

# The feasibility of daily monitoring in adolescents and young adults with mild intellectual disability or borderline intellectual functioning

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## Funding information

The Netherlands Organisation for Health Research and Development (ZonMw), Grant/Award Number: 555002014

## Abstract

**Background:** It is unclear whether the limitations of young persons with a mild intellectual disability or borderline intellectual functioning preclude feasibility of the daily diary method.

**Method:** For 60 consecutive days, 50 participants ( $M_{age} = 21.4$ , 56% male) who receive care in an ambulatory, residential, or juvenile detention setting, self-rated both standardised and personalised diary questions through an app. Diary entries were used for feedback in treatment. Interviews were used to explore acceptability.

**Results:** Average compliance was 70.4%, while 26% of participants dropped out. Compliance was good in ambulatory (88.9%) and residential care (75.6%), but not in the juvenile detention setting (19.4%). The content of self-selected diary items varied widely. Participants deemed the method acceptable.

**Conclusions:** Daily monitoring is feasible for individuals with a mild intellectual disability or borderline intellectual functioning receiving ambulatory or residential care, and can provide scientists and practitioners with important insights into day-to-day behavioural patterns.

## KEYWORDS

adolescents, daily diary, ecological momentary assessment, feasibility, mild intellectual disability, personalised monitoring

## 1 | INTRODUCTION

Self-report questionnaires are often used in research in young persons with a mild intellectual disability or borderline intellectual functioning. A mild intellectual disability is characterised by an intelligence quotient (IQ) between 50 and 69, combined with limited conceptual, social and practical adaptive skills (American Psychiatric Association, 2013). Persons with borderline intellectual functioning have an IQ that typically ranges between 70 and 85. Similar to their peers with

an IQ below the 70 cut-off, they struggle with the adaptive skills to meet the demands of everyday life, and thus need care that is considerable of their limited adaptive and intellectual abilities (American Psychiatric Association, 2013; Wieland & Zitman, 2016). Self-report questionnaires require participants to first comprehend the questions and then have the resources to think abstractly and retrospect before answering. This can be challenging for anyone, but particularly for persons with a mild intellectual disability or borderline intellectual functioning. To ensure comprehension, scholars typically construe

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questionnaires with a simple language and format, or, alternatively, modify existing surveys to the level of their cognitive abilities (Kooijmans et al., 2022). However, making *some* appeal to participants' abstract thinking and retrospective abilities remains an inherent feature of traditional surveys. Scientist and practitioners should therefore look for alternative methods that make it easier for persons with a mild intellectual disability or borderline intellectual functioning to provide unbiased accounts of their lives.

## 1.1 | Ecological momentary assessment

In most clinical populations, ecological momentary assessment (EMA) has been a well-established method, but it is not a common practice in the intellectual disability field. In EMA research, individuals' experiences and behaviours are frequently measured over time through short surveys that are administered with pen-and-paper or mobile phone technology (Shiffman et al., 2008; Stone & Shiffman, 1994). This accommodates the study of everyday behaviour as it unfolds in real-time within the participants' natural environment. Instead of recalling or summarising emotional or behavioural traits over longer periods of time, as is typically done in traditional cross-sectional or longitudinal survey research, participants in EMA research repeatedly self-report their current or very recent states. This enhances the ecological validity and minimises recall bias (Shiffman et al., 2008). EMA studies all have frequent self-assessments over time, but the chosen timespan and assessment frequencies differs from study to study. Surveys may for example be prompted at multiple (random) points in time during the day for several days or weeks (Myin-Germeys et al., 2009) or once per day for several weeks or months (Guntherth & Wenze, 2012). The latter is a special case of EMA that is called daily diary monitoring (Shiffman et al., 2008).

## 1.2 | Daily diary compliance

The goal of daily diary research is always to describe or explain day-to-day fluctuations. To achieve this, adhering to frequent self-assessments over an extended period of time is a necessity which does entail some participant burden (Palmier-Claus et al., 2012; Piasecki et al., 2007). When participants are overburdened and miss a lot of diaries, it becomes practically impossible to make a valid inference about day-to-day fluctuations, because a dynamic process cannot be described or explained when only fragments of that process are available and the parts in between are missing. The fact that daily diaries (or any other type of EMA) have barely been applied in persons with a mild intellectual disability or borderline intellectual functioning is likely to be due to researchers assuming that they lack the adaptive skills to comply to a daily protocol. That is, persons with a mild intellectual disability or borderline intellectual functioning can have difficulties with judgement, abstract thinking, planning—skills they may need to stay committed to the diaries over time. On the other hand, the daily surveys themselves demand less from participants' retrospective abilities than traditional questionnaires (Shiffman et al., 2008), which could be

particularly appealing to research in the intellectual disability field. Because daily diary studies either do not (report) screening for intellectual (dis)abilities or even actively exclude them from participating (e.g., Pihet et al., 2017), it remains unknown how compliant the target group would be and what would influence this compliance.

In other clinical populations, the daily diary method has demonstrated good feasibility, as evidenced by average compliance rates of 52% in people with psychosis (Welch et al., 2022), 69% in suicidal teenagers (Czyz et al., 2018) and 81% in outpatients with major depressive disorder (Vachon et al., 2016). In substance use research, daily diaries are particularly popular. Jones et al. (2019) meta-analysed compliance rates of 32 daily diary studies on substance use. Compliance rates ranged between 70% and 83%, with a pooled average of 77%. Schreuder et al. (2023) found an average diary compliance of 85% in 134 young adults who had a history of psychiatric inpatient treatment. In each of these different clinical populations, participant age and gender were shown to be unrelated to compliance, indicating broad diary feasibility (Czyz et al., 2018; Jones et al., 2019; Schreuder et al., 2023; Vachon et al., 2016). Interestingly, Schreuder et al. (2023) stands out from other diary studies by including information about participant IQ, which was also not associated with diary compliance. Their sample's total IQ (which had been registered during their inpatient time) ranged between 67 and 142, with 16 participants below the 85 cut-off that is considered an indicator of borderline intellectual disability (American Psychiatric Association, 2013; Wieland & Zitman, 2016). Although IQ in itself is not a sure sign of mild intellectual disability or borderline intellectual functioning (i.e., information about adaptive skills and a formal diagnosis was missing), it does suggest that limited intellectual abilities may not be a reason to expect method infeasibility.

