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Review

Ecological momentary assessment in aging research: A critical review

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ABSTRACT

Ecological momentary assessment (EMA) gathers respondent data on affective, behavioral, and contextual experiences as close in time to those experiences as possible. Potential advantages of EMA in aging research include reducing memory biases and gathering intra-individual data, yet there is little understanding about implementation. The goal of this critical review was to assess the feasibility and applications of EMA in psychological and behavioral research on aging. Through a comprehensive search of the online electronic databases, Psycinfo and Pubmed, for English-language peer-reviewed journals published between 1990 and 2007, we identified 40 articles using EMA methods in older adults. Studies sampled participants between five times per day over one day to once a week for 210 days. Samples were generally not cognitively impaired, evenly split between healthy and clinical populations, and only 6 of 40 studies focused on psychiatric diagnoses. The most common assessment content solicited ratings on affect ($n = 15$), activities of daily living ($n = 12$), physical activities ($n = 10$), and social exchanges ($n = 8$). A total of 90% of the studies that reported compliance reported rates over 80%. Uses of EMA varied widely, with research goals including validation of global measures, detection of subtle treatment effects, and for testing hypotheses about causal intra-individual relationships. Although these measures appear feasible and useful in aging research, recommendations for future studies include adapting measures to enable data collection among older participants with cognitive impairments and/or psychopathology, along with greater use of electronic data capture to improve compliance and increase ease of implementation.

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1. Introduction

Ecological momentary assessment (EMA) is defined by Shiffman et al. (2008) as "Monitoring or sampling strategies to assess phenomena at that moment they occur in natural settings, thus maximizing ecological validity while avoiding retrospective recall" (p. 3). Historically, EMA has represented an alternative to global self-report measures, encapsulating diaries, behavioral observation, self-monitoring, time-budget studies, experience sampling method, and ambulatory monitoring (Stone et al., 2007). EMA enables collection of data on the timing, frequency, or relative strength of symptoms, affect, behaviors, activities, and cognitive functions, with the general aim of assessing phenomena as close in time to their occurrence as possible, typically repeatedly over the course of a study (Moskowitz and Young, 2006). Given the dynamic interactions between affective, behavioral, and physical phenomena that are often the subjects of global self-reports used in aging research, as well as the influences of cognitive impairments on self-reports, EMA approaches may be useful for behavioral research in aging. However, while there are a number of excellent review articles on EMA approaches (Beal and Weiss, 2003; Bolger et al., 2003; Dubbert et al., 2002; Johnson and Bytheway, 2001; McConnell and Copestake, 1999; Moskowitz and Young, 2006; Shiffman et al., 2008), the use of these methods in aging research have not been recently reviewed. Our goal was to evaluate the feasibility and application of EMA in behavioral research in older samples so as to provide recommendations for future research.

EMA methods can be classified into three different categories: (1) diaries, (2) experience sampling, and (3) event-based sampling (Moskowitz and Young, 2006). These three approaches differ from each other in terms of design, use, and their proximity of timing with events or experiences of interest. Daily diaries are defined as "fixed-interval assessments with an assessment frequency of once per day, employing a retrospective coverage strategy" (Shiffman et al., 2008, p. 17). Experience sampling typically implements some form of signaling device, which randomly signals participants to make reports a fixed number of times per day (Moskowitz and Young, 2006). Another variation is event-based measurement, where self-reports are solicited at the time the variable of interest takes place (e.g., physical activity (Bolger et al., 2003).

Each of these approaches may provide a more comprehensive picture of a person's activities and affect than global measures, revealing everyday events or feelings that may be viewed as trivial and thus easily forgotten (Milligan et al., 2005). Particularly when respondents are asked to describe emotional experiences, global questionnaires often exhibit recall biases in regard to past events. For example, respondents recall events as more negative with increasing time elapsed (Schaie, 2006). As well, recall may be influenced by the respondent's mood at the time of assessment. Experimental research indicates that subjective experiences and their intensity are poorly retained in memory, and are often based on inference strategies or peak moments (Schwarz, 2007). Measures of performance in controlled laboratory settings can limit these recall biases, yet often lack ecological validity (Moskowitz and Young, 2006). However, the participant burden in EMA studies is usually greater than with more global types of assessment, as many of the EMA methods involve a significant time commitment over days, weeks, or months (Moskowitz and Young, 2006). Although these methods should limit retrospective recall biases that might be increased by memory deficits, prospective memory is required to remain compliant with data entry, and, thus compliance may be a concern among older adults.

We identified only one review of EMA methods in older adults, which was published in 1990 (Ujimoto, 1990). We conducted a critical review evaluating the feasibility and application of EMA methods in behavioral research in older populations, published between 1990 and 2007. Specifically, we synthesized research findings from four main arenas: (1) Sampling and administration feasibility: we collected data on the sample characteristics, timing, and duration of data collection; (2) Design: we assessed the frequency of differing study approaches (e.g., event-based) and data input methods (e.g., electronic versus paper); (3) Compliance: we examined the drop out rate and amount of missing data; and (4) Application: we assessed what kinds of research questions were addressed and the content of the instruments used.

2. Methods

2.1. Article selection and search strategy

We restricted our searches to studies published in English-language peer-reviewed journals between 1990 and 2007, whose samples were limited to adults over age 50. We excluded studies that included any participants younger than age 50 as well as those that solely gathered data on dietary habits, physical symptoms, or sleep. The decision to include papers with participants older than age 50 (rather than a more typical older adult age cut-off such as age 60 Hazzard, 2003) was based on the observation that several studies stated an intention study older adults and used 50 as the minimum age requirement. In an effort to include as many studies as possible with older adults, we decided to set our minimum age criterion to age 50. However, we chose not to include papers that used EMA across the lifespan but that examined age effects e.g. (Carstensen et al., 2000). Since our focus was on data with relevance to psychiatry, we sought to include studies with EMA-based measures of affect, cognition, behavior, or physical/social activity. We excluded a large number of studies that solely targeted physical symptoms (e.g., pain) or self-monitoring of basic physical functions (e.g., sleep, dietary intake). For papers that were derived from the same sample, we included the earliest published paper, which we found to have the most information on compliance. No restrictions were placed on minimum number of participants. Searches were conducted in Psycinfo and PubMed databases. Specific search terms included "diary", "experience sampling", "ecological momentary assessment", and time-use + "elderly and/or aging." We also identified additional studies via reference lists of relevant papers.

2.2. Data extraction and synthesis

Title and abstract information was imported into ref works and evaluated against the specific inclusion and exclusion criteria. Initially, abstracts were screened for exclusionary characteristics, and subsequently full-text articles were obtained. Each article that was excluded was placed into one of seven exclusionary categories: (1) published before 1990, (2) not in English, (3) participants under the age of 50, (4) did not use any form of a diary, (5) food, sleep, and fall diaries, (6) physical symptom diaries, and (7) follow-up studies from the same sample. The final paper selection was