Systematic Review of the Influence of Sociocultural Determinants of Health on Mobile-based Ecological Momentary Assessment Studies

Yinan Sun, Aditi Jaiswal, Christopher Slade, Kristina T. Phillips, Roberto M. Benzo, Peter Washington

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Yinan Sun[1]; Aditi Jaiswal[1]; Christopher Slade[1]; Kristina T. Phillips[2, 3]; Roberto M. Benzo[4]; Peter Washington[1]

[1]University of Hawai?i at M?noa Honolulu US
[2]Department of Health Systems Science, Kaiser Permanente Honolulu US
[3]Bernard J. Tyson School of Medicine Pasadena US
[4]Division of Cancer Prevention and Control, Department of Internal Medicine, College of Medicine, The Ohio State University Columbus US

Corresponding Author:
Yinan Sun
University of Hawai?i at M?noa
1680 East-West Rd
Honolulu
US

Abstract

Background: Ecological momentary assessment (EMA) involves repeated, real-time prompts for self-reported behaviors in the real world. Due to the widespread availability of mobile devices, mobile-based EMA is a research method commonly used in modern health studies. Yet, an overview of how sociocultural determinants of health can affect the EMA compliance rate and how EMA health studies can uncover sociocultural determinants has been lacking in the literature.

Objective: In this study, we conducted a systematic review to understand (1) how sociocultural determinants of health influence the compliance rate of EMA health studies and (2) what sociocultural determinants can be identified through EMA health studies.

Methods: We searched PubMed, Web of Science, and EBSCOhost to address these research questions. Our inclusion criteria required the selected papers to satisfy at least one of the following criteria: (1) describing how sociocultural determinants of health affect the compliance rate of EMA studies, (2) reporting any sociocultural determinants observed during an EMA study, or (3) mentioning any sociocultural determinants that are discovered during the course of an EMA study.

Results: Among the 49 eligible studies, 35 discussed 11 different sociocultural determinants, including lifestyle behaviors (12), sex (10), age (9), socioeconomic status (8), culture (7), social support (6), education (4), social context (4), social acceptance (4), structural/system barriers (2), and race/ethnicity (2). 14 studies demonstrated that EMA research can uncover sociocultural determinants, including increased substance use for social facilitation, discrimination, stigmatization, family culture, sex, and the relationship between social support and health issues.

Conclusions: This systematic review provides a comprehensive understanding of how various sociocultural factors affect EMA compliance rates in health studies and how EMA studies can uncover the embedded, hidden, yet crucial sociocultural factors in health issues.

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Review

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Keywords

ecological momentary assessment, culture, social determinants of health, mHealth, systematic review.

Introduction

Background

Understanding the correspondence between human behavior and health outcomes is central to many research projects. Traditional research methods often rely on retrospective self-reports, surveys, interviews, and periodic assessments, leaving gaps in obtaining the nuanced fluctuation of individual experiences in real time. Compared to the use of retrospective surveys or interviews, implementing an ecological momentary assessment (EMA) involves real-time, repeated assessment of self-reported variables (e.g., emotions, activities, symptoms) in the real-world environment. EMAs can provide a more precise and reliable understanding of how health-related issues unfold over time and in context, potentially reducing methodological issues such as recall bias, recency bias, or availability bias [1].

Initially introduced in the early 1970s, this procedure was known as experience sampling and later coined as EMA [2-4]. In the four decades since its inception, the primary vehicles of EMA data collection have been constantly evolving, moving from paper and pencil to pagers, palm-top computers, and smartphones. Recently, utilizing mobile phones for EMA data collection has become increasingly prevalent primarily due to the widespread availability of mobile devices [5]. EMA is a popular research method applied to health-related studies to better understand phenomena such as substance use, depression, suicide, sleeping, and physical activity [5-8]. The use of EMA in health-related studies is increasingly prominent due to the mobile phone's seamless integration into daily lives and immediate environments [9-11]. When conducting EMA studies, mobile-based health technology (e.g., wearable devices, mobile phones, mobile-based apps) can monitor real-time health-related data in real-world environments [12,13], transcending the constraints of traditional research methods (e.g., survey, interview) and uncovering the dynamic interplay between human behavior and health outcomes.

Prior Work

Despite its advantages, EMA research faces technical, methodological, and privacy challenges that can hinder compliance (i.e., the percentage of completed prompts during the study period) [14,15]. Some of the most salient challenges include user burden and engagement, which can be deeply intertwined with socio-cultural determinants of health. In this systematic review, we

define socio-cultural determinants as social, cultural, and economic factors that have important effects on health directly or indirectly [16,17]. For example, disregarding cultural factors has been shown to lead to failure in technology-based research among Pacific Islanders [18]. In another study, the authors found associations between cultural background (e.g., race, ethnicity) and frequency of response to EMA text messages among substance users in the community of men who have sex with men (MSM) in San Francisco [19]. In some countries, such as China, EMA has been less feasible of a method to understand behaviors surrounding substance use disorders due to concerns about privacy [20]. Furthermore, the repeated mistreatment of marginalized groups may result in decreased motivation to share their momentary experiences [21]. It was found that the sociocultural environment of rural MSM might not be conducive to implementing EMA research to collect behavioral and psychological data [22]. Though White participants provided overall higher compliance rates than African American participants in another study, lower response rates among younger African Americans were attributed to working multiple jobs [23]. These studies collectively demonstrate that sociocultural determinants impact the intention and ways to use mobile-based health technology, including in EMA research [24,25]. Therefore, it is crucial to understand how sociocultural determinants can affect the feasibility or compliance rate of EMA health studies.

The relationship between sociocultural determinants and technology is reciprocal rather than unidirectional, with each influencing the other [26]. The culture of a society affects technological development; new technology can create a new social situation, leading to the emergence of new cultural values and practices [26,27]. For example, new communication technologies created new platforms for social networking [28]. Furthermore, technology can collect data to investigate pressing social issues or cultural phenomena [29,30]. Similarly, when using EMA in health studies, cultural or social issues associated with the studied topics can be uncovered during the process. As an example, in one study, the authors suggested that EMA can be an effective approach for investigating suicide among Black Americans, particularly with respect to the cultural factors that influence the lived experiences of Black American men [31]. Based on these prior works, it is worth systematically exploring how EMA health studies can uncover sociocultural determinants of health that are sometimes hidden or overlooked.

Goal of This Study

In this systematic review, we seek to understand how sociocultural determinants can affect EMA compliance and how EMA can be used to uncover the embedded sociocultural determinants related to health issues. To the best of our knowledge, no prior systematic reviews summarize the interplay between sociocultural determinants of health and EMA. This review aims to fill this gap by identifying recent literature discussing the role of sociocultural determinants in EMA research across various health behaviors such as substance use, physical activity, sedentary behavior, dietary habits, and sexual behavior. The findings from this review highlight the ongoing challenges and research gaps in this field and the corresponding opportunities for innovation. We study the following research questions:

(R1) How do sociocultural determinants influence the compliance rate of EMA health studies?