To the best of our knowledge, only two studies explicitly applied EMA in persons for whom low intellectual functioning is a focus of clinical attention. Wilson et al. (2020) studied 18 adults with a moderate to mild intellectual disability. Their EMA protocol included seven randomly scheduled prompts per day during 7 days, which resulted in a 34% compliance rate. Interviews revealed that technical problems with the application and inconvenient timing of randomly prompted surveys were the main reasons for not completing surveys. Because prompting momentary surveys at random time-points increases the chance that the prompts reach the participant at an inconvenient moment, the frequency and timing of administering surveys may be of importance for keeping compliance rates high and drop-out low. Gosens et al. (2020) were then the first to use daily diary sampling through mobile phones in 12 young persons with a mild intellectual disability or borderline intellectual functioning who followed a treatment for problematic substance use. On average, they adhered to 71% of their diaries during a period ranging from 2 to 12 months depending on treatment duration (Gosens et al., 2023).

## 1.3 | Clinical application of daily diaries

Two aspects of daily diary method by Gosens et al. (2020) were relatively innovative. First, participants' daily entries were channelled back to the clinician during the sampling period, so that recent

self-reported behavioural patterns could be discussed in therapy sessions (cf. Fartacek et al., 2016; Schiepek et al., 2016). Second, the content of daily diary items were not all standardised across individuals. Instead, some items were self-selected by each individual participant. Although fully personalised monitoring would hamper comparisons between individuals, the use of both pre-selected standardised items and personalised items ensures maximal relevance for both science and treatment (Riese et al., 2021; Rodgers et al., 2018). For treatment, it meant that at the start, the participant, clinician and researcher collaboratively construed a set of diary items that matched the unique clinical condition and circumstances of the person (cf. Elliott et al., 2016; Haynes et al., 2009). The choice of items should not only be personally relevant, but also appropriate to monitor in a diary. That is, they should be subject to day-to-day fluctuations, reflecting ‘the issue of the day’ rather than phenomena that fluctuate month-by-month or annually. Daily diary items thus ideally yield temporal answer patterns with day-by-day fluctuations. That way, daily diaries can contribute more to treatment than traditional self-report assessments like (e.g., trimonthly) routine outcome monitoring surveys.

## 1.4 | Current study

The current study will explore the feasibility of a 60-day daily diary EMA protocol, with both standardised and personalised items, for adolescents and young adults with a mild intellectual disability or borderline intellectual functioning who receive care in either an outpatient, residential or juvenile detention setting. More specifically, we addressed four research questions. First, how high are compliance and drop-out rates? Second, which demographic and contextual factors associate with compliance? Third, how acceptable do participants perceive the daily diary protocol? Fourth, which diary items bear personal relevance and are sensitive to day-to-day fluctuations? The latter is explored by presenting the content of the personalised diary items and analysing the extent to which each of the standardised items captured day-to-day fluctuations. This study aims to inform clinical research and practice for adolescents and young adults with a mild intellectual disability about the feasibility of daily diary monitoring. Due to the exploratory nature of this study, we posed no specific hypotheses for the research questions.

## 2 | METHODS

### 2.1 | Design

The current research was an observational study that included an intake, a 60-day diary period and a structured follow-up interview. The study was approved by the Ethical Committee Social Sciences of Radboud University (ECSW-2020-105). The pre-registration and justifications for later amendments to the design can be found via <https://doi.org/10.17605/OSF.IO/DPBK8>.

### 2.2 | Participants

Recruitment took place by distributing information folders to care professionals<sup>1</sup> at Dutch care facilities specialised in treating complex behavioural problems in young persons with a mild intellectual disability or borderline intellectual functioning. It should be noted that in the Netherlands, those with a mild intellectual disability (IQ 50–70) and those with borderline intellectual functioning (IQ 71–85) have access to the same specialised care facilities. Participants who were interested, were contacted by a researcher to be briefed about study procedures. When consenting to participate, an informed consent form was signed by participant and—if underage or under legal guardianship—additionally by a parent or legal guardian. Each participant's case record was checked to verify whether a participant had a mild intellectual disability or borderline intellectual functioning diagnosis. Five adolescents that were subscribed, were excluded before diary sampling started, because neither of these diagnoses could not be confirmed from the case records. This resulted in a final sample size of 50 adolescents and young adults. The case files of 44 of those 50 participants (88%) contained information about IQ obtained through a Wechsler Intelligence Scale (Wechsler, 2003, 2008, 2014). Of the six participants whose IQ scores could not be retrieved from records, a DSM-5 based mild intellectual disability or borderline intellectual functioning diagnosis was present, which warranted inclusion. Moreover, their clinicians confirmed these participants belonged to the target group.

### 2.3 | Procedures

Data collection commenced between October 2020 and March 2022. Participants could contact the researcher if they wished to drop out (i.e., terminate their daily diary prompts). If the researcher noticed that not a single diary was completed for two consecutive weeks, the participant was contacted and asked whether he/she wished to terminate the diary prompts. When a participant did not want to terminate, the researcher asked after the reason for missing the diaries. When the reason did not reflect a lack of legitimate intrinsic motivation (e.g., I was hospitalised after an accident) it was reason to stay in the study, while simply forgetting with a wish to continue for the financial reward was not. Structured follow-up interviews were conducted with all participants, including drop-outs. Only one participant was not available for a follow-up interview. As an incentivising reward, every participant had the prospect of receiving a gift card (after the interview following the 60-day diary period), which, depending on how many diary surveys they completed, was worth maximally 75 €.

### 2.4 | Daily diaries

Because of Covid-19 restrictions, an intake meeting was planned via video call. During this intake, the researcher helped the participant

<sup>1</sup>We use care professional as an umbrella term that refers to clinicians, psychologists, professional care takers or youth workers.

SKIP

Voelde je je vandaag blij?

