perceptions of such visualisations in routine care. **Results:** Using reflexive thematic analysis, three key findings were: (1) visualisations were seen as valuable tools for enhancing patient motivation and engagement; (2) simplicity and clarity of visual formats were crucial for usability; and (3) practical concerns, such as integration into clinical workflows, influenced perceived utility. **Challenges,** including the risk of cognitive overload, were also highlighted. **Conclusions:** These findings underline the importance of designing digital tools that align with clinical needs while addressing potential barriers to implementation by exploring the opportunities and challenges associated with ESM visualisations.

Keywords: Experience Sampling Method, mHealth, data visualisation, qualitative research, personalised care

Introduction

Smartphones have become valuable tools in health contexts, enabling the collection of real-time, scalable health data that tracks behaviour such as sleep, physical activity, and symptoms. These devices can gather both “passive” (e.g., step count, heart rate) and “active” data (e.g., survey data), providing valuable insights into an individual’s health over time [1, 2]. As a result, mobile health (mHealth) tools have gained significant attention for their potential to offer a more comprehensive understanding of both physical and mental health [3]. mHealth tools, such as those used for monitoring conditions like depression [4], substance use disorders [5], and schizophrenia [6], show increasing promise in improving patient care. A key method within this field is the Experience Sampling Method (ESM), which facilitates real-time data collection [7, 8] and the delivery of interventions [9] directly to patients. Despite its potential, however, data collected with ESM is rarely shared with patients or integrated into routine clinical practice. This gap may stem from the ongoing challenge of transforming raw ESM data into meaningful, actionable visualisations that clinicians can use effectively in patient care [4].

The necessity to improve data visualisations in healthcare is becoming increasingly evident [10-12]. Research suggests that data visualisations can improve patient engagement and compliance by helping them better understand important trends in their health data by enhancing the ability of both clinicians and patients to explore, interpret, and discuss complex data [8, 13, 14]. Visual tools for personal healthcare data can help patients improve their health literacy, support informed decision-making, and speed up the comprehension of complex information [15, 16]. By recognising patterns over time, users may gain new insights into their own health signals and triggers, empowering them to manage their health proactively [17]. Furthermore, effective visualisations can

build trust and encourage patients to share their smartphone data, as they offer a transparent view of how their information is utilised in their care [18]. Simple line graphs are particularly effective for depicting temporal changes, as they make trends and patterns easily discernible [19, 20].

While the benefits of visualisations are noteworthy, there are potential adverse effects that warrant consideration. Firstly, overly complex can pose challenges for both clinicians and patients; confusing or overwhelming patients, particularly those with lower health literacy or cognitive impairments [21]. This may lead to disengagement or frustration, undermining the intended trust-building effect. Secondly, if patients perceive the visualisations as reductive, they may feel that their experiences are being trivialised, which could further erode confidence in the tool or the clinician's understanding of their condition [22]. Thirdly, patients may misinterpret visualised data without adequate guidance from clinicians, potentially leading to unfounded concerns or inaccurate self-assessments, which might exacerbate anxiety [4].

Understanding clinicians' perspectives is crucial for optimising these tools and ensuring they meet the practical needs of healthcare providers. Therefore, the aims of this study were 1) to investigate how mental health clinicians perceive and interpret visualisations of patient-reported ESM data prototypes and 2) to explore its potential implementation into routine care pathways. Taking Germany as an example, this study wants to contribute to the broader discourse on the applicability of ESM visualisations in mental health care in practice.

Methods

Study Design

To explore how clinicians within the mental health sector perceive and utilise visualisations of ESM data a qualitative study design using semi-structured interviews was chosen. This qualitative study

forms part of the IMMERSE project, dedicated to advancing person-centred mental health care across four countries in Europe (Belgium, Germany, Slovakia, and UK) through the development of a Digital Mobile Mental Health (DMMH) tool [23, 24]. For this study, screenshots of three prototypes of patient-ESM-data visualisations, which are to be integrated into a mHealth tool in a later phase [23, 24], were subject of the interviews: a) line graph, b) mood in context of activities, and c) pie chart.