(R2) How can EMA studies uncover sociocultural determinants that influence health problems?

Methods

Data Collection and Preprocessing

We constructed search strings related to EMA, sociocultural determinants, feasibility, and challenges on three different platforms: PubMed, Web of Science, and EBSCOhost. We conducted the searches in early April 2024. The following search string was used for R1: (("ecological momentary assessment " OR "EMA "OR "mobile-based ecological momentary assessment "or "mEMA")) AND ("feasibility " OR "challenge" or “barrier”) AND ("social" OR "cultural" or “culture” or “sociocultural”). The following search string was used for R2: (("ecological momentary assessment" OR "EMA "OR "mobile-based ecological momentary assessment "or "mEMA")) AND ("social" OR "cultural" or “culture” or “sociocultural”).

We filtered articles in three phases and organized them using the PICO Portal, an online literature screening platform [32]. The first phase involved uploading all results to the PICO Portal and removing duplicates. The second phase involved reviewing the title, abstract, and keyword as obtained from the databases searched. The third phase included reviewing the full text of the articles by obtaining PDF documents from the three databases. All authors agreed upon the selection criteria for screening studies prior to filtering the papers.

In the first phase, 400 papers were initially collected. 114 duplicates were removed, resulting in 286 studies for screening. In the second phase, inclusion and exclusion criteria were applied to all 286 publications by checking the titles, keywords, and abstracts. At this stage, 200 studies were selected for full-text screening. This process was conducted by the first two co-authors, leading to 49 studies included in the final review. 35 of these articles answered R1 while 14 answered R2. Any disagreement during the screening process was resolved through discussion between the two co-authors responsible for selecting articles.

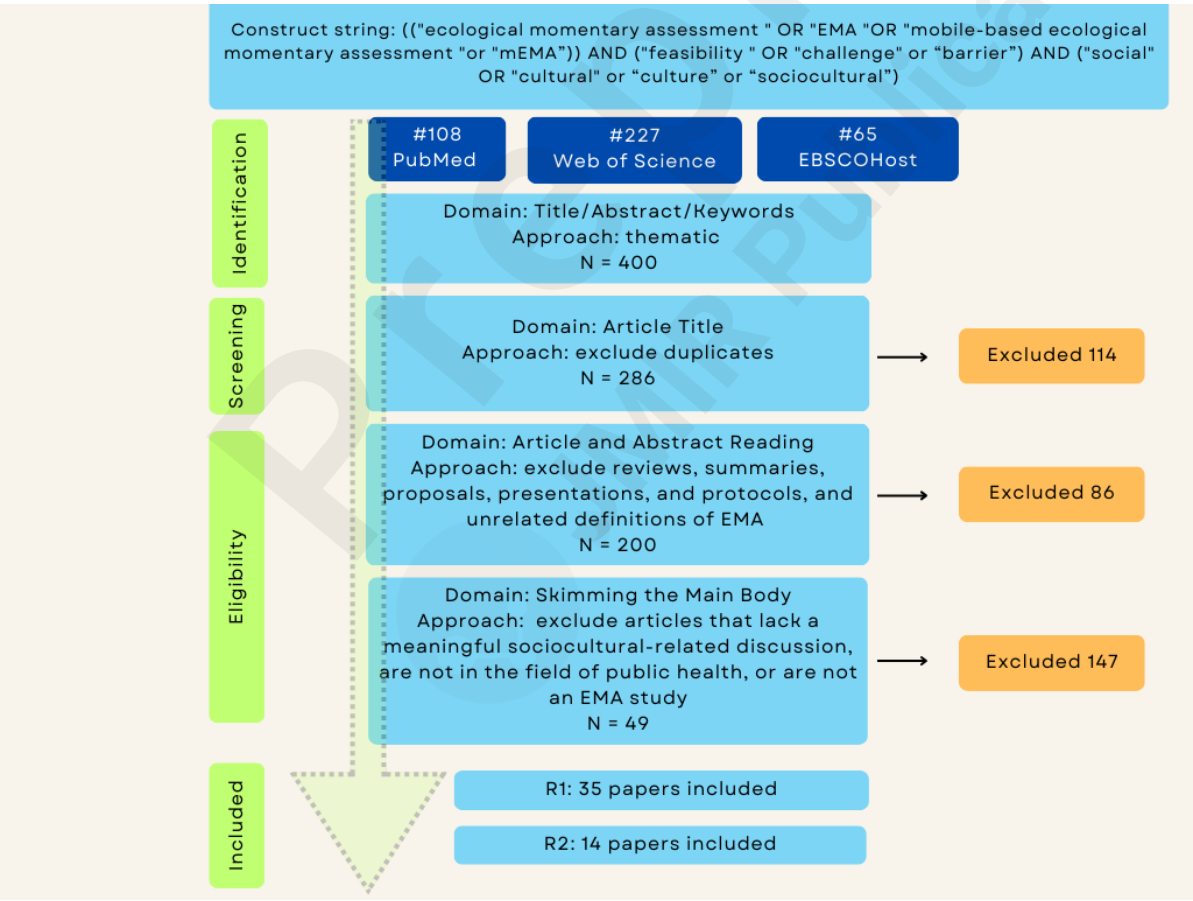
Selection Criteria

Studies were eligible for this review if all of the following inclusion criteria were met: (1) there was a discussion about how sociocultural determinants of health either facilitated or hindered EMA data

collection, or of any social or cultural phenomena observed during the study, or of any emerging social and cultural practices along with the development of the study; (2) the EMA study examined a health-related issue; (3) the study was written in English and published on or after the year 2013; and (4) the study was not a review paper, dissertation, or protocol, and was published through a peer-reviewed process.

The exclusion criteria for this review were as follows: (1) the EMA studies were not associated with health-related issues; (2) there was no meaningful discussion regarding sociocultural determinants in the EMA studies, even though related terms were mentioned; (3) the EMA studies were not based on mobile devices (e.g., mobile apps, text message, phone calls); instead, the studies were conducted using personal computers or other devices not considered to be mobile; (4) the EMA studies reported sociocultural phenomena, yet they were unrelated to health; (5) studies were a protocol, review, proposal, or presentation summary; or (6) studies were published before 2013.
Studies published before 2013 were omitted, as the popularity of mobile devices has significantly increased in the past decade [33]. Additionally, discussions regarding the use of smartphone capabilities to assess health or lifestyle have garnered increased attention in modern research articles [13]. Therefore, we considered older literature to be outside of the scope of this review. Figure 1 depicts the process followed in this literature review, outlining the inclusion and exclusion criteria in accordance with PRISMA guidelines.