Helemaal niet      Redelijk      Heel erg



↑ PREVIOUS

↓ NEXT

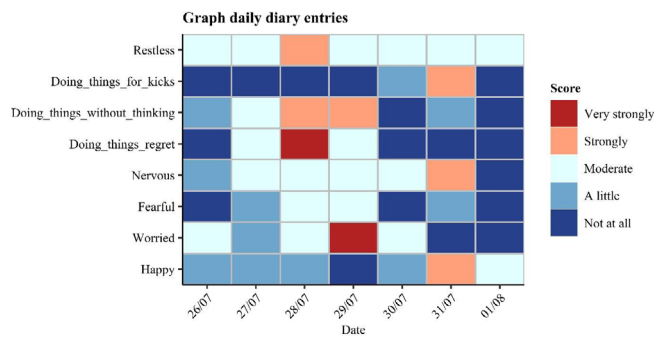
**FIGURE 1** Screenshot of daily diary showing the standardised item ‘Did you feel happy today?’ The Dutch question and rating scale translate to ‘Did you feel happy today?’ with response option ‘Moderate’ selected on a rating scale between ‘Not at all’ and ‘Very much’

instal the mobile phone application Ethica (Ethica Data, n.d.), which was used for daily diary sampling. In Ethica, it is possible to customise the assessment schedule and survey content per individual. Hence, the daily prompts were scheduled at an evening time that was convenient for the participant. The most chosen evening time was 8:00 PM (24%). Regardless of the chosen prompt time, surveys expired at 8:00 AM. This was done because some participants indicated that they wanted to complete their daily diary right before sleeping, which for some occasionally was way past midnight. A reminder was automatically prompted if the survey had not been completed 1 h after the initial survey prompt.

The daily diary survey included eight items that were the same for all participants, which were aimed at assessing both internalising symptoms (anxiety sensitivity, negative thinking) and externalising symptoms (impulsivity, sensation seeking). The items inquired to what extent the person was (1) feeling happy, (2) worrying about the future, (3) feeling fearful, (4) feeling nervous, doing things (5) that you regret, (6) without thinking, (7) for kicks, and (8) feeling unrest, on that particular day. These eight items could be answered on a slider with five answer options that ranged between ‘not at all’ and ‘very strongly’. Figure 1 visualises what this looked like in the app. If a participant proceeded to the next diary item without answering the latter item, the application asked the participants to confirm this. Prior to the study, the application, the items and the response scale were piloted by four adolescents with a mild intellectual disability. During the intake, the researcher read each standard item out loud to the participant and asked the participant to confirm whether its meaning was clear.

The participant, care professional and the researcher then added personalised diary items to the eight pre-selected, standardised diary items. Each participant could opt to add personally relevant closed or open-ended questions, as few or as many as they wanted. The participants essentially generated these items themselves. That is, each participant was asked what they notice that tells them whether they had a good or bad day. Participants then generally came up with either specific (e.g., my sleep) or very broad concepts (my mood), to which the researcher then asked ‘How would you phrase this as a question that you can ask yourself daily in the app?’. The care professionals received no instructions on how to help choose individualised items. They are, however, aware of (therapeutic) goals and needs of the participant, and typically helped by offering suggestions, but it was ultimately the participant's choice. In a few cases, participant and care professional had trouble coming up with concepts or questions. The researcher then provided a few examples for inspiration.

Once per week during the 60-day diary period, the researcher sent an overview of the participant's responses in the daily diary application to their care professional so they may integrate it in the treatment. There were no instructions for care professionals on how to use the daily diary entries in their everyday practice. The nature of therapy varied between participants. For example, some received protocolled dialectical behavioural therapy by a registered psychotherapist while others received more unstructured therapy in which their youth worker coached them on adaptive behaviours such as eating behaviour or managing money. Importantly, the care professional agreed to (1) ensure the privacy of response overviews and (2) in case the participant reported on behaviours that are against the community rules (e.g. substance abuse), entries would be free of disciplinary consequences. The weekly overviews always contained an Excel file with all closed- and open-ended responses and a summarising data visualisation of all items that were answered on the same 5-point scale (see Figure 2 for an illustrative example).



**FIGURE 2** Exemplary weekly graphical overview of one participant's diary entries that was sent to the care professional

## 2.5 | Follow-up interview

After the 60-day diary period, a follow-up interview was administered via video call, in which the participant reflected on the acceptability of the daily diary method. The interviews took approximately 20 min and were structured—each participant was asked the same set of questions in the same order. They were administered by either a researcher or an independent scientist-practitioner who was briefed and trained in the interview protocol. The questions were a mix of open-ended questions and questions for which a rating-scale was offered. Participants rated their general opinion about adhering to the daily diary protocol on a 5-point Likert-scale ranging from ‘Very pleasant’ to ‘Very unpleasant’. Participants used a 6-point Likert scale ranging from ‘Never’ to ‘More than once per week’ to indicate the frequency of reminders that care takers gave them to complete their diaries and the frequency with which they discussed their diary entries with their care professional. Furthermore, they reflected on the length and frequency of the 60-day protocol with one survey per day, by indicating whether it was ‘fine for them’, ‘too long/too many’, ‘too short/too few’. Open-ended questions related to reflecting on reasons for participating in the study, reasons for dropping out (if applicable), perceived gains and drawbacks from participating, perceived duration of completing a daily diary (on average), reasons for not completing diaries on certain days and what might have improved their compliance (if applicable).

## 2.6 | Analyses

All analyses were performed in RStudio-2022.02.2-458 (RStudio Team, 2022), which runs on R software (version 4.2.0; R Core Team, 2020). The data are available upon request from <https://doi.org/10.17026/dans-zkw-fbvs>. R scripts are publicly available from <https://doi.org/10.17605/OSF.IO/DPBK8>.