Study Population, recruitment and sampling

To be eligible for participation in this study, clinicians needed to be part of the IMMERSE study in Germany, that took place at the Central Institute of Mental Health (CIMH) (Mannheim, Germany) and the Psychiatric Centre Nordbaden (PCN) (Wiesloch, Germany). Both centres have multiple departments working in interdisciplinary teams. Purposeful sampling was employed to ensure diversity in clinical backgrounds (i.e., psychologists and psychotherapists from different wards) and experience levels (senior vs. in training). Recruitment continued until thematic saturation was reached.

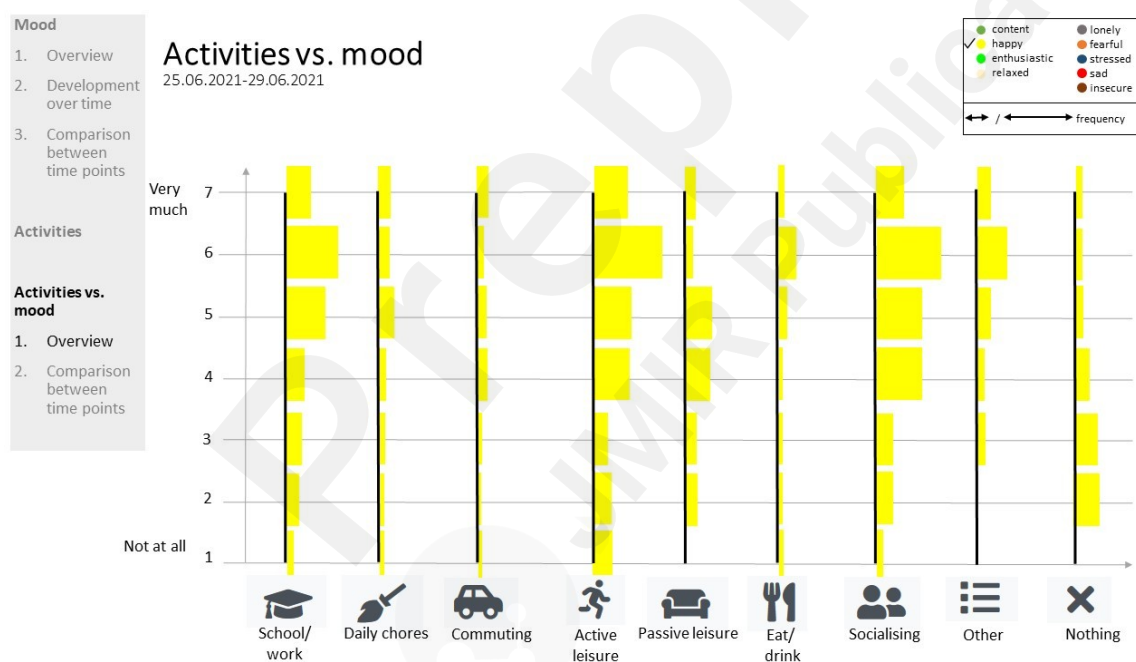
Data collection

Semi-structured guide-based interviews used in this study were conducted by one female interviewer (JSS), with a background in psychology and psychotherapy. Participants were either interviewed face-to-face at their workplace or via video call according to the participants' preferences. Based on pre-defined research questions, an interdisciplinary research team from all IMMERSE participating field sites developed the semi-structured interview guide in the respective languages for all countries and the four different stakeholder groups (clinicians, patients, friends and family members of patients, admins/IT). Interviews were recorded using audio recorders.

The interview guide for clinicians comprised 27 questions focussing on a) prior experiences with digital health tools, b) perspectives on app usability and patient engagement, potential barriers, c) feedback on the DMMH item prototype, and d) the expected impact of app usage on therapy outcomes. Three prototypes (**Figures 1-3**) of visualised longitudinal patient data were shown and explained to participating clinicians for feedback. In addition, vignettes with clinician case examples were presented and discussed.



Figure 1. Prototype 1: Line Graph - Description: For each therapy goal, patients rate their perceived progress that day and satisfaction with the progress. This data is visualised in a line chart in which a trend line can be inserted.