Figure 1. PRISMA flow diagram illustrating the steps of this systematic literature review.



Results

49 eligible studies were identified. Among them, 35 studies discussed 11 different sociocultural

determinants. 14 studies demonstrated that EMA research can uncover sociocultural determinants in multiple ways. Among the 49 articles, 14 overlapped between R1 and R2 research questions.

R1: Sociocultural determinants that influence the compliance rate of EMA health studies

The first research question investigates the sociocultural determinants that influence the compliance rate of EMA health studies. We identified 35 of the 49 eligible articles that discussed determinants that can affect the compliance rate of EMA health studies. We reviewed several core sociocultural determinants of health: lifestyle, age, culture, social support, socioeconomic status, sex, education, social context, social acceptance, structural/system barriers, and race/ethnicity. We found that these factors can be important considerations influencing the compliance rate of EMA health studies.

For each reviewed study, we extract the study topic, population, summary of study findings, and notable compliance rate statistics. In cases where qualitative differences in compliance rate were provided without specific numbers, we describe only the average compliance rate instead.

Timing of Lifestyle Behaviors

Twelve of the 35 selected articles mentioned that lifestyle behaviors can influence participants' responsiveness when receiving EMA prompts (Table 1). This influence is reflected in how the timing of EMA prompts intersects with daily activity routines, which can be affected by sociocultural determinants. Specifically, ten studies indicated preferences or aversions regarding the timing of the EMA prompt delivery. For example, some participants are more likely to respond in the mornings [34], during lunch breaks [35], evenings [36], and weekends [5,34,35]. Three studies noted that EMA prompts could disrupt participants' daily activities, such as during school hours [37,38], when engaged in activities like napping or driving [38] or during heavy workloads [39]. We note that while sociocultural determinants can affect lifestyle behaviors, there are many other influences of daily routines that are not encompassed by either social or cultural factors.

Table 1. Articles that reported different lifestyle behaviors and their role in EMA compliance, including the possible cause of improved or worsened EMA compliance rates.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Bell et al., 2022 [34]	Using EMA to study Family eating activities	Families that include at least one adult parent and one child between the ages of 11 and 18 in Los Angeles	Compliance was significantly higher in the mornings overall and higher on the weekends for the eating-event–triggered EMAs, when participants did not need to go to work or school (typically on weekend days).	For all EMAs: Odds ratio (OR) for afternoon vs morning response: 0.63 OR for evening vs morning response: 0.61OR when other family members have also responded to an EMA vs no family member has responded within the same time frame: 1.91 For time-triggered EMAs: OR for afternoon vs morning response:

				0.60 OR for evening vs morning: 0.53 OR when other family members have also responded to an EMA vs no family member has responded within the same time frame: 2.07 For eating event-triggered EMAs: OR for weekend vs weekdays response: 2.40
Soong et al., 2015 [35]	Using EMA to study tobacco use	Individuals between the ages of 16 and 40 from local colleges, offices, and popular neighborhood places (e.g., cafes, restaurants) in urban India	Participants, particularly students, are most willing and able to use their phones and respond to a prompt during lunch or break times or on weekends.	Average momentary surveys completion rate: 46.87% Average of end-of-day surveys completion rate: 73.02%
Gómez-Pérez et al., 2020 [36]	Using EMA to evaluate therapy intervention	Patients with fibromyalgia between the ages of 53 and 67	Evening compliance rate was high compared to the morning, which might be due to poor sleep quality in this population.	At the patient level: 45.2% to 88.10% Evening: 68.37% Morning: 61.22%
Ferguson et al., 2023 [37]	Using EMA to study sugary drink consumption	Black adolescents between the ages of 12 and 17 in Washington, DC	Not being able to use mobile phones at school limited the time windows that EMA prompts could be administered and/or completed.	At home: 37% At friend's or family's home: 38% In transit: 41% While outside: 26% At extracurricular activities: 25% At school :19%
Xu et al., 2020 [38]	Using EMA for audiology Research	Adults between the ages of 19 and 37 with hearing impairment	Participants would not complete surveys when they were involved in activities, such as when they were working, in a class or meeting, driving, napping, bathing, or exercising.	Over 60% of participants reported that repetitive surveys disrupted daily activities, including during work, class, driving, and social events.
Kronkvist et al., 2020 [39]	Using EMA for daily assessment of crime fear	College students between the ages of 18 and 28 at Malmö University	The average participant only answered surveys for a handful of days before dropping out, which may have been due to a perceived heavy workload.	For signal-contingent survey: Estimated compliance rate for full sample: 28%-31% Compliance rate for Occasional Participators (OP): 21% to 24% Compliance rate for Daily Participators (DP): 49% to 53% For daily assessments:

				Overall: 61%-68% OP compliance: 53%-59% DP compliance: 77%-85%
El Dahr et al., 2023 [40]	Using EMA to understand the daily experiences of parents and children	Parents and their children between the ages of 9 and 13	Completion rates were higher on weekdays than on weekends. Between mothers and children, children's compliance was lower on weekends than on weekdays.	EMA completion rate on weekdays: 82.4% vs. 77.8% on weekends (P = .02) OR of weekend vs weekday survey completion: 0.86 Faster response times in evenings vs mornings (mean 43.1 minutes vs. 51.0 minutes; P = .03)
Dunton et al., 2016 [41]	Using EMA to capture physical activity	High school students between the ages of 14 and 18	EMA compliance rate was lower in the mornings compared to later times in the day, which may reflect participants' inability (due to sleep) or reluctance to answer EMA prompts in the early mornings on weekends.	Response rate after first prompt: 82.3% Response rate after first reminder: 11.0% Response rate after second reminder: 6.7% 8.7% more likely to respond to EMA per hour as the day progresses
Maher et al., 2018 [42]	Using EMA to monitor physical activity	Overweight, obese, and normal-weight older adults between the ages of 60 and 98	Overweight and obese older adults were more likely to miss a prompt on weekends. Normal weight older adults were more likely to miss prompts in the afternoon compared to the morning.	OR for overweight adults missing more prompts on weekends vs. weekdays: 1.72 OR for normal weight adults missing more prompts in the afternoon vs. morning: 1.53
Trang et al., 2022 [43]	Monitoring the relationship between mental distress and HIV risk	MSM between the ages of 18 and 24 in Hanoi, Vietnam	Highly variable work schedules reduced participants' compliance rate.	Day-by-Day Compliance Trends: Day 1: 64.5% (SD = 33.1%) Day 2: 67.8% (SD = 31%) Day 3: 66.9% (SD = 31.6%) Day 4: 71.6% (SD = 32.7%) Day 5: 64.7% (SD = 35.6%) Day 6: 61.8% (SD = 33.8%) Day 7: 37% (SD = 41.9%)
Narziev et al., 2020 [44]	Using EMA to detect short-term depression	Individuals from depression groups based on the Patient	The response rate at 7 a.m. was quite lower than at other hours,	EMA response rates by hours: 7 a.m.: 38%