Descriptive statistics on drop-out and compliance rates were obtained for the whole sample and per type of care facility (ambulatory care, residential care, juvenile detention centre). Bivariate associations between various demographic and contextual factors and

compliance rates were calculated. A Kruskal–Wallis test was used to test whether compliance rates differed between the three care types. Two point-biserial correlations were calculated to assess whether compliance rates differed as a function of gender (dummy coded as 0 = female, 1 = male) and whether or not the participant completed diaries on their own or a group mobile phone device (dummy coded as 0 = group device, 1 = own mobile phone). Pearson correlation coefficients were used to determine whether compliance was associated with age, total IQ, the frequency of reminders from care takers, and the frequency of diary response integration in treatment. We evaluated the significance level of  $p$ -values at  $<.05$ , after controlling for false positives due to multiple testing using the Hochberg–Benjamini correction method. Results from the structured interviews are presented descriptively. To assess the extent to which the eight standardised diary items captured temporal fluctuations, we computed the mean squared successive difference (MSSD) for all available data-points per individual and per item. The MSSD is a measure of dispersion on a timeseries (Von Neumann et al., 1941). As opposed to the variance statistic, which is insensitive to periodic fluctuations on a timeline, MSSD captures variability between adjacent timepoints while taking into account gradual mean shifts. Specifically, it calculates the average of all differences between successive observations at timepoints  $i$  and  $i + 1$  on a time series of  $n$  timepoints, which is given by:

$$\text{MSSD} = \frac{\sum_{i=1}^{n-1} (x_{i+1} - x_i)^2}{n - 1}$$

A higher MSSD thus reflects an instable pattern with high variability between answers from day-to-day, whereas lower values indicate that the temporal pattern of the answers was stable with relatively few day-to-day variability.

## 3 | RESULTS

### 3.1 | Sample description

The sample's mean age was 21.4 ( $SD = 5.1$ , range 14–33), with 14 participants (28%) being under the age of 18. In the whole sample, mean total IQ was 72.6 ( $SD = 9.4$ ) and 28 (56%) were male. Participants received either ambulatory care ( $n = 6$ , 12%) or intramural care at a residential care facility ( $n = 38$ , 76%) or juvenile detention centre ( $n = 6$ , 12%). All care facilities were specialised for youth with complex behavioural problems and a mild intellectual disability in the Netherlands. Comorbidity to the mild intellectual disability was common in our sample: 16 participants (32%) had one DSM diagnosis comorbid to their mild intellectual disability (or borderline intellectual functioning), 15 (30%) had two comorbid diagnoses, and 9 (18%) had three comorbid diagnoses. We counted 23 unique comorbid disorders according to the DSM-5 (American Psychiatric Association, 2013), which reflects a heterogeneous sample. The most frequently recurring



**TABLE 1** Demographics and outcome measures of the total sample and per care type

|  | Total sample (n = 50) | Ambulatory care (n = 6) | Residential facility (n = 38) | Juvenile detention (n = 6) |
|--|-----------------------|-------------------------|-------------------------------|----------------------------|
| <b>Demographics</b>                        |                       |                         |                               |                            |
| Age (M, SD)                                | 21.4 (5.1)            | 21.2 (5.3)              | 21.5 (5.4)                    | 21.0 (2.8)                 |
| Total IQ (M, SD)                           | 72.6 (9.4)            | 75.0 (6.7)              | 73.1 (9.8)                    | 66.2 (7.7)                 |
| Number diary items (M, SD)                 | 13.2 (3.0)            | 13.3 (2.1)              | 13.3 (3.3)                    | 12.2 (1.0)                 |
| Gender (n male, %)                         | 28 (56%)              | 3 (50%)                 | 19 (50%)                      | 6 (100%)                   |
| Own phone (n own phone, %) <sup>a</sup>    | 41 (82%)              | 6 (100%)                | 35 (92%)                      | 0 (0%)                     |
| Frequency reminders <sup>b</sup>           | 1.1 (1.6)             | 0.2 (0.4)               | 0.8 (1.3)                     | 3.5 (1.9)                  |
| Frequency therapy integration <sup>b</sup> | 1.7 (1.5)             | 2.5 (0.8)               | 1.5 (1.6)                     | 2.0 (1.4)                  |
| <b>Outcome measures</b>                    |                       |                         |                               |                            |
| Diary compliance rate (%)                  | 70.4%                 | 88.9%                   | 75.6%                         | 19.4%                      |
| Drop-out (n dropped out, %)                | 13 (26%)              | 0 (0%)                  | 7 (18%)                       | 6 (100%)                   |

<sup>a</sup>Number of participants who completed diaries on their own phone as opposed to on a tablet or phone of their living group.

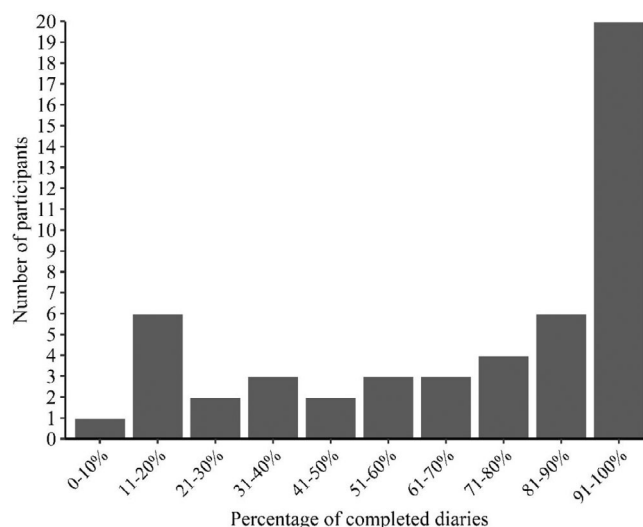
<sup>b</sup>The frequency by which participants were reminded to complete diaries and the frequency of integrating diaries in therapeutic settings with caregiver or clinician reflects a 6-point scale with categories (0) 'never', (1) '< once per month', (2) 'once per month', (3) 'every two weeks', (4) 'once per week', (5) 'once per week'.

DSM-5 disorders were post-traumatic stress disorder ( $n = 11$ , 22%), attention deficit hyper activity disorder ( $n = 10$ , 20%), autism spectrum disorder ( $n = 9$ , 18%) and reactive attachment disorder ( $n = 9$ , 18%). Nine participants (three from residential care and all six from the juvenile detention centre) had restricted or no access to their own mobile phone due to disciplinary reasons. For them, arrangements were made with staff to allow them to complete their diary survey once per day, in privacy, on a phone or tablet device provided by the care facility.