Figure 2. Prototype 2: Activities in the Context of Mood

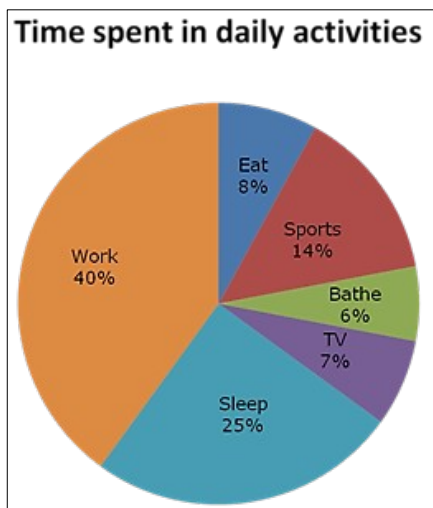


Figure 3. Prototype 3: Pie Chart - Description: An overview of the service-user's daily activities can be obtained from the activity pie chart, summarising and displaying the distribution of the different reported activities. Users can choose the time frame for which they want to have data displayed (e.g. last 7 days).

Data Analysis

All interviews in the current study were transcribed verbatim by student assistants in German and coded by the first author (JSS) in English. The interview data were analysed using reflexive thematic analysis, following the six-step framework outlined by Braun and Clarke [25, 26]: familiarization with the data, generating initial codes, searching, reviewing, defining and labelling patterns of results, and producing the final report. Inductive coding provided a structured method for identifying and interpreting patterns within the data [27]. This approach ensured a thorough and nuanced understanding of participants' perspectives, balancing the exploration of pre-identified topics with the discovery of novel insights. The analysis was conducted using MAXQDA software [28], which supported systematic organisation and management of the data. Included quotes have been translated into English by the first author with due diligence and are cited with indication of participant number and transcript position.

Open Science. The following paper was preregistered on January 29, 2024 (osf.io/mjqd7)

Ethical Approval. Ethical approval was granted on 24/09/2021 by the Ethics Committee II of the University of Heidelberg at the Medical Faculty Mannheim, Approval Reference 633-21. The source of funding for this project is the EU-Horizon2020 program under the IMMERSE project (European Union, Horizon2020 (H2020 – 945263)). All participants signed an informed consent form prior to participation.

Results

Participant characteristics and overview

Between January and June 2022 a total of 14 clinicians were interviewed, primarily in a face-to-face setting. Most clinicians were female psychologists (education: Masters or above), currently in advanced postgraduate education to become licenced psychotherapists, and differed in terms of focalised vs. comprehensive fields (Table 1). Interviews were between 40 and 60 min with a mean duration of 50min.

Table 1. Socio-demographic characteristics of mental health professionals

		Count/Mean
Assessment site, N (%)		
	PCN	2 (14%)
	CIMH	12 (86%)
Age (in years), mean		36,9
Gender, N (%)		
	Female	10
	Male	4
Profession		
	PPiA ^a	9
	Doctor of medicine	4
	Social work	1

Note. N = 14. PCN - Psychiatric Centre Nordbaden, CIMH – Central Institute of Mental Health.

^a PPiA = Psychologists holding a Master Title of Clinical and Cognitive Psychology in practical training to become a licenced psychotherapist within the German clinical training system (German: *Psychologische Psychotherapeut:in in Ausbildung*)

The analysis of the interview data provided an in -depth understanding of the clinicians' perspective on the visualisation of data collected using ESM, emphasising a) how clinicians themselves perceived the visualisations, b) how clinicians think their patients might perceive the visualisations, and c) how the clinicians envision using the visualisations in future practice.

A. Clinicians' perceptions

When asked for first impressions on the prototypes, clinicians shared insights and suggestions for enhancing the design and functionality of the ESM data visualisation prototypes.