		Health Questionnaire-9 (ages are not reported)	possibly due to late wake-up times or rushing to work or school.	10 a.m.: 60% 1 p.m.: 64% 4.p.m.: 61% 7 p.m.: 60% 10 p.m.: 58%
Swendeman et al., 2020 [45]	Using EMA for self-monitoring of family functioning	Young adolescents between the ages of 10 and 14 and their parents	Children tended to miss the morning and noontime EMAs, whereas parents tended to miss the late afternoon/early evening EMAs. Completing surveys on weekends can be difficult, as activities and schedules are less routine.	Average: 96.2% Children: 95.1% Parents: 97.1% 100% or greater response rates: 69% (Average) 60% (Children) 76% (Parents) Lowest response rate: 70% (Children) 79% (Parents)

Sex

Ten prior studies reported that sex is a factor that influences the compliance rate of EMA studies (Table 2). Among them, eight out of 10 prior studies reported that female participants tend to have a higher response rate than males [39,40,46-51]. In other specific scenarios, male participants provide more responses. For example, one study reported that females are less likely to carry mobile phones due to their tight jeans [41]. Another study found that overweight females tend to miss EMA prompts, while there is no sex difference among normal-weight adults [42].

Table 2. Articles that reported the effect of sex on EMA compliance.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Kronkvist et al., 2020 [39]	Using EMA for daily assessment of crime fear	College students between the ages of 18 and 28 at Malmö University	More women participated in the study due to a sense of responsibility for the study topic.	For signal- contingent surveys: Female vs. male in OP (occasional participant) vs. abstainers: OR = 2.75 (P < 0.05) Female vs. male in DP (dedicated participants) vs. abstainers: OR = 6.50 (P < 0.01) For daily assessments: Female vs. male in DP (dedicated participant) vs. Abstainers: OR = 6.90 (P < 0.05)
El Dahr et al., 2023 [40]	Using EMA to understand the daily experiences of parents and children	Parents and their children between the ages of 9 and 13	Compliance was higher with girls than in dyads with boys, but no explanation was provided.	EMA assessments with girl child from girls (mean 24.9, SD 6.2) vs boy child (mean 21.7, SD 8.4): p=0.02 For children completed EMA surveys, no significant difference

				was found between genders (74.7% for girls, 77.2% for boys, 75.7% for children averagely; P=0.29)
Dunton et al., 2016 [41]	Using EMA to capture physical activity	High school students between the ages of 14 and 18	Girls were less likely to carry mobile phones because they did not fit in their pant pockets.	OR of girls' vs boys to carry the phone in their pockets: 0.15 As compared with boys, girls were more than 3 times as likely to have the mobile phone *within reach* and less likely to carry the mobile phone in their pockets.
Maher et al., 2018 [42]	Using EMA to monitor the physical activity of older people	Overweight, obese, and normal-weight older adults between the ages of 60 and 98	Among overweight and obese older adults, females were more likely to miss an EMA prompt.	OR of overweight and obese older female adults to miss an EMA prompt compared to males: 2.75
Elavsky et al., 2021 [46]	Using EMA to monitor physical activity	Czech adults between the ages of 50 and 74	Women had a slightly higher compliance rate.	Overall compliance rate for surveys administered 3 times per day at a pseudorandom schedule: 82.3% Sex-related data not shown in paper
Mackesy-Amiti et al., 2018 [47]	Using EMA to study mood and risk behavior	Young people who inject drugs (PWID) between the ages of 18 and 35	Women were more likely to have a higher compliance than men.	Female completion rate: 85.5% Male completion rate: 72.2% OR of responding to EMA consistently (female vs male): 4.06 Incidence Rate Ratio of completing total number of surveys (female vs male): 1.51
Nam et al., 2020 [48]	Using EMA to understand biobehavioral responses to stress and racial discrimination	Middle-aged African Americans between the ages of 30 to 55	Females showed higher EMA compliance rates.	Average: 82.8% Female response rate: 87.5% Male response rate: 70.3%
Silva et al., 2022 [49]	Using EMA to assess suicide risk	Spanish-speaking adult outpatients between the ages of 24 and 63	Study participants were primarily females (81.3%).	No quantitative statistics related to gender disparities provided.
Valentiner et al., 2019 [50]	Using EMA for interval walking training	Patients between the ages of 18 and 80 with type 2 diabetes	Men had a lower compliance rate than women.	Average: 83% Females: 90% Male: 68% EMA responses missing rate for females: 10% EMA responses missing rate for males:

				32%
Willoughby et al., 2018 [51]	Using EMA to provide adolescent sexual health service	Students between the ages of 13 and 17 in middle and high schools	Female students were more likely than male students to comply with the SMS questionnaire.	Female response rate for SMS questionnaire: 76.1%

Age

Nine prior studies highlighted age as a significant factor that affects the compliance rate of EMA studies (Table 3). Five studies reported that older adults maintain a higher compliance rate [39,43,48,51,52]. One possible explanation made by the authors is that older individuals may have more time [52], while younger participants who are employed and have variable work schedules can have a higher non-compliance rate for EMAs [43]. By contrast, two prior research papers pointed out that older individuals face multiple challenges, including being less familiar with technology [36], having a lukewarm attitude towards technology [46], and being reluctant to use mHealth technology due to a struggle with reading EMA prompts with small font sizes [46]. Interestingly, one study reported that older people complete the EMA survey despite sometimes not hearing the alerts [53].

Table 3. Articles that reported the effect of age on EMA compliance.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Gómez-Pérez et al., 2020 [36]	Using EMA to evaluate therapy intervention	Patients with fibromyalgia between the ages of 53 and 67	Older people were less familiar with technology.	Compliance rates were higher among younger participants (50-64 years) compared to older ones (65+), though exact age differences were not statistically detailed.
Kronkvist et al., 2020 [39]	Using EMA for daily assessment of crime fear	College students between the ages of 18 and 28 at Malmö University	The compliance rate was higher among senior students.	For Signal-contingent survey: Age was significantly associated with belonging to the DP (Dedicated Participant) group versus abstainers (OR=1.26, p<0.01) For daily assessments: Older age significantly increased the likelihood of belonging to DP (Dedicated Participant) versus OP (Occasional Participant) and abstainers (OR=1.16, p<0.05)
Maher et al., 2018 [42]	Using EMA to monitor physical activity of older People	Overweight, obese, and normal-weight older adults between the ages of 60 and 98	Older adults had difficulty hearing the EMA alerts.	No quantitative statistics related to age disparities provided.
Trang et al., 2022	Using EMA to monitor the	MSM between the ages of 18 and 24 in Hanoi, Vietnam	Younger participants had unique challenges compared	No quantitative statistics related to age

