Collecting Ecological Momentary Assessments From Older Adults: Lessons Learned From the Social Environment and Cognitive Health in Urban and Rural Areas Study

Abstract

In this case study, I highlight lessons learned from the Social Environment and Cognitive Health in Urban and Rural Areas (SECHURA) study, a longitudinal study assessing cognitive aging among 510 older adults. A central component of the study was the implementation of ecological momentary assessments (EMAs) that captured real-time data on participants' daily social interactions, activities, and environments via smartphone technology. While this methodology offers unique advantages, it also presents distinct logistical and practical challenges. This case study details the methodological considerations involved in deploying EMAs in a population-based sample of older adults, from pilot testing and participant onboarding to addressing unforeseen technological disruptions during fieldwork. Specific challenges included ambiguous survey wording, compliance issues, and technological complications. The study also highlights solutions such as supplying participants with instructional videos, real-time monitoring of participant compliance, and troubleshooting procedures. By reading this case study, researchers will gain insights into designing EMA protocols that prioritize clarity, feasibility, and participant engagement. Readers will learn how to anticipate and adapt to field-based challenges in real time to preserve data quality and participant trust. This case study offers practical guidance for any researcher considering EMAs, especially those working with aging populations.

Learning Outcomes

Having read this guide, readers should be able to . . .

- identify common logistical and technical challenges that arise when implementing ecological momentary assessment (EMAs) in field-based research, particularly among older adult populations;
- evaluate the importance of pilot testing and instructional materials in enhancing participant understanding, compliance, and data quality in EMA studies; and

- apply strategies for real-time problem-solving and participant support during data collection to minimize data loss and maintain research integrity in time-sensitive methodologies like EMAs.

Case Study

Project Overview and Context

The Social Environment and Cognitive Health in Urban and Rural Areas (SECHURA) study was developed in response to the increasing rates of cognitive impairment in the United States. Indeed, there are nearly 7 million Americans currently living with Alzheimer's disease, and millions more experiencing various forms of cognitive aging (Alzheimer's Association, 2024). The disability and functional dependence associated with cognitive impairment during the final years of life constitute a major physical, emotional, and economic burden for affected individuals and their families. Given that there are no effective disease-modifying pharmaceutical therapies for Alzheimer's disease or many other forms of dementia, many researchers are turning to an examination of social, cognitive, and lifestyle factors that may protect against the onset of cognitive decline in later life (Perry et al., 2022; Piolatto et al., 2022; Sachdev, 2022).

SECHURA is a longitudinal study that provides a dynamic view of aging by gathering a range of data on the cognitive function of participants as well as an in-depth account of their social interactions, relationships, and networks, the activities in which they engage throughout daily life, and the places these activities transpire. This is achieved via two modes of data collection. First, SECHURA field interviewers visited the homes of the participants to conduct computer-assisted personal interview (CAPI) surveys that gathered data on the cognitive function, social networks, and lifestyles of participants. Second, all participants were invited to participate in an ecological momentary assessment (EMA) module that required them to respond to four short burst surveys (i.e., EMAs) per day for the following seven days using smartphone technology. These EMAs asked about their interactions, activities, and location as experienced in real time. Collectively, the data from the CAPI survey and the EMA module provide a nuanced portrait of the types of social factors that are theorized to protect against cognitive aging.

In this case study, I highlight the lessons learned from conducting an EMA study on a sample of older adults. Although the EMA methodology emerged in the 1990s (Stone & Shiffman, 1994),

researchers still face many challenges when looking to implement such a study (Browning et al., 2024; Roth, 2024; Stone et al., 2023). These challenges extend beyond the classic issues facing most survey-based research (e.g., deciding on the wording/ordering of questions) to include logistics that must be considered before initiating the study (e.g., creating unambiguous instructions) as well as unforeseeable circumstances that emerge when the participants return to their daily lives yet are still actively participating in the study (e.g., dealing with technological failures).