Firstly, in fast-paced work environments, where decisions often need to be made rapidly, the intuitiveness of a visual tool is crucial. Complexity in visualisations can hinder quick comprehension, which is a critical consideration in a clinical work setting. One clinician stated:

"Okay – well, I actually needed a second to understand how the diagram is structured. I have to say, it's not exactly intuitive." (Z_01_Pos.95)

This quote illustrates that while visualisations may convey rich data, they can also pose an initial barrier to understanding. The clinician's experience suggests that some visualisations may require a moment of adjustment or interpretation, which could be a drawback in situations where time is limited. Secondly, clinicians provided feedback on the *design and layout* of the visualisations, suggesting specific changes that could improve their usability and effectiveness; e.g., by rotating images and using lists (Z_01_Pos.97).

Moreover, currently analogue forms of patient data was perceived as cumbersome, and interest in digitally tracking currently analogue data through more user-friendly means, such as digital visualisations, was expressed as illustrated within one interview.

"There are these mood-tension curves from DBT [Dialectical Behavioural Therapy], I haven't used them yet because I always find them a bit unhandy, but I've often thought yes, it would be cool

if you could track something like that.” (P_02_Pos.80)

This reflects a broader concern regarding the accessibility of information. By adjusting the layout to make it more intuitive or easier to interpret, visualisations could perhaps better support interactions with patients and improve the clarity of the data being communicated. This aligns with the need for striking a *balance between providing detailed information and maintaining clarity* in visualisations. Clinicians acknowledged that while adding more categories or data points can increase the richness of data in a visualisation, this does not necessarily detract from its usefulness. One clinician reflected:

“No, I don’t find the amount of categories particularly problematic. A pie chart is something that everyone should be able to interpret in some way. And – yeah, I don’t think it’s an issue to include several categories. Of course, the more categories there are, the more complex it becomes. You could consider combining some of them, but in principle, I don’t find it problematic.” (Z_12_Pos.241)

This underscores the importance of careful design in creating visualisations that are both informative and accessible, ensuring that they serve as effective tools in the fast-paced and demanding environment of clinical practice. By understanding and addressing the challenges associated with complexity, developers may create visual tools that better meet the needs of clinicians and support more efficient and accurate decision-making processes.

B. Clinicians view on patients’ perceptions

When asked about their patients’ perspectives, clinicians highlighted the possibility of enhanced motivation, a desire for personalisation, and worries regarding cognitive load. Clinicians stressed that the true value of the visualisation lies in the patient’s ability to comprehend and engage with it. Firstly, clinicians noted the powerful role that data visualisations could play in *changing and enhancing patient motivation*. Visual feedback could be used effectively in therapy to reinforce

positive behaviours and encourage patients to take more proactive roles in their treatment. One clinician described:

"I find that very interesting. I think it's something you can discuss really well with patients, like saying, 'Look at this, it seems like being active is really beneficial. Why not try doing that more?' I could really use something like that." (P_02_Pos.68)

In making abstract concepts such as mood or activity levels more tangible, ESM data visualisations may contribute to a *patient's sense of self-management* and control over their mental health (data). Clinicians pointed out the importance of giving patients access to the visualisations and viewed this approach as a way to strengthen the patient's intrinsic motivation, which is crucial for long-term engagement and success in therapy (e.g., Z_06_Pos.57-59). They advocated for giving patients access to their own data and emphasised the importance of empowering patients to take an active role in their own care and decision-making processes as seen in the following interview quote:

"I can only make use of the data if the patient wants to. I also think that this is the patient's true motivation - that they feel like they have control over themselves and can engage in self-management and self-control. That's the most powerful motivational argument in treatment. It's something that shouldn't be dismissed lightly, so it's important to also give the data back to the patient." (Z_06_Pos.59)

Secondly, clinicians underlined the importance of flexibility in ESM visualisations, enabling patients to track specific behaviours or concerns that are pertinent to their personal experiences. Such customisation may make the visualisations more "relevant" and actionable, thereby potentially enhancing their value as one clinician described:

"Well, it depends on what the patient is doing. For certain disorders, definitely yes. But maybe it would only be useful if one could also enter activities themselves or note what they're preoccupied with. For example, if there were an option to add things like 'worrying' or 'being preoccupied with my appearance and body', something like that. If you could add these kinds of things, it might also help

capture problematic behaviours.” (Z_09_Pos.60)