### 3.2 | Drop-out and compliance

Table 1 presents participant demographics and primary outcome measures for the whole sample and per care type (ambulatory, residential or juvenile detention). Overall, 13 of the 50 participants (26%) who started the 60-day diary period dropped out before completing the 60 days. The median day number on which these 13 participants dropped out was day number 19 (range day 2 to day 46). Of the 13 drop-outs, 12 were interviewed. The reasons provided for dropping out were forgetting to adhere to the diaries ( $n = 4$ ), frustrations with technical problems with the mobile device or application ( $n = 3$ ), stress in their personal lives that was unrelated to the diary study ( $n = 3$ ), and the diary protocol being too intense ( $n = 1$ ) or too boring ( $n = 1$ ).

The average compliance rate of the whole sample ( $N = 50$ ) was 70.4%. Those that were retained throughout the 60-day diary period ( $n = 37$ ) had an average compliance rate of 86.4%. There were 14 participants (28%) who completed all 60 diaries. Figure 3 visualises the distribution of compliance rates across the whole sample. It shows that 20 participants (40%) completed over 90% of their diaries during the 60-day period. The distribution of participants that completed less than 90% of their diaries is relatively uniform, which means that the number of participants that had a compliance rate

**FIGURE 3** Distribution of compliance rates between participants

between 0% and 30%, between 31% and 60% or between 61% and 90% was roughly the same. There were no missing data points within the diaries that were completed. That is, participants who completed a daily diary answered all of its items. The median time lag between receiving the initial prompt and completing the survey was 47 min (range = 22 s to 10 h). The latter is explained by three participants who wished to complete their diary before sleeping, which (e.g., due to work) was sometimes well past midnight.

Associations between the compliance rate and eight demographic and contextual variables were evaluated. There was no difference in the percentage of completed diaries,  $t(43) = 1.03$ ,  $p = .311$  between participants diagnosed with a mild intellectual disability ( $M = 65.3$ ,  $SD = 33.4$ ) and those with borderline intellectual functioning diagnosis ( $M = 74.6$ ,  $SD = 30.8$ ). Fisher's exact test further showed that this

diagnosis was not associated with drop-out ( $p = .197$ ). A Kruskal-Wallis test revealed that there was a significant difference in compliance rates between the three care types ( $\chi^2(2) = 12.80, p = .010$ ), with those in the juvenile detention system ( $M = 19.4$ ) having lower compliance rates than participants receiving ambulatory ( $M = 88.9$ ) or residential care ( $M = 75.6$ ). Participants who could enter diaries on their own phone—rather than on a group-owned device—had a higher compliance rate ( $r_{pb} = 0.58, p < .001$ ). Furthermore, participants who were reminded more frequently by staff to complete diaries had a lower compliance rate ( $r = -0.57, p < .001$ ). The compliance rates did not show significant associations with gender ( $r_{pb} = -0.33, p = .09$ ), age ( $r = 0.25, p = .33$ ), total IQ ( $r = 0.04, p = .80$ ), the number of items included in daily diaries ( $r = -0.04, p = .80$ ), or the frequency of diary answer integration in treatment ( $r = 0.08, p = .80$ ).

### 3.3 | Acceptability

Most participants experienced their participation in the daily diary study as ‘pleasant’ ( $n = 19, 39\%$ ) or ‘very pleasant’ ( $n = 11, 22\%$ ). Only one participant (2%) found the experience ‘unpleasant’, nobody rated it as ‘very unpleasant’, and 18 participants (37%) had a ‘neutral’ stance to their participation. The majority indicated that the 60-day period was appropriate ( $n = 34, 69\%$ ) or even too short ( $n = 7, 14\%$ ), while only eight participants (16%) indicated that it was too long. One survey prompt per day was appropriate for the majority ( $n = 36, 73\%$ ), while for nine participants (18%) more surveys per day would have been better and for four participants (8%) less than one survey per day would have been better. In total, 46 participants (94%) would recommend their peers to participate in this study.

In the first open-ended question in the follow-up interview, participants were asked to specify their reason(s) for participation. Recurring reasons for participation were the gift-card (38%), increasing self-awareness (34%), to aid in achieving treatment-related behavioural change, such as reduce aggression, self-harm or substance use (26%), simply to participate in research (26%), or improve communication with care givers (8%). When openly asked what participants gained from participating, the most frequently mentioned gains related to increased self-awareness (64%), receiving a gift-card (30%), that it helped them communicate with care givers (18%) and aiding them in reducing the problematic behaviours that were the focus of their therapy, such as reduced substance use (10%), reduced aggression (4%) and reduced self-harm (4%). Five participants (10%) indicated that they did not gain anything. Perceived drawbacks from adhering to the daily diary protocol were technical complications with their phone or the diary application (18%), that certain diary questions were included that they deemed irrelevant for themselves (14%) or difficulties finding an appropriate moment to complete diaries (8%). A majority (52%) could not think of any drawbacks from participating. Lastly, participants were asked to estimate, on average, how long completing one daily diary survey took them. Their responses varied from <1 to 8 min, with a median of 2 min.

The 36 participants who did not complete 100% of their diaries were asked what was/were reason(s) for the day(s) they did not complete their diaries. The most prominent reasons for missing diaries were forgetting without a specific reason (23%), being in the company of other people (20%) or that they chose not to complete diaries during days when they experienced high levels of stress (20%). Lastly, they were asked to reflect on what would have helped them to increase their compliance. The most frequently mentioned responses were that they needed more reminders by care professionals (23%), more reminding notifications of the app (11%) or that their set of diary questions should have been updated or altered throughout the study (14%).