Section Summary

- There is an increasing prevalence of cognitive impairment and Alzheimer's disease in the United States.
- The SECHURA study uses a two-pronged data collection approach—computer-assisted personal interviews (CAPI) surveys and smartphone-based ecological momentary assessments (EMAs)—to collect comprehensive, real-time data on older adults' cognitive function, social interactions, activities, and locations.
- This case study highlights the unique methodological and logistical challenges of implementing EMAs with older adults, including the need for clear instructions and managing issues like technology failures during real-time data collection.

Research Design

This section will provide a brief overview of the SECHURA research design with emphasis on the ecological momentary assessment module. Further details on the project design may be found elsewhere (Roth et al., 2024).

Sampling and Recruitment

SECHURA participants were recruited from the Person to Person Health Interview Study (P2P)—a preexisting state representative health and wellness study fielded from 2018 to 2021. The P2P used a probability sampling frame to recruit and gather data on 2,685 participants (age 18 and over) who resided in 41 Indiana counties. See elsewhere for details on the P2P sample (Green & Pescosolido, 2024; Perry et al., 2021; Railey et al., 2023; Roth et al., 2022). Our research team recruited all P2P participants who met the following three criteria: (a) 55 years or older, (b)

currently residing in Indiana, and (c) agreed to be contacted for follow-up studies. A total of 510 of the 868 eligible participants consented into the SECHURA study and completed the in-home CAPI survey between November 2023 and March 2024. After the participants completed the survey, the field interviewers invited them to the EMA module.

Ecological Momentary Assessment Module

In all, 273 participants consented to the EMA module and installed a smartphone app called LifeData onto their device. Participants who did not own a smartphone were offered a loaner phone to reduce selection bias. For the next seven days, the app randomly notified participants four times per day to respond to an EMA. Notifications were spaced at least two hours apart between the hours of 8:00 a.m. and 8:00 p.m. Participants had 20 minutes to initiate a response before the EMA expired. All EMAs consisted of the same eight baseline questions with an additional six contingency questions that depended on their answers to the initial questions. The 273 participants who enrolled in the EMA module completed an average of 20.48 (of 28) EMAs over the study period. Thus, the mean compliance rate was 73%.

The field interviewers inquired about internet connectivity before scheduling the in-home visit. This allowed them to install the app on a loaner smartphone before visiting the homes of participants who did not have internet access. After the app was installed, all data that participants recorded throughout the EMA module were temporarily stored in the smartphone's internal memory. The data were automatically uploaded to LifeData's secure online platform as soon as the smartphone reconnected to the internet.

Section Summary

- In total, 510 older adults who had previously participated in the population-based study enrolled in SECHURA.
- All participants completed an in-home survey between November 2023 and March 2024.
- Of these participants, 273 took part in a weeklong EMA module that used a smartphone app to send them four random daily notifications to report on their interactions and activities.

Research Practicalities

There are numerous practicalities that all human subject researchers must consider before launching a study. For instance, researchers employing a survey-based study must have a good sense of how long their survey will take participants to complete, and they must also ensure that neither the questions nor response options may be misinterpreted. These types of practicalities are heightened when employing an EMA methodology for several reasons. First, participants are largely left on their own to figure out how to accurately record their responses in a short period of time. Indeed, EMA studies are intended to capture behaviors as they are experienced in real time. If a participant cannot immediately figure out how to respond to an EMA notification, they will miss the opportunity to provide data during that moment. This runs the risk of introducing bias in the subsequent analysis. Second, there may often be ambiguity in the questions due to the temporal nature of EMAs. Imagine a scenario where a participant receives a notification to complete an EMA while they are talking with a friend. To avoid appearing rude, they decide to wait until they are alone before responding to the EMA. How then should they answer the question "Are you currently with anyone?"? The answer to this question will depend on whether the participant refers to the moment during which they heard the notification (when they were with a friend) or the moment during which they responded to the EMA (when they were alone). It is the researcher's job to make this clear to the participant *before* they start data collection. In the following subsections, I highlight two steps our research team took to ensuring data quality in the SECHURA project.