Thirdly, clinicians expressed concerns about the *risk of overwhelming patients* with too many options and complex interfaces in visual data tools. While the ability to customise and compare various data points can be beneficial for clinical practice, it may also be burdensome for some patients as one clinician explained:

“Yes... it definitely needs to be well-selected. In the end, it could easily become overwhelming, especially for highly burdened patients who may also have cognitive impairments. From my perspective, I think, “Oh, I want to be able to compare everything with each other, and I want a lot of options to customise things myself.” For example, if I suddenly have the idea to compare mood with the sleep from the previous night, I think it would be incredibly helpful to always have the possibility to visualise all my ideas. But in contrast, for patients, it might be overwhelming if they are given the option to adjust everything themselves, as this would likely be too much for them to handle.”

(Z_01_Pos.105)

This quote reflects a tension between the clinician's desire for detailed and customisable tools and the assumed potential for these features to become a source of stress for patients.

C. Clinicians view on future use of ESM data visualisations in routine care

When asked about future use-cases, clinicians highlighted the practical value of ESM data visualisations in enhancing *patient communication*. Firstly, emphasis was placed on the importance of involving the patient in the process of understanding and interpreting their own data visualisation. This understanding can only be achieved through dialogue and collaboration between the clinician and the patient, with clinicians imagining discovering new insights about the patient's perspective and experiences during data-driven discussions. Overall, the following quote underscores a general interest in shifting towards patient empowerment and collaboration, highlighting the value of involving patients in understanding and utilising their own data:

“So, when I look at this, I can certainly glean some insights, but it only truly becomes valuable when the patient can also see it. And I can only really develop that during a conversation with them – figuring out how much they can perceive at the moment, whether they can follow me. Often, entirely new insights emerge for me that I wasn’t aware of before, only when the patient explains them to me. I used to be much more paternalistic, especially when I started out around 30 years ago. I thought, ‘Ah, I have it all figured out.’ But I don’t think that way anymore. I can only make sense of the data if the patient is willing.” (Z_06_Pos.57-59)

Clinicians consistently highlighted the utility of graphical representations in their clinical practice: Line graphs in particular were seen as essential for making abstract data – such as mood fluctuations – more concrete and accessible to patients. One clinician pointed out the value of graphical representation of ESM as a *communication tool*:

“Yeah, somehow with numerical averages – hm, I’m not sure. Probably, especially for mood items or affect-related aspects, graphical representations would be best. On one hand, it’s information for me, for example, for my ward rounds or something similar. But on the other hand, I would also want to bring this into conversations with patients. And then it’s incredibly helpful to show them something like, ‘Look at this line graph, see how your afternoons are always very high.’ It’s much more illustrative that way, and I believe it makes it easier to discuss and work with psychotherapeutically.” (Z_01_Pos.89)

This quote underscores how line graphs may facilitate clearer communication and help patients better understand their own emotional patterns, in turn perhaps enhancing the interaction quality.

A second notable aspect accentuating utility in practice was a desire for visualisations to *integrate mood data with other relevant variables*, such as activities, specific symptoms, mood, sleep, and therapy goals. Clinicians emphasised that these correlations may be crucial for providing a comprehensive understanding of the patient's condition. One participant remarked:

"It is also very meaningful to not only measure mood itself but also to consider its connection, in this case, with activities or, for example, with various symptoms – like warning signs in connection with mood or whatever else might be relevant." (Z_01_Pos.97)

Such integration may facilitate clinicians in identifying patterns and triggers, making it easier to address specific issues during therapy. Moreover, visualisations that allow clinicians to *correlate mood data with specific issues*, such as substance use or relapse risks, were particularly valued. Such tools may enable clinicians to address complex therapeutic concepts (e.g., self-medication hypothesis) in a more tangible way:

"When thinking about functionality, one might work with a patient to address, for example, their avoidance of boredom or feelings of emptiness, or whatever the patient individually seeks to achieve through substance use. Being able to correlate this could also help in working through a relapse. When considering relapse processing, this could be a useful approach." (P_01_Pos.62)

Clinicians also showed a strong interest in the visualisation prototype that illustrated the *relationship between activities and mood*. These visualisations were considered valuable for guiding patients toward behaviours that enhance mood and overall well-being. As one clinician articulated:

"This means that, by using something like this, I could work with the patient to identify, for example, that positive activities, being productive, and engaging in social contact are more likely associated with a good mood. In contrast, if the patient spends time just watching TV or doing nothing – what might fall under the category of "nothing" – we might see more instances of low mood." (Z_08_Pos.58)

Thirdly, the use of visualisations for *goal setting and tracking progress* towards therapy goals reflected another notable use-case for clinicians. Clinicians saw value in using these tools to monitor how well patients are meeting their therapeutic objectives as visualisations may provide patients with a clear sense of their progress, which can be motivating and reinforcing.