### 3.4 | Standardised diary items

Table 1 presents the MSSD scores that were computed per standardised diary item and per participant, on a subset of 30 participants who had >75% compliance. MSSD scores were calculated to assess the extent to which these items captured fluctuations across time. Participants differed in their average MSSD across the different diary items (range 0.02–2.14). The highest within-item MSSD scores were observed across participants in the items ‘Did you feel unrest today?’ ( $M_{\text{mssd}} = 1.19$ ) and ‘Did you feel happy today?’ ( $M_{\text{mssd}} = 1.28$ ). The latter item was the only item with non-zero MSSD scores for all participants. The seven other items each had MSSD scores of zero for one or more of the participants. The item that captured the least variance was ‘Did you do things purely for kicks?’ ( $M_{\text{mssd}} = 0.31$ ) resulting in a MSSD of zero for 12 participants (40%; Table 2).

### 3.5 | Personalised diary items

The content of the personalised items illustrates what topics were relevant to the participants. The number of personalised items that were added to the standardised items varied per participant, resulting in a median total of five personalised diary items (range 0–13). Only two participants did not add any personalised items. As the content of the personalised diary items were typically related to personal goals that participants had set for themselves in treatment, the array of the diary items was highly diverse. The most frequently added items were open-ended entries asking the participant to describe their day ( $n = 16$ ) or highlight what was positive about their day ( $n = 23$ ). Furthermore, items concerning cannabis use ( $n = 15$ ), alcohol use ( $n = 6$ ), self-injury ( $n = 7$ ), or eating behaviour ( $n = 5$ ) were relatively frequently added. Other items related to, for example, feeling aggressive, angry, annoyed, aroused, depressed, energetic, panicky, safe, self-confident, suicidal, tensed, quality of sleep, quality of communication with others, peer pressure, ruminations, money spending, social media use, the urge to run away, or a generic description of mood. Notably, personalised items were formulated by the participant in their own vocabulary. This meant that some items, for example ‘Did your bucket empty by smoking weed?’, may confuse outsiders, but matched the participant’s self-perception and vocabulary.

**TABLE 2** Mean squared successive differences (MSSD) for each of the eight standardised diary items for participants with over 75% diary compliance ( $N = 30$ )

| Participant ID   | Happy      | Worried     | Scared      | Nervous     | Act later regret | Act without thinking | Act for kicks | Unrest      | Participant MSSD M (SD) |
|------------------|------------|-------------|-------------|-------------|------------------|----------------------|---------------|-------------|-------------------------|
| 1                | 1.12       | 1.85        | 1.20        | 0.83        | 1.49             | 1.54                 | 0.88          | 1.85        | 1.34 (0.40)             |
| 2                | 1.43       | 1.49        | 0.89        | 0.87        | 1.06             | 1.06                 | 1.43          | 2.09        | 1.29 (0.41)             |
| 3                | 0.31       | 0.03        | 0.56        | 0.53        | 0                | 0                    | 0             | 0.36        | 0.22 (0.25)             |
| 4                | 0.29       | 0.24        | 0.03        | 0.07        | 0.08             | 0.27                 | 0.07          | 0.32        | 0.17 (0.12)             |
| 5                | 1.80       | 0.30        | 0           | 0           | 0                | 0                    | 0             | 0.13        | 0.28 (0.62)             |
| 6                | 0.58       | 0.47        | 0.34        | 0.44        | 0.07             | 0.19                 | 0             | 0.58        | 0.33 (0.22)             |
| 7                | 1.80       | 1.08        | 0.43        | 1.12        | 0.80             | 0.84                 | 0.20          | 1.96        | 1.03 (0.61)             |
| 8                | 1.19       | 3.75        | 2.08        | 3.91        | 1.45             | 1.34                 | 0             | 3.38        | 2.14 (1.41)             |
| 9                | 0.43       | 0.12        | 0.21        | 0.59        | 0.07             | 0.10                 | 0             | 0.47        | 0.25 (0.22)             |
| 10               | 1.13       | 1.11        | 1.25        | 1.09        | 0.29             | 0.35                 | 0             | 1.05        | 0.78 (0.49)             |
| 11               | 0.62       | 0.18        | 0           | 0.50        | 0.39             | 0.43                 | 0.25          | 0.46        | 0.35 (0.20)             |
| 12               | 0.47       | 0.24        | 0.03        | 0.28        | 0.16             | 0.05                 | 0             | 0.40        | 0.20 (0.17)             |
| 13               | 0.75       | 1.10        | 1.42        | 1.12        | 0.56             | 0.51                 | 0.03          | 1.51        | 0.88 (0.50)             |
| 14               | 0.42       | 0.62        | 0           | 0.23        | 0.10             | 0.08                 | 0.69          | 0.21        | 0.29 (0.26)             |
| 15               | 1.14       | 1.47        | 1.86        | 1.36        | 0.44             | 0.02                 | 0             | 0.76        | 0.88 (0.69)             |
| 16               | 4.73       | 0.25        | 0.41        | 0.61        | 0.49             | 0.42                 | 1.78          | 1.49        | 1.27 (1.50)             |
| 17               | 1.51       | 0.40        | 0.22        | 0.36        | 0.11             | 0.69                 | 0.09          | 1.02        | 0.55 (0.50)             |
| 18               | 0.36       | 0.19        | 0.38        | 0.30        | 1.36             | 1.23                 | 0.02          | 0.75        | 0.57 (0.49)             |
| 19               | 0.75       | 0.71        | 1.03        | 1.10        | 0.78             | 0.98                 | 0.80          | 1.24        | 0.92 (0.19)             |
| 20               | 0.63       | 0.74        | 0.93        | 0.86        | 1.70             | 1.37                 | 1.70          | 0.58        | 1.06 (0.46)             |
| 21               | 2.46       | 0.31        | 0.19        | 0.83        | 0.29             | 0.48                 | 0.35          | 1.9         | 0.85 (0.86)             |
| 22               | 0.69       | 0.24        | 0           | 0.14        | 0.14             | 0.14                 | 0             | 2.0         | 0.42 (0.68)             |
| 23               | 0.14       | 0           | 0           | 0.02        | 0                | 0                    | 0             | 0           | 0.02 (0.05)             |
| 24               | 2.20       | 1.93        | 0.31        | 1.05        | 1.42             | 0.58                 | 0.03          | 2.27        | 1.22 (0.87)             |
| 25               | 1.95       | 1.19        | 1.46        | 1.39        | 0.92             | 1.59                 | 0.61          | 2.37        | 1.44 (0.56)             |
| 26               | 1.07       | 0.81        | 3.17        | 3.12        | 0.05             | 0.17                 | 0             | 2.02        | 1.30 (1.32)             |
| 27               | 0.27       | 0.13        | 0.11        | 0.27        | 0.24             | 0.31                 | 0.24          | 0.40        | 0.25 (0.09)             |
| 28               | 1.71       | 1.41        | 1.76        | 1.14        | 0.90             | 1.10                 | 0.14          | 1.88        | 1.25 (0.57)             |
| 29               | 4.55       | 0           | 0           | 0           | 0.04             | 0.04                 | 0             | 0.02        | 0.58 (1.60)             |
| 30               | 2.05       | 0.92        | 2.42        | 2.36        | 0.88             | 0.51                 | 0.10          | 2.22        | 1.43 (0.93)             |
| Item MSSD M (SD) | 1.28 (1.1) | 0.78 (0.78) | 0.76 (0.83) | 0.88 (0.88) | 0.54 (0.52)      | 0.55 (0.50)          | 0.31 (0.51)   | 1.19 (0.87) |                         |