[43]	relationship between mental distress and HIV risk		to older participants (e.g., variable work schedules) as barriers to responding to EMA prompts	disparities provided.
Elavsky et al., 2021 [46]	Using EMA for real-time behavior monitoring	Czech adults between the ages of 50 and 74	Older users had a lukewarm attitude regarding mHealth technology and struggled to read EMA prompts with small font sizes.	OR of EMA response in morning for older adults vs younger participants: 0.89 (p=0.07) OR of EMA response in evening for older adults vs younger participants: 1.38 (p<0.001)
Nam et al., 2020 [48]	Using EMA to understand biobehavioral responses to stress and racial discrimination	Middle-aged African Americans between the ages of 30 to 55	Older participants had higher compliance rates.	Higher response rate significantly associated with older age: p = 0.03
Willoughby et al., 2018 [51]	Using EMA to provide adolescent sexual health service	Students between the ages of 13 and 17 in middle and high schools	High school seniors had a higher compliance rate compared to younger students.	Mean age of participants completing SMS survey: 15.14 vs mean age of participants completing online survey: 14.50 [p=0.003]
Mattos et al., 2019 [52]	Using EMA for mood assessment	Individuals between the ages of 69 and 81 with mild cognitive impairment (MCI)	Older adults respond to more EMA due to having greater available time.	No quantitative statistics related to age disparities provided.
Burke et al., 2022 [53]	Feasibility of app-based noncontact EMA	Experienced and technology-naïve older participants between the ages of 45 and 78	Older users had difficulty hearing the EMA alerts.	Higher enrollment among experienced participants (63.3%) compared to technology-naïve older ones (38.2%, P=0.004) Higher completion rates for experienced users (83.9%) versus technology-naïve older participants (53.8%, P<0.001) Older participants more frequently reported issues with not receiving survey alerts (P = 0.008)

Socioeconomic Status (SES)

Eight prior studies reported that socioeconomic status is another significant factor influencing compliance rates in health-related EMA studies (Table 4). Three main sub-factors emerged in this category: housing, employment, and income. On the one hand, prior studies show that lower income negatively affects the EMA compliance rate [54-56]. Similarly, unemployment [35,56], lack of stable housing [54,55,57], and living in a community with high violence [56] can lead to difficulty finding a place to charge devices or connect to the Internet. On the other hand, two prior studies

report that those working part-time [48] or unemployed participants [58] exhibit higher compliance levels than employed participants since they might have more time to reply. By the same token, a working environment without cell phone access can be another barrier for employed participants [43].

Table 4. Articles that reported socioeconomic factors and their effect on EMA compliance.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Soong et al., 2015 [35]	Using EMA to understand tobacco behavior in urban India	Participants between the ages of 16 and 40	Unemployed groups (e.g., students) were less likely to comply as they might be in appropriate areas for mobile phone use.	Being employed predicted higher momentary (β =0.10, *P*=0.01) and end-of-day (β =0.09, *P*=0.48) compliance rate Household car ownership affected momentary (β =-0.03, *P*=0.32) and end-of-day (β =0.13, *P*=0.22) compliance rate
Trang et al., 2022 [43]	Monitoring the relationship between mental distress and HIV risk	MSM between the ages of 18 and 24 in Hanoi, Vietnam	Employed participants had a lower compliance rate as they did not have phone access at work.	No quantitative statistics related to employment differences provided.
Nam et al., 2020 [48]	Using EMA to understand biobehavioral responses to stress and racial discrimination	Middle-aged African Americans between the ages of 30 to 55	Participants who worked part-time had higher compliance rates than their counterparts.	Higher compliance rate for part-time employees (p=0.02).
Biello et al., 2020 [54]	Real-time co-occurrence of drug use and harm reduction service	People between the ages of 30 and 47 who inject drugs	Housing instability and disruptions in cell phone access brought challenges to EMA compliance.	No quantitative statistics related to housing status or cell phone accessibility provided.
Turner et al., 2019 [55]	Feasibility of using EMA for data collection	Young men between the ages of 18 to 34 who have sex with men (MSM) and trans women (TW) living with HIV in San Francisco	Participants who lived in temporary/ transitional housing with lower income had a lower compliance rate.	Participants in temporary or transitional housing were significantly less likely to complete EMA surveys than those who rented or owned a home (adjusted hazard ratio [aHR] 1.78, *P*=0.03)
Yang et al., 2015 [56]	Using EMA to study alcohol use	African American men between ages of 27 and 62 who have sex with men (MSM) in Baltimore	Unemployment, low-income status, incarceration, and community violence can become barriers.	Hazard ratio for noncompletion for participants in transitional housing: 1.78 (p=0.03) Part time employees had higher response rates compared to full-

				time employees (p=0.02)
Semborski et al., 2022 [57]	Feasibility of using EMA with homeless	Young adults between the ages of 18 and 25 without stable housing	Unhoused participants had difficulty in charging the devices, bringing increased stress and concern of being tracked.	Unhoused individuals reported greater difficulty charging their phones (p=0.02), higher levels of stress and anxiety due to EMA participation (p=0.02) Housed participants had slightly higher compliance rates (81.4%) compared to unhoused participants (78.7%): p=0.39
Song et al., 2023 [58]	Leisure activity participation	Autistic adults between the ages of 18 and 61	Low-income autistic adults and those with unpaid jobs had greater compliance rates, possibly because they had more available time.	Average: 90.2% Paid full time job (94.8%) and paid part time job (83.9%) associated with higher response rates (p=0.01)

Culture

Seven previous studies indicated that culture considerably influences compliance rates in EMA studies (Table 5). Although there are relevant ecological momentary intervention (EMI)-based papers [59], they are excluded due to EMI being a separate concept from EMA. Within this category, four subfactors have emerged: language, stigmatization, youth culture, and gender power gaps. Among them, five studies emphasize the importance of language usage in EMA studies. Specifically, MSM perceived using LGBTQ-friendly language as highly important [43]. In contrast, using patronizing and superficial language can make the participants feel targeted, stereotyped, and further alienated. In non-English-speaking countries, language can be a barrier when using the Fitbit App, particularly for older participants [46]. Social media is an important part of youth culture and other social media platforms, and texting activities can compete with the EMA apps as youth can receive multiple messages from their friends simultaneously [60].

Questions framed from a negative perspective, such as “Have you thought about killing yourself since the last prompt?” can lead suicidal participants to negative mood states and reduce their compliance rates [31]. Instead, the content of EMA messages should be written at around a 6th-grade reading level, and the message tone should stress personal autonomy, competence, and relatedness [61].

