An Ecological Momentary Assessment Approach to the Study of Post-traumatic Stress Symptoms in U.S. Military Service Members

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Introduction

Ecological Momentary Assessment (EMA) is a relatively new method to capture current experiences while respondents are engaged in normal daily routines.[1,2] EMA maximizes validity and allows examination of the influences of context and time on behavior. Repeated assessment of current experiences decreases recall bias and increases reliability of data. EMA is based on paper and pencil research methodology using daily diaries/journals. However, paper assessments have drawbacks including respondents failing to complete assessments at the specified time and the potential for forward-filling and back-filling of assessments,[3,4] which bring the validity of the data into question.[5] Electronic assessments overcome many of the limitations of paper assessments and are increasingly common in EMA studies. To examine differences in assessment methods, we compared assessment completion rates, usability, and participant-reported benefits of assessments completed using paper and pencil versus electronic tablets.

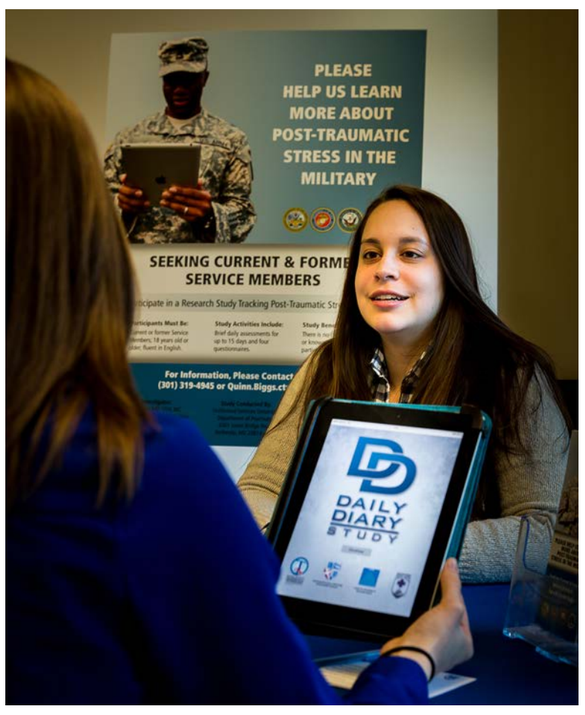
Methods

Participants: Data for this investigation were drawn from the Daily Diary Study, an EMA study tracking variability in post-traumatic stress symptoms (PTSS) over time. Current and former U.S. military service members (*N* = 80) were recruited from the behavioral health clinic at a large military medical center. A minimal level of PTSS was required to join the study. Of enrollees, 69 complete at least one EMA and 68 met minimum data inclusion requirements. Participants were age 19 – 67 (*M* = 36.6, *SD* = 10.3) and primarily male (55.9%), Caucasian (73.5%), and in the Navy (42.1%) or Army (36.3%).

Procedures: Participants were asked to complete four Daily Diary assessments per day for 15 days.

Phase 1: Participants 1 – 50 were given paper assessments.

Phase 2: Participants 51 – 80 were given electronic assessments with the option to complete paper assessments as needed.



Assessments were fixed interval, four hours apart, and were to be completed within six hours. The date and time for completion was written on each paper assessment and participants recorded when the assessment was completed. Electronic assessments were only accessible at assessment times. Options for assessment reminders were offered to all participants. After the 15-day period of daily assessments, participants completed the post-assessment.

Measures:

- **Daily Assessments:** Each PTSS assessment included 26-items measuring symptoms of post traumatic stress, depression, and generalized anxiety. Sleep, pain, substance use, medication use, mental health care, and social support were included on one assessment per day.
- **Post-assessment:** Five items asked the participant to rate the daily assessments on ease of use and personal helpfulness on a 1 = *Not at All* to 10 = *Very Much* scale. One item asked if the participant would use the daily assessments on his or her own if made available, *Yes* or *No*.

Data Analysis: Assessments were reviewed for compliance with assessment procedures (i.e., completion time) and marked as usable or not usable for data analysis. Analyses of paper and electronic methods included frequency of usable assessments and participants, and significance tests (chi-square or *t*-tests) to determine differences on the six post-assessment items.

Results

A total of 3026 assessments were collected from 69 participants (Table 1). Three participants completed primarily electronic assessments (*n* = 153) and some paper assessments (*n* = 15) when their electronic tablet was not available.