Pilot Testing

We recruited eight individuals to participate in a pilot test of our EMA module approximately nine months before going into the field. All these individuals were over the age of 55 and owned a smartphone. As our research team later discovered, it would have been instructive to include some non-smartphone owners in our pilot study. (More details on smartphone ownership will be provided in a later section.) The pilot test participants received an email with written instructions on how to install the LifeData app on their personal devices. After installing the app, the participants were prompted with five questions per day for the following seven days. These questions asked about whom they were with, what they were doing, where they were, and how they felt at the moment. At the end of the week of EMAs, we held a focus group over a video call

to elicit feedback on the participants' experiences. The focus group lasted approximately one hour. Three main themes emerged.

First, the participants noted that they were confused about whether their responses should refer to the questions during the moment they first heard the notification or during the moment that they were responding to the survey. There was no uniformity in how each participant chose to handle this issue. We therefore adjusted the final wording of these questions to make it clear that all responses should be anchored to the notification time rather than the survey response time.

Second, the EMAs asked a question about the number of people present ("How many people are you currently with?") that caused confusion during moments in which the participants were in public. For example, one participant noted how they had been in a restaurant when they received an EMA. They did not know if they should answer with the number of people they were dining with (which was four) or an approximation of the number of people in the restaurant (which was over 100). We revisited this problem before going into the field by splitting it into two questions. One question asked about specific interactions, whereas the other question asked about people who were nearby but were neither talking to nor interacting with the participant. The latter question asked for an approximation rather than an exact count.

Finally, there was confusion regarding face-to-face interactions versus telecommunication (e.g., phone/video calls). This issue arose during the focus group when one participant mentioned that they had been talking on the phone with their adult children when they heard a notification asking them to respond to an EMA. This participant was unsure if they should acknowledge that they were with anyone at this moment since they were physically alone when they heard the notification. We resolved this issue by first specifying that we were interested in any form of communication. This was followed by a question asking participants to select the mode of communication that was used during that interaction (i.e., face-to-face, telecommunication, both). The exact wording of all EMA survey questions can be found in the project's codebook that is housed on the SECHURA website (Roth, 2023).

Instructional Video

The insights gleaned from the focus group taught us that we needed to create better instructions to avoid ambiguity in common situations. We therefore paid a professional production company to

make a short instructional video that would explain to participants the basics of the EMA module and walk them through many common scenarios that they may face over the course of the next week. The field interviewers showed this video to all participants during the onboarding process. The video was made available on the SECHURA website, which could be referenced by participants at any point during their week of EMAs.

Section Summary

- EMA studies present unique practical challenges, including real-time response demands, ambiguity around timing, and interpreting questions in dynamic contexts.
- A pilot test with eight older adults revealed several issues that led to revisions in question wording and structure for greater clarity.
- To reduce ambiguity and support consistent data entry, we developed a professionally produced instructional video, supplied written instructions, and helped participants handle technical problems in real time.

Method in Action

Data collection ran from November 2023 through March 2024. We experienced several setbacks—ranging from mild to major—during this time. The first setback came almost immediately. Participants who owned an iPhone needed to provide their Apple password before installing the LifeData app. Several participants did not know their password offhand and therefore were unable to install the app while the field interviewers were present. Most of these participants were either unable or unwilling to find their password afterward and therefore abstained from participating in the EMA module.

The second setback came after the first week in the field at which time participants began to call the project manager to inform them that they were still receiving LifeData notifications to complete EMAs after their seventh day in the study. This occurred due to an error in programming in which our team inadvertently forgot to place a range of the dates that each participant should receive EMAs. After apologizing to the participants and telling them to uninstall the app, we fixed the mistake to ensure that future participants would stop receiving EMA notifications after the seventh day.