Note: Each cell reflects the MSSD for self-ratings of one participant on one standardised diary item, which pertained to either (1) feeling happy, (2) worrying about the future, (3) feeling fearful, (4) feeling nervous, doing things (5) that you regret, (6) without thinking, (7) for kicks, or (8) feeling unrest, on that particular day. The bottom row reflects the average and standard deviation of MSSD per item across participants. The right column reflects the average and standard deviation of MSSD per participant across the eight diary items.

## 4 | DISCUSSION

The current study explored the feasibility of a 60-day daily diary protocol in adolescents and young adults with a mild intellectual disability or borderline intellectual functioning. An average compliance rate of 70.4% and a drop-out rate of 26% indicate that daily monitoring holds as a feasible method for data collection in this specific target group. Follow-up interviews showed that the vast majority of participants deemed the 60-day daily diary protocol to be

acceptable. It should be noted that not having access to one's own mobile phone device to complete diaries seriously hampered compliance. That is, participants who completed diaries on their own mobile phone (as opposed to a group-owned device) were significantly more compliant. Those in the juvenile justice system had to use group-owned devices and all dropped out. Compliance was not associated with age, gender, IQ, the number of diary items included and the frequency of diary entry integration in treatment. We therefore conclude that daily diary sampling is feasible for individuals



receiving ambulatory or residential care and who can complete the diaries on their own mobile phone.

Our compliance rates are comparable to those found in other daily diary studies in the same (Gosens et al., 2023) and different clinical populations (Czyz et al., 2018; Jones et al., 2019; Schreuder et al., 2023; Vachon et al., 2016; Welch et al., 2022), and are in line with general recommendations for EMA research (Trull & Ebner-Priemer, 2020). Moreover, a considerably higher compliance was observed than that of the EMA study with adults with a moderate to mild intellectual disability (Wilson et al., 2020). This might be explained by the chosen sampling frequency. Compared to this study's 60-day diary protocol, the study by Wilson et al. (2020) had a considerably shorter but more intense protocol with surveys that were prompted at seven random time-points per day during 7 days. It is likely that participants perceive multiple prompts per day as too burdensome. This would echo our finding that the majority of participants found the 60-day diary protocol to have an appropriate sampling length and sampling frequency. Furthermore, prompting EMA surveys at random time-points increases the chance that the prompts reach the participant at an inconvenient moment. Nevertheless, such a short spanned EMA protocol with multiple assessments per day may be preferable over a daily diary protocol when the phenomena of interest are faster-changing constructs. We therefore recommend that future research focusses on if and under what circumstances a protocol with multiple assessments per day is feasible for people with limited intellectual abilities.

#### 4.1 | Limitations and strengths

This study has two notable limitations. First, whereas a follow-up interview assessed acceptability among the participants, information is still lacking on how the care professionals experienced the method. Implementing this method in specialised care and therapy settings will largely depend on the gains and draw-backs that care professionals experience when using the daily diary method. Bos et al. (2019) showed that the implementation of EMA in care for psychiatric patients (without an intellectual disability) had several advantages for the clinicians, such as improved patient-clinician relationship, increased personalization and efficiency of care. Future research could explore how daily diaries are used in specialised practice for those with a mild intellectual disability and how acceptable the care professionals deem this method. A second limitation is the small sample size, especially in the juvenile detention centre ( $n = 6$ ). This makes it hard to explain why compliance there was so low (19.4%) and how it may be improved in future research. Findings by Pihet et al. (2017) suggest it is possible to implement EMA in a juvenile detention centre. They found a 92% compliance rate in 52 incarcerated adolescents, that were given a special handheld computer to self-report momentary experiences four times per day during 8 days. Given that the target group is overrepresented in the criminal justice system (Hellenbach et al., 2017), it is important that future research investigates the needs

of juvenile justice institutions and incarcerated young persons with mild intellectual disability or borderline intellectual functioning, in facilitating and accomplishing good compliance rates in daily diary research.

There are several strengths to this study. Compared to daily diary protocols that take several days or weeks, our relatively long sampling period of 2 months is a strength. Psychological treatment trajectories typically take more than a month, which means the method is useful for clinical research and practice. The utility for clinical practice, and thereby the feasibility, was further enhanced by channelling the responses back to the care professionals and by offering participants the option to monitor self-selected items daily. This strategy adheres to a call for a personalised approach to psychopathology (Wright & Woods, 2020), but is relatively innovative in the realm of (daily diary) EMA research that typically employs surveys that are fully standardised across participants. Our findings introduce a new strategy to the field of intellectual disability research, but also contribute clinical research in general.