Stigmatization associated with autism and mild cognitive impairment is a barrier to using EMA studies for data collection. For instance, in Vietnam, where autism is socially and culturally stigmatized, the use of EMA for self-reports is associated with introversion, which is considered a sign of autism [43]. Consequently, participants often prefer engaging in interviews when providing qualitative data rather than utilizing their mobile phones for self-reports. Similarly, participants with mild cognitive impairment experience discomfort or even apprehension to respond when receiving random EMA prompts when they are surrounded by friends, family, or public spaces [52]. The gender power gap is another barrier, as one study found that female participants must hide their phones from their male sexual partners when participating in HIV prevention studies [62]. This

finding reveals how traditional gender roles in intimate relationships as cultural norms can hinder women's access to health interventions.

Table 5. Articles that reported cultural-related factors and their effect on EMA compliance.

Study	Topic	Study Population	Findings	Notable Compliance Rate Statistics
Adams et al., 2024 [31]	Using EMA to assess suicide	Black men between the ages of 18 and 34 with suicidal thoughts and behaviors	Deficit-framed questions about suicide discouraged EMA survey compliance and diminished mood.	No quantitative statistics related to question differences provided.
Trang et al., 2022 [43]	Monitoring the relationship between mental distress and HIV risk	MSM between the ages of 18 and 24 in Hanoi, Vietnam	Participants perceived having an MSM-friendly and culturally appropriated language as highly important.	No quantitative statistics related to language differences provided.
Elavsky et al., 2021 [46]	Using EMA for real-time behavior monitoring	Czech adults between the ages of 50 and 74	In non–English-speaking countries, it was a challenge for participants to use apps that were not in their native language.	No quantitative statistics related to language differences provided.
Mattos et al., 2019 [52]	Using EMA for mood assessment	Individuals between the ages of 69 and 81 with mild cognitive impairment (MCI)	MCI was socially and culturally stigmatized.	No quantitative statistics related to MCI stigmatization provided.
Garcia et al., 2014 [60]	Using EMA to collect real-time data that influence physical, mental, emotional, and social well-being	Latina adolescents between ages of 14 and 17	The research team had to be familiar with texting shorthand linguistics among youth, e.g., <x_x> ("smiling"). EMAs compete with other messaging activities, such as texting families and friends.	No quantitative statistics related to text differences or youth culture provided.
Walters et al., 2021 [61]	Using EMA to identify predictors of imminent drinking	Homeless, at-risk adult drinkers between the ages of 37 and 56	Messages should be written at a 6th-grade reading level, and the message tone should emphasize personal autonomy, competence, and relatedness.	No quantitative statistics related to message differences provided.
Dietrich et al., 2020 [62]	Using EMA to assess sexual risk	Women between the ages of 18 and 25 who self-reported sexual risk behavior or were at risk of HIV infection	Male sex partners may prevent female participants from joining the study.	Barriers for non-completion rate: concerns of lack of privacy and partners finding out as the barrier for non-completion rate: 3.4%

Social Support

Six prior studies mentioned that EMA compliance rates are associated with social support, including from family, friends, or the research team (Table 6). Participants tend to reply to more EMA prompts when participating in the study with their family members simultaneously [34]. Moreover, receiving

support from the research team, such as knowing the staff, receiving training, and having an example of feedback reports at the beginning of a study, can positively affect the compliance rate [46,53,63,64]. In contrast, couples are less likely to respond to EMA prompts if they go out together [65].

Table 6. Articles that reported the effect of social support on EMA compliance.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Bell et al., 2022 [34]	Using EMA to study family eating activities	Families that include at least one adult parent and one child between the ages of 11 and 18 years in Los Angeles	Participants were more likely to answer an EMA if another family member had answered it in a similar time frame.	Average family level compliance: 89.4% Average individual level compliance: 89.6% OR for a participant to respond if another family member had responded recently: 1.91 for all EMAs, 2.07 for time-triggered EMAs
Elavsky et al., 2021 [46]	Using EMA for real-time behavior monitoring	Czech adults between the ages of 50 and 74	Participants would have been more compliant and attentive if they knew what type of feedback was possible. Providing an example of feedback reports and training sessions on using devices and apps can increase the compliance rate.	No quantitative statistics related to participation feedback or training provided.
Burke et al., 2022 [53]	Feasibility of app-based noncontact EMA	Experienced and technology-naïve older participants between the ages of 45 and 78	Participants have higher compliance willingness if they know the researchers.	No quantitative statistics related to researchers' support provided.
Coughlin et al., 2021 [63]	Using EMA to monitor substance use	Youth between ages of 16 and 24 with binge drinking or recreational cannabis use	Having a strong relationship with the research team can support data archiving.	No quantitative statistics related to participants' relationship with research team provided.
Fortuna et al., 2022 [64]	Using EMA for peer support interventions	Patients between ages of 28 to 46 with serious mental illness	Participants with higher levels of social support have higher EMA compliance.	Participants completing >20% of EMA responses had higher social support at 3 months (M = 79.22) than those with lower adherence (M = 59.60): p = 0.095
Derrick et al., 2018 [65]	Using EMA to study smoking concessions	Single-smoker couples between ages of 18 and 55	Couples are less likely to reply to a prompt when out together.	Quitter compliance increased to 86% when partners were compliant but dropped to 30% when partners were not. OR of lapse report from quitters expecting

				more support vs less or no support from their partners: 1.18 OR of lapse report from partners with a higher level of planned support vs lower levels or no planned support regarding their own compliance: 3.25

Education

Four prior studies report that the level of education can affect the compliance rate of EMA studies (Table 7). Among them, two studies found that higher education typically leads to a higher response rate for EMA studies [66,67]. In contrast, people with a lower level of education tend to have a lower EMA response rate [36,55]. Lower levels of education can sometimes be associated with poor experience with new technologies [36].

Table 7. Articles that reported the effect of education on EMA compliance.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Gómez-Pérez et al., 2020 [36]	Using EMA to evaluate therapy intervention	Patients with Fibromyalgia between the ages of 53 and 67	The patients with relatively low education (primary or secondary) and limited familiarity with smartphone technology might have influenced the lower-than-expected compliance.	No quantitative statistics related to education level differences provided.
Turner et al., 2019 [55]	Investigating the social inequity and structural barriers to complete EMA	Young men between the ages of 23 to 35 who have sex with men (MSM) and trans women (TW) living with HIV in San Francisco	Participants with less than a college education have a higher noncompliance rate.	Participants with high school education had higher hazards of weeklong or more EMA survey noncompletion (aHR = 1.83, 95% CI 1.16-2.89, P = 0.01) compared to those with some college education or more
Kirk et al., 2013 [66]	Using EMA for data collection with illicit drug users	Individuals between ages of 40 to 55 who self-reported illicit drug use and craving	People with higher education have a higher compliance rate to random prompts.	Responding to ≥80% of weekly random prompts was more common among those with high school education compared to those without high school education (OR 2.07, p=0.012)
Klaus et al., 2022 [67]	Understanding	Community-dwelling	People with higher	Participants with more

	withdrawal and adherence to self-report EMA survey	older aged adults between the ages of 67 and 87 years	education have a higher compliance rate.	years of education demonstrated significantly better adherence to EMA surveys: p = 0.013

Social Context

Four prior studies reported that social context could be a barrier to compliance rate due to concerns about disrupting others, respecting social norms, stigmatization, and privacy concerns (Table 8). Specifically, participants encounter difficulties or discomfort responding to prompts when they are in a classroom [35], in church [68], or in meetings [38]. When receiving phone calls from researchers, privacy concerns can be worsened when participants are surrounded by others [52].