The third and largest setback came when our team started receiving phone calls from participants telling us that their loaner smartphone was not prompting them with EMA notifications during the day but was instead waking them up in the middle of the night with notifications. This was extremely problematic because it was causing an unintended yet obvious disruption in the sleep patterns of participants. Many of the participants were understandably annoyed. Not only was this mistake on our part causing an ethical issue regarding the well-being of our participants, but it also ran the risk of causing these participants to drop out of future waves of data collection. Moreover, it was causing us to lose opportunities to gather data from these participants since for the most part they were not completing the EMAs during the night. (One participant actually completed the EMAs throughout the night, but these data were unusable because there was no new activity to report other than sleeping.) Although neither I nor my research team had any idea why this was happening, it was imperative that we figure it out immediately because every day that we spent trying to diagnose the problem was another day that we would lose the opportunity to collect data and another night that participants might be woken up in the middle of the night. We looked at the time-stamped data—which was made available instantaneously online—and learned that (1) this problem was only occurring among participants who were using a loaner phone and (2) all notifications appeared to be occurring between 8:00 p.m. and 8:00 a.m. rather than the other way around. We instructed our field interviewers to see if the AM/PM settings had not been accidentally switched before they gave the loaner phones to the participants. They assured us that the phones were displaying the correct time during drop-off, but the problem persisted. Eventually, we discovered the source of the problem. The loaner phones that we had purchased for the project did not have SIM cards installed. This was a conscious decision on our part because the only purpose of these phones was to use the app, not to make phone calls or send text messages. The phones had been working fine before dropping them off with the participants because they were using the Wi-Fi connection at our main office. Yet as we later discovered, these phones automatically reset to their default settings once they left and reentered a Wi-Fi zone. The phones were manufactured in China where the time zone was 11 hours ahead of Indiana. This caused the EMA notifications to shift 11 hours ahead, which meant that they would be randomly set to trigger between the hours of 7:00 p.m. and 7:00 a.m. We had not initially noticed this because the first affected participants coincidentally did not have any

notifications that occurred before 8:00 p.m. The solution to this problem was to turn off the Wi-Fi capabilities as soon as the app was installed but before dropping it off with the participant.

The final setbacks were fortunately mild in comparison. Although the majority of participants had their own smartphone, occasionally there was a participant who needed help operating a loaner smartphone (e.g., turning it off/on, changing from vibrate to ring). This was usually handled by the field interviewer during the home visit, but in one instance a participant called me to ask for help. Fortunately, they called on a weekday when I was in the office. If they had called on a weekend, I would not have seen the call until Monday morning. As with all the previously mentioned setbacks, there was a sense of urgency to resolve these types of field problems because participants were expected to complete an EMA every few hours. The longer our team took to resolve these problems, the more missing data we would incur. This sense of timeliness is among the most important logistical considerations when implementing an EMA study.

Section Summary

- Early setbacks included participants being unable to provide smartphone passwords to install the EMA app and an initial programming oversight that led to participants receiving EMA prompts beyond the seven-day study window.
- A major issue occurred with phones sending EMA notifications throughout night due to time zone misalignment.
- Quick troubleshooting was essential throughout the study to prevent data loss and maintain participant trust.

Practical Lessons Learned

SECHURA is a longitudinal study with data collection waves spaced two years apart. In this section, I reflect on the lessons that were learned from the baseline wave of data collection and the steps we are currently implementing in preparation for the second wave.