“What I find very meaningful is working with patients to create an individualised therapy goal plan and then regularly checking with them to see how far they’ve progressed regarding the goals that were formulated together, I find that very meaningful. Of course, activities are important, and correlating them with mood seems effective, at least. Addiction treatment often involves the topic of identifying meaningful activities.” (P_01_Pos.60)

In sum, this highlights the role that ESM data visualisations could play in enhancing clinical practice in the future. Clinicians see these visualisations as not just informative but perhaps valuable for patient communication, personalised treatment, and goal tracking.

Discussion

The present study explored German clinicians’ perspectives on the visualisation of patient-reported ESM data by using three prototypes of a) line graph, b) mood in context of activities, and c) pie chart, with a specific focus on its potential integration into routine clinical care. Findings indicate that clinicians perceive ESM visualisations as valuable for supporting patient self-management and enhancing therapeutic dialogue in sessions. However, preferences for specific visualisation formats varied, and concerns about complexity and usability emerged, particularly in time-constrained clinical environments.

Visualising of real-time moods

Clinicians in this study generally acknowledged the utility of ESM visualisations in providing a dynamic view of patients’ mental health, particularly in tracking mood fluctuations and activity levels over time. This aligns with existing literature on the benefits of ESM in mental health care, which highlights the potential of real-time data to inform treatment decisions and improve outcomes [29, 30]. However, while clinicians found simple line graphs helpful for visualising

temporal changes in mood, they were more sceptical about the usefulness of more complex formats, which were sometimes viewed as overwhelming or difficult to interpret. This concern is consistent with previous research suggesting that the design of visual tools in healthcare must strike a balance between providing sufficient detail and being easily interpretable [4]. In particular, visualisations with too many data categories or excessive granularity may increase cognitive load, potentially limiting their practical use in busy clinical settings [13, 31]. Therefore, the findings tentatively suggest that while visualising ESM data holds promise for improving clinical practice, careful attention to the design and simplicity of such tools is necessary to ensure their usability.

Several studies have demonstrated the potential of ESM to offer clinicians a more nuanced understanding of patients' daily mental health experiences [7, 17, 19]. In line with these studies, clinicians in the current study emphasised that ESM visualisations could facilitate more personalised interventions, particularly by simplifying the process of identifying patterns of behaviour that correlate with mood changes.

However, the current study also highlights a tension between the perceived utility of these tools and their practical application. Echoing previous findings [32, 33], some clinicians expressed concerns about the time required to interpret complex visualisations, particularly when working with patients who may have cognitive impairments or limited data literacy. Therefore, while ESM visualisations are seen as valuable, their successful integration into routine care may depend on how effectively they can be simplified and tailored to meet the needs of both clinicians and patients. This is largely contingent on how a clinician may want to integrate the visualisations in daily practice.

Patient involvement and empowerment

Clinicians frequently mentioned that visualising patient data could enhance patients' sense of

autonomy and self-management, which is consistent with research on patient-centred care and motivational strategies in mental health treatment [34]. Presenting patients with a visual representation of their mental health patterns may foster a greater sense of control, potentially improving engagement and adherence to treatment plans, but also as an informative tool to capture perhaps non-pathological fluctuations in daily life (i.e., normalising ups and downs) [13, 20, 30].

Nonetheless, clinicians cautioned that the effectiveness of such tools depends on how well patients can understand and relate to the visualised data. As highlighted previously [19], patients' ability to engage with digital health tools is highly variable and may be significantly diminished under conditions of heightened distress or cognitive burden. Thus, while ESM visualisations have the potential to empower patients, their implementation should be accompanied by careful consideration of individual learning needs and capacities.