Table 1. Number of Assessments and Participants

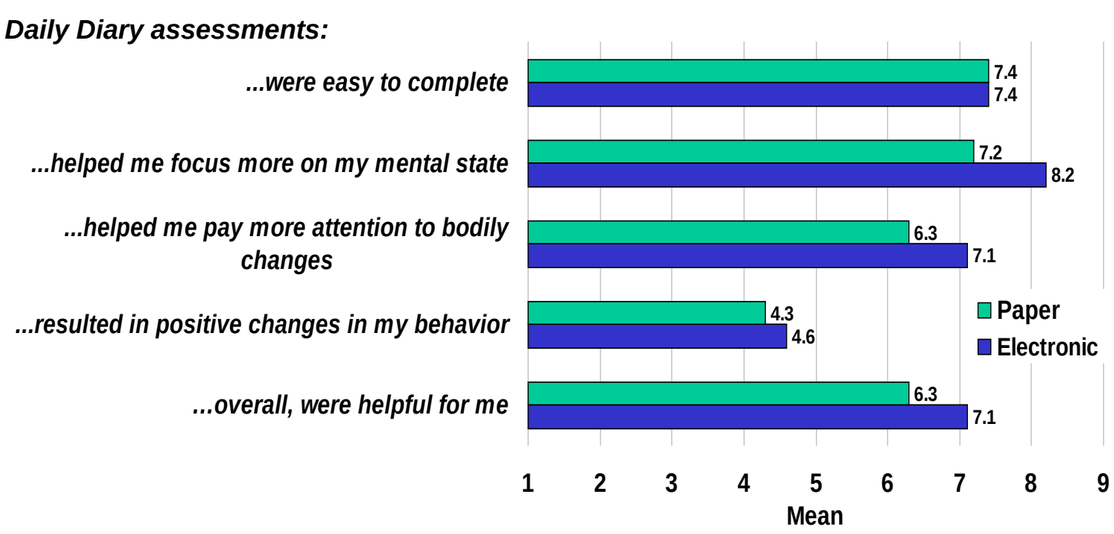
Assessments & Participants	Total	Paper	Electronic	Paper & Electronic
Assessments	**3026**	**2048**	**810**	**168**
Participants	**69**	**42**	**24**	**3**
Average # Assessments	**43.9**	**48.8**	**33.8**	**56.0**
Not Usable				
Assessments	**123**	**123**	**0**	**0**
Participants	**1**	**1**	**0**	**0**
Usable				
Assessments	**2903**	**1925**	**810**	**168**
Participants	**68**	**41**	**24**	**3**
Average # Assessments	**42.7**	**47.0**	**33.8**	**56.0**

Results (*Cont.*)

A total of 123 (6%) of paper assessments were not usable because they had been completed prior to the assessment time (*n* = 31), after the assessment time (*n* = 41), the completion time was not recorded (*n* = 50), or the participant did not meet minimum data inclusion requirements (*n* = 1). Conversely, all of the electronic assessments were usable. The average number of usable assessments per participant was higher for paper (47.0) than electronic (33.8).

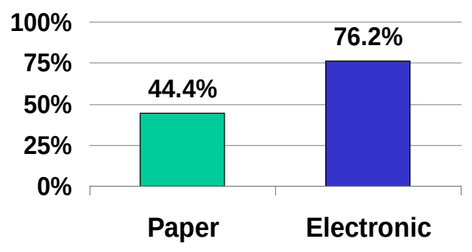
A post-assessment was completed by 62 participants (41 paper, 21 electronic). There were no significant differences in ease of use, focus on mental state, attention to bodily changes, positive changes in behavior, or overall helpfulness of daily assessments completed by paper versus electronic methods (Figure 1). In these comparisons, participants who completed both paper and electronic assessments were included in the electronic group.

Figure 1. Ease of Use and Helpfulness of Daily Diary Assessments



Participants using electronic assessments were significantly more likely than participants using paper assessments to report that they would use Daily Diary assessments on their own if made available (*p* = .02) (Figure 2).

Figure 2. Use of Daily Assessments



Considerations in Electronic Assessment:

PROS

- Greater Control
  - Assessment time window
  - Alarm reminders
  - Can vary item order
- Interactive program incentives/feedback encourage participation
- Wireless transfer ensures data are received and backed-up

CONS

- Cost for purchase, software development, updates, tech problems
- Risk of damage, theft, or loss, but devices can be tracked
- Electronic devices not permitted in some security sensitive locations

Discussion

In the Daily Diary Study, both paper and electronic EMAs were reported to be easy to complete and, on average, participants completed more than half of the assessments. Many paper assessments were not usable because participants did not complete them on time or did not record the time they were completed. In contrast, all electronic assessments were on time and usable because electronic assessments were only accessible at the programmed times. However, the average number of assessments per participant was lower for electronic than paper. Regardless of assessment method, repeated assessments helped participants monitor their mental and physical state and make positive changes in behavior. Participants using electronic assessments were more likely to continue using daily assessments if available.

The potential applications of EMAs, paper or electronic, in behavioral health care include: (1) increased symptom monitoring to inform clinical decisions and provide early intervention, (2) improved patient-provider communication regarding symptoms, (3) development of behavioral and pharmacological treatments tailored to the patient's specific needs, and (4) the feedback from self-monitoring can improve health through changes in personal lifestyle.

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