The largest disappointment from the baseline wave was the participation rate in the EMA module. (Recall that the compliance rate was 73% among the 273 participants who enrolled in the EMA module.) Although it was unrealistic to expect every SECHURA participant to agree to enroll in the EMA module, our research team identified several strategies to increase participation that we will implement ahead of our second wave. First, our field interviewers will instruct

participants who own a smartphone to download the app to their device at least a day before the in-home visit. This will allow participants sufficient time to troubleshoot technological issues that they previously faced on the spot (e.g., forgetting iPhone passwords). Second, participants will be instructed to complete a practice EMA in the presence of the field interviewers. This will help participants know what to expect once they are on their own for the next seven days. Third, we will use LifeData's online platform to actively monitor each participant's compliance rate throughout their week of EMAs. Field interviewers will follow up with participants who are consistently missing EMAs to see if this is due to a technical problem that can be addressed from afar.

Section Summary

- The baseline wave revealed lower-than-expected participation in the EMA module, prompting us to identify opportunities for improving enrollment and engagement in future waves.
- In future waves, participants will be asked to download the app before the home visit and complete a practice EMA with the field interviewer to reduce on-the-spot technical issues and improve comfort with the process.
- The research team will use an online platform to monitor participant compliance during the EMA week and follow up proactively to resolve technical issues that may affect compliance.

Conclusion

This case study of the SECHURA project demonstrates the utility of ecological momentary assessments for capturing the daily life of participants that would otherwise be difficult or impossible to systematically observe in a quantitative fashion. We leveraged this emerging data collection method to better understand the social disparities facing cognitive aging in the older population. At the same time, it is important to recognize the many barriers and considerations that prospective researchers will face when conducting an EMA study.

We recommend that researchers interested in EMA research think carefully not just about their research question (which is definitely important) but also about the practicalities involved in onboarding participants and anticipating any technical challenges that may arise while in the field.

Pilot testing is extremely important as it can help identify some (but not all) of these challenges. Researchers must also be expected to remain diligent while their study is live in the field. This means staying in constant contact with their research team as well as the participants who are remotely providing data with every passing hour (or however frequently it is requested). Ultimately, it is important to understand that things will go wrong. Reacting to these problems in a prompt and professional manner is crucial to the project's success.

Discussion Questions

1. How might the challenges of implementing ecological momentary assessments differ when studying younger populations or populations in low-resource settings, and what adaptations would be necessary to maintain data quality and participant engagement?
2. In what ways can researchers balance the benefits of real-time data collection through EMA with the ethical obligation to minimize participant burden and disruption to daily life?
3. What are the methodological trade-offs between using EMAs and more traditional survey methods for capturing social interactions, and how should researchers decide which approach is most appropriate for their study goals?

Multiple-Choice Quiz Questions

1) **What are the benefits of conducting a pilot test of the EMA module before launching full data collection?**
   a) To collect preliminary data that can be analyzed alongside baseline findings
   b) To identify and correct potential issues in question interpretation and participant response behavior – **CORRECT**
   c) To ensure that participants with smartphones will have higher response rates than those using loaner phones

2) **What is the rationale for providing loaner smartphones to participants who do not own one?**
   a) To encourage participants to purchase smartphones for future study waves

b) To reduce sampling bias that might occur if only smartphone owners could participate in the EMA module – **CORRECT**
c) To give participants access to non-study-related applications

3) **What is the methodological reason for splitting the question "How many people are you currently with?" into two separate items?**
   a) To allow for direct comparisons with prior EMA studies
   b) To distinguish between social interactions and general environmental presence, reducing ambiguity in responses – **CORRECT**
   c) To shorten the overall length of the EMA survey

4) **Why is it important for the research team to actively monitor compliance rates during the EMA week?**
   a) To evaluate participant satisfaction with the app interface
   b) To detect whether participants are submitting fake data
   c) To quickly identify and troubleshoot technical issues that might be reducing data quality – **CORRECT**

5) **What is the primary purpose of creating an instructional video for participants in the EMA module?**
   a) To provide participants with entertainment during the onboarding session
   b) To standardize instructions and reduce ambiguity in how participants should respond to EMA prompts – **CORRECT**
   c) To train participants to use additional features of the app beyond the EMA module

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