Table 8. Articles reported how different social contexts can affect EMA studies.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Soong et al., 2015 [35]	Using EMA to study tobacco use	Individuals between the ages of 16 and 40 from local colleges, offices, and popular neighborhood places (e.g., cafes, restaurants) in urban India	Students were more frequently in locations where it was less appropriate to use a phone, and therefore less likely to comply.	Average of momentary surveys: 46.87% Average of end-of-day surveys: 73.02% Participants exposed to other people using tobacco showed lower compliance rates for momentary surveys (**β**=-0.17, p=0.02) Exposure to antitobacco messages predicted a decrease in compliance (**β**=-0.15, p=0.01)
Xu et al., 2020 [38]	Using EMA for audiology research	Adults between the ages of 19 and 37 with hearing impairment	Social contexts such as communication difficulties, access to assistance, or coping strategies in participants with hearing impairments and social factors such as daily schedules, work commitments, or familial duties for normal hearing participants may affect compliance.	No quantitative statistics related to social contexts and EMA compliance rate provided.
Mattos et al., 2019 [52]	Using EMA for mood assessment	Individuals between the ages of 69 and 81 with mild cognitive impairment (MCI)	Receiving prompts can bring apprehension when participants are surrounded by friends and families or in public places.	No quantitative statistics comparing compliance rates between participants when alone versus accompanied by others provided.
Schinkel-Bielefeld et al., 2020 [68]	Using EMA to evaluate hearing aids	Individuals between the ages of 24 to 79	Participants purposefully did not	Reasons of missing questionnaires:

	in everyday life	with hearing impairment	bring the study phone to social situations or skipped questionnaires because doing so might be considered as inappropriate (e.g., in church, engaging in a conversation) or safety considerations outweigh the desire to respond during certain activities (such as driving).	inappropriate to respond in that situation : 46% safety reasons: 35%,. unheard questionnaire triggers: 36%.

Social Acceptance

Social acceptance of a particular behavior can influence the compliance rate in EMA studies by misreporting or overreporting the studied issues (Table 9). To be specific, participants tend to misreport behavior perceived as immoral, such as sexual activity and alcohol use [34,56,62,69]. Conversely, one study found that participants tend to overreport socially taboo sexual behaviors since such behaviors were easier to report via electronic delivery methods [62]. Nonetheless, the authors did not elaborate on why this type of overreporting occurred.

Table 9. Articles reported how social acceptance can affect EMA studies.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Bell et al., 2022 [34]	Using EMA to study family eating activities	Families that include at least one adult parent and one child between the ages of 11 and 18 years in Los Angeles	False positive eating events were self-reported for validation, which might be subject to social desirability bias, leading to underreporting of eating events (e.g., falsely denying an eating event because they might believe that reporting it could be viewed negatively by others, or even by the study team).	72% of the analytic sample had at least one falsely detected eating event (false positive).
Yang et al., 2015 [56]	Using EMA to study alcohol use	African American men between ages of 27 and 62 who have sex with men (MSM) in Baltimore	The number of daily drinks decreased over the course of study, as observed by reactivity analysis.	Alcohol use decreased over the study, leveling off after 25 days, with 20%-31% reporting reduced desire to drink from answering questions.
Dietrich et al., 2020 [62]	Using EMA to assess sexual risk	Women between the ages of 18 and 25 years old who self-reported sexual risk behavior or were at risk of HIV infection	Participants stated that they might have overreported sexual activity because of social desirability bias.	6 out of 59 participants (10%) described over reporting sexual activity because of social desirability bias.
Willis et al., 2021 [69]	Using EMA to study sexual consent	Sexually active individuals between the ages of 18 and 39	Participants were inclined to misreport certain types of behaviors (e.g., sex,	No quantitative statistics related to social acceptance and EMA compliance rate

			alcohol use) due to the social desirability bias.	provided.

Social Systems/Infrastructure Barriers

Social systems and structural barriers, such as incarceration, can lead to a higher rate of noncompletion and even drop-off [55,56] (Table 10).

Table 10. Articles reported how the social system/infrastructure barriers could affect EMA studies.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Turner et al., 2019 [55]	Feasibility of using EMA for data collection	Young men between the ages of 23 to 35 who have sex with men (MSM) and trans women (TW) living with HIV in San Francisco	TW and MSM living with HIV faced significant structural barriers (e.g., incarceration, competing needs) that prevent them from participating in EMA research.	Temporary or transitional housing was associated with higher likelihood of extended EMA noncompletion (aHR 1.78, p=0.03) as compared to renting or owning a house. Sacrificing basic needs for HIV medication was linked to increased EMA noncompletion (aHR 1.71, p=0.02)
Yang et al., 2015 [56]	Using EMA to study alcohol use	African American men between ages of 27 and 62 who have sex with men in Baltimore	Social challenges such as unemployment, low-income status, incarceration, community violence and infrastructure barrier related to device loss or theft may interfere with study participation	No quantitative statistics related to social challenges provided.

Race/Ethnicity

Two studies found that race and ethnicity can influence the compliance rate in EMA studies (Table 11).

Table 11. Articles reported how race could affect EMA studies.

Study	Topic	Population	Findings	Notable Compliance Rate Statistics
Mackesy-Amiti et al., 2018 [47]	Using EMA to study mood and risk behavior	Young people who inject drugs (PWID) between the ages of 18 and 35	Among non-white participants, individuals of non-Hispanic ethnicities, including Asian, Pacific Islander, Native American, Black/African American, mixed race, and unidentified race, were more responsive.	EMA participation of Hispanic participants vs other groups: 84% vs. 94% (Fisher's exact test, p=0.057) EMA responsiveness of non-Hispanic "other" race/ethnicity vs other groups (NH black, NH white, Hispanic

				(chi^2[assessments]=8.54, p=0.004)
Semborski et al., 2022 [57]	Feasibility of using EMA	Young adults between the ages of 18 and 25 without stable housing	Histories of marginalization that have led to a deep-seated distrust of systems, including social service systems, could discourage participation (e.g., the concern of confidentiality).	No quantitative statistics related to racial differences in EMA compliance provided.