#### 4.2 | Practical and scientific implications

Daily diaries benefitted participants—all of whom received care in specialised care settings. Although the concept of keeping diaries and discussing them in treatment sessions is not a new therapeutic technique for people with an intellectual disability (Surley & Dagnan, 2018), this is typically done with pen-and-paper diaries because of electronic diaries raised feasibility concerns (e.g., Illingworth et al., 2015). Youth typically have their mobile phone with them, which makes completing a diary entry preferable over the pen-and-paper approach. The majority of participants (64%) reported improved self-awareness due to the daily self-evaluations in the app. This finding is highly promising for participants, as it suggests that the method itself can empower them in the process of 'getting to know yourself'. Benefits are optimised when the daily diary data are integrated in their clinical trajectories, by routinely providing daily diary input in treatment sessions. This finding echoes other clinical studies that reported advantages of daily diaries (Fartacek et al., 2016; Schiepek et al., 2016) and EMA research in general (Bos et al., 2019; Riese et al., 2021). In our study, care professionals received weekly overviews of raw diary data with visualisations (Figure 2) which they could discuss with the participant. Future research could explore other ways in which clinicians can benefit from diary feedback. That is, in addition to visualisations of raw diary, diary data can also be analysed statistically to unravel underlying patterns. For example, timeseries analysis of diary data, when channelled back to a clinician, can provide insights into potential causes and consequences of specific behaviours for groups of clients or individual cases (Daniëls et al., 2022). Statistical timeseries analyses have aided the identification of treatment needs of psychotic patients, after they participated in a 6-day EMA protocol with 10 prompts per day (Van Os et al., 2014). In other studies, individual clients' daily diary patterns were analysed with non-linear dynamic systems analyses (Fartacek et al., 2016; Schiepek

et al., 2016). Their results had real-life predictive value about the chances of meaningful clinical change occurring on the short-term.

Diary items are ideally used to capture fluctuations over time. This study showed that, of the eight standardised items to assess internalising and externalising symptoms, 'feeling happy' and 'feeling unrest' were most sensitive to day-to-day changes. The items 'doing things without thinking', 'doing things that you later regret' and 'doing things for kicks', on the other hand, demonstrated the lowest overall MSSD. This may indicate that items measuring impulsivity may be more trait-like (i.e., patterns that are relatively similar across situations) than state-like emotional experiences such as happiness or unrest (cf. Baumeister et al., 2007). In other words, although there was some variation over time in impulsivity, a person's level of happiness or unrest seemed to depend more on the circumstances of a particular day and therefore demonstrated more fluctuations over time. The descriptive statistics of day-to-day fluctuations, and additionally the notion that the care professional and client attributed meaning to them in treatment settings, seems to indicate that the daily self-ratings reflected overall good face validity. That is, the fact that items indeed captured the day-to-day fluctuations that one would expect and the benefits that participants reported from keeping the diaries, give us no reason to suspect that the self-ratings somehow did not correspond to reality.

The diversity of topics that were chosen as personalised diary items demonstrates that there is considerable heterogeneity within the target group in terms of their everyday challenges. Between-person heterogeneity had previously been indicated by Nouwens et al. (2017), who identified five unique classes of persons with a mild intellectual disability or borderline intellectual functioning in terms of their personal and environmental characteristics. However, even within classes, each individual has his/her own unique characteristics and experiences. In a fully standardised questionnaire, each individual will thus either encounter items that may be irrelevant for themselves and/or miss items that would have had personal relevance (Haynes et al., 2009; Weisz et al., 2011; Wright & Zimmerman, 2019). On the other hand, constructing personalised items in collaboration with each participant has the disadvantage that it requires more effort and time than just constructing one set of standardised items. Moreover, it hampers between-person comparisons. Complementing standardised assessments with personalised assessments may be a strategy to ensure both the comparability between individuals as well as the personal relevance. Diary compliance, especially when integrated with clinical practice, may be maximised when the survey measures what is relevant for the individual.

The primary advantage of daily diary sampling, however, is not only to determine how individuals differ from each other, but to map fluctuations in behavioural and emotional patterns within individuals. Empirical findings about those with a mild intellectual disability are almost exclusively based on between-person inferences. Between-person data for example shows that, on average, persons with a mild intellectual disability or borderline intellectual functioning who have higher levels of negative thinking report more severe alcohol use (Poelen et al., 2017). With daily diaries one could study

whether individuals are actually using alcohol on moments/days when they are having negative thoughts, which would yield important insights for intervention. After all, interventions primarily focus on when and why symptoms occur. In other words, EMA provides researchers with a valuable tool to examine behaviours and emotions as they unfold across different contexts over time (Shiffman et al., 2008). Studying such within-person processes and how within-person processes differ between individuals, has considerably advanced psychological science over the past two decades (Russell & Gajos, 2020). Now that daily diary sampling has demonstrated feasibility, young persons with a mild intellectual disability will hopefully also benefit from this in the future.

## 5 | CONCLUSION

The current study explored the feasibility of daily diary sampling with a mobile-phone application for adolescents and adults with a mild intellectual disability or borderline intellectual functioning. Diary items were partially tailored to the individual and overviews of diary answers were shared with the participant's care professional throughout the 60-day diary period. Compliance rates were good for persons who received ambulatory (88.9%) or residential care (75.6%), but not for individuals who were detained in the juvenile detention centre (19.4%). For the participants it was more convenient to answer diaries on their own mobile phone devices as opposed to using a group-owned device. Interviews revealed that the majority of participants deemed the daily diary method to be acceptable. Findings from this study should prompt researchers to employ daily diaries for the study of behaviour and emotions in adolescents and young adults with a mild intellectual disability, so that they, their practitioners and science as a whole may gain a better understanding about their behavioural processes.

## ACKNOWLEDGEMENTS

The authors would like to thank the participants and their care professionals for taking part in our study.

## FUNDING INFORMATION

This work was funded by The Netherlands Organisation for Health Research and Development (ZonMw project 555002014).

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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**How to cite this article:** Hulsmans, D. H. G., Poelen, E. A. P., Lichtwarck-Aschoff, A., & Otten, R. (2023). The feasibility of daily monitoring in adolescents and young adults with mild intellectual disability or borderline intellectual functioning. *Journal of Applied Research in Intellectual Disabilities*, 36(4), 847–858. <https://doi.org/10.1111/jar.13102>