Design and customisation of visual tools

The findings also highlight the importance of customisation in the design of ESM visualisations. Several clinicians expressed a desire for more flexible tools that allow them to adjust the visualisations to reflect specific patient behaviours or symptoms. This aligns with the growing trend towards personalised health technologies, which emphasise the need for adaptable tools that cater to individual differences in patient experience [35]. Customisation options, such as the ability to correlate mood with specific activities or life events (Fig. 2), were seen as useful for maximising the clinical utility of ESM data. However, there are also potential drawbacks to customisation. Clinicians noted that overly flexible or complex visualisation tools could become burdensome, particularly for patients who might be overwhelmed by too many options or unfamiliarity with data's interpretation, as demonstrated in the literature [31].

The findings suggest several practical implications for the use of ESM visualisations in mental health care. First, simplicity and clarity in design are essential for ensuring that these tools can be effectively integrated into routine clinical practice. As digital health tools become more widespread, it will be important to examine how ESM visualisations can be adapted for use in various mental health care contexts, including outpatient care, community mental health services, and telemedicine. Further research should also consider the integration of these tools within electronic health records, ensuring that they are compatible with existing clinical workflows and data systems [33]. Moreover, visualisations must be intuitive enough to be interpreted quickly, particularly in time-constrained settings. Second, involving patients in the interpretation of their ESM data may enhance their engagement and sense of ownership over their treatment, which could improve therapeutic outcomes [34, 36]. Third, as with the implementation of other tools in healthcare [35], clinicians will likely require some training and support. As such, any implementation of ESM visualisations should be accompanied by comprehensive training that ensure clinicians feel confident in their use.

Methodological considerations

The qualitative design of this study, utilising semi-structured interviews, provides an in-depth understanding of clinicians' perspectives on visualising ESM data within mental health care. Purposeful sampling ensured diversity in clinician expertise and backgrounds, enhancing applicability of the findings across different levels of clinical experience. However, the sample size, while diverse, remains limited to two clinical institutions in Germany, which may affect the generalisability of the findings to other national or international contexts.

The use of visual prototypes and vignettes strengthened the study by making abstract concepts more concrete, thus facilitating more informed and practical reflection. However, the use

of fixed screenshots of visual prototypes, may have limited the scope of feedback to the designs offered, potentially overlooking alternative visualisation formats more effective in communicating ESM data and direct engagement/application with the app. This study focussed on the view of healthcare providers. To understand how patients perceive and interact with these visualisations and view their use within consultation, future research should include in-depth interviews with patients and direct observations of consultations using ESM data-visualisations.

In general, future research could benefit from including a wider range of visual formats or using co-design approaches [35], where clinicians and patients collaboratively develop visualisation tools that better suit their needs.

Conclusion

This qualitative study investigated the use of ESM data visualisation in mental health care from the perspective of clinicians in Germany, from which we draw three main conclusions. First, clinicians expressed a strong desire for comprehensive data visualization options that enable the comparison and individualisation of patient data. Second, concerns were raised about the potential for overwhelming patients, particularly those with cognitive limitations, due to excessive customisation options. Third, and perhaps most importantly, the study observed a shift towards personalised care, with an emphasis on empowering patients to interpret their own data. Clinicians noted the motivational benefits of involving patients in self-management, stressing the importance of tools that enhance patient engagement. In conclusion, the study advocates for the development of data visualisation tools that prioritise the needs and preferences of patients while maintaining their utility for clinicians. By prioritising stakeholder needs, such as clinicians, in the design of ESM data visualisations, we can transform complex data into actionable insights, fostering a more

collaborative and perhaps, more effective therapeutic process.

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Conflict of Interest

The authors declare no conflicts of interest.

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Supplementary Files

TOC/Feature image for homepages

Generate an image with DALL-E using photorealistic or 3D style of a mental health clinician discussing a line graph with their patient. The patient is holding a smartphone because it generated the data. The clinician and the patient are looking at the line graph on a computer monitor. It is a psychiatrist's office, female.