R2: Use of EMA to understand sociocultural determinants of health

The second research question explores how EMA studies can uncover sociocultural determinants of health. We identified 14 prior studies out of 49 reviewed articles that describe how EMA studies can uncover sociocultural determinants of health that influence health-related issues. Among them, four prior studies revealed that social facilitation can influence drinking [70-72] and cannabis use [73]. Six prior studies found that EMA can identify discrimination and associated issues, including racial discrimination and stress [48], racial discrimination and physical activity [74], social exclusion due to schizophrenia [75], social media ostracism and emotion [76], stigmatization against people with autism [77], and resource barriers and geographic isolation [78]. Three prior EMA studies [18,77,79] examined the relationship between family culture and health-related issues. In one study, Chinese adolescents with ASD may require assistance to live alone when transitioning from school, as they commonly reside with parents and family – in contrast to their counterparts living in Western cultures [77]. In another study, negative family events appeared to increase the likelihood of suicidal ideation (SI) [79]. Another study found that compared to other ethnic groups, Pacific Islander populations are less likely to smoke at home [18].

Prior studies also reported gender roles, stories, and social support are associated with health issues. To elaborate, female individuals with ASD were more likely to engage in social activities due to the cultural beliefs and social expectations of females and males [77]. Another study reported that reframing brain injury recovery through a heroic narrative can increase optimism and promote health management among teenagers [80]. Unlike perceived social support evaluated through surveys, actual social support can be assessed in real-time to better understand diabetes self-management [81]. Detailed information about each reviewed paper is provided in Table 12.

Table 12. Articles show how EMA studies can uncover sociocultural determinants.

Study	Topic	Population	Findings	Sociocultural Determinants
Pike et al., 2016 [18]	Using EMA to measure cigarette use	Pacific Islanders between the ages of 18 and 29 who are in Southern California	Different from prior studies that reported the home as a place where smoking frequently occurs, this study found that Pacific Islanders smoke fewer cigarettes than average at home, suggesting home could be a constructive space for smoking cessation.	Family culture
Nam et al., 2020	Using EMA to	African Americans	It is feasible to use	Race/ethnicity

[48]	understand biobehavioral responses to stress and racial discrimination	between the ages of 30 and 55	EMA to study racial discrimination and biobehavioral responses to stress.	
Fischer et al., 2023 [70]	Using EMA to understand binge drinking, its context, and alcohol use	Young adult between the ages of 21 and 25 who are heavy drinkers	Drinking with others or in public may increase alcohol consumption for enhanced drinking rewards, leading to more harm for at-risk drinkers.	Social context
Pennay et al., 2023 [71]	Using EMA to understand alcohol consumption while watching football	Adults between the ages of 18 and 62 who watch Australian Football League games	Drinking during the game was heavier when watching the game with others, such as at a pub or with friends and family.	Social context
Wray et al., 2019 [72]	Using EMA to study alcohol-drinking locations	High-risk gay and bisexual men between the ages of 18 and 54 who are defined as hazardous drinkers according to NIAAA	Participants were more likely to express themselves at gay bars/ clubs and private residences, where locations were more “sexualized.” They did not drink more heavily when in locations with more intoxicated patrons or guests.	Culture (e.g., lesbian, gay, bisexual, transgender, or, queer culture)
Phillips et al., 2018 [73]	Using EMA to assess whether social context influences cannabis use	College students between the ages of 18 and 33	A positive association was found between the probability of using cannabis with others and minutes spent using cannabis.	Social context
Nam et al., 2021 [74]	Using EMA to understand racial discrimination and physical activities (PA)	African Americans between the ages of 30 and 55 in New Haven communities in Connecticut	Greater racial discrimination is associated with more sedentary time.	Race/ethnicity
Hanssen et al., 2020 [75]	Using experience sampling to improve daily social functioning and symptoms in schizophrenia spectrum disorders (SZ)	Outpatients between the ages of 18 and 60 with a diagnosis of SZ	Findings show a decrease in loneliness over time after participating in the study.	Social support
Stieger et al., 2020 [76]	Using EMA to study social media ostracism and emotion	Individuals between the ages of 18 and 57 who are interested in the study topic	Being ignored online led to feelings of being offended in one-to-one chat situations, becoming more pronounced when ignored by a group.	Social context
Chen et al., 2017 [77]	Using EMA to explore social participation	Individuals between the ages of 16 and 45 with autism spectrum disorders in Australia and Taiwan	Female participants with ASD were more likely to engage in social situations. Chinese adolescents with ASD may require	Sex, culture (e.g., gender role and expectation, family culture in Chinese society)

			particular assistance when transitioning from school to living independently as they commonly live with family.	
Browning et al., 2022 [78]	Using EMA to study isolation and mobility	English-speaking black youth between the ages of 11 and 17 and their caregiver	Black youth tend to travel further to seek resources provided in organizational locations (e.g., library, workplace, place of worship).	Race/Ethnicity
Husky et al., 2017 [79]	Using EMA to study predictors of daily life suicidal ideation (SI)	Adults between ages of 25 and 50 who were recently discharged after a suicide attempt	Being with family members and friends can reduce the risk of SI, but negative family events can increase the likelihood of SI.	Family culture
Worthen-Chaudhari et al., 2017 [80]	Using the mHealth application for unresolved concussion symptoms	Youth between the ages of 13 and 18 with concussion symptoms 3+ weeks after injury	Mobile apps designed to reframe the recovery challenge as a personal heroic narrative can increase optimism and reduce learned helplessness.	Culture (e.g., heroic narrative)
Wooldridge et al., 2022 [81]	Using EMA to assess psychosocial factors and self-management behaviors	Veterans between the ages of 50 and 58 with type 2 diabetes	An EMA study is an ideal opportunity to assess actual social support, which is different from perceived social support.	Social support

Discussion

Principle Findings

We conducted a systematic review of the dynamics between sociocultural determinants of health and EMA studies from 2013 to 2024. We identified 35 articles related to the intersection of EMA and sociocultural determinants, including 11 factors that can influence the feasibility or compliance rate of EMA studies: lifestyle behaviors, sex, age, culture, socioeconomic status, social support, education, social context, social acceptance, structural/system barriers, and race/ethnicity. Among these sociocultural determinants, lifestyle behaviors, sex, age, and culture are the most influential in terms of EMA compliance rate in health-related studies. In addition, we found 14 articles that demonstrated that EMA health studies could uncover sociocultural determinants, including increased substance use for social facilitation, discrimination, stigmatization, family culture, gender culture, and uniqueness of social support and their relationship with health-related issues.

Implication, Challenges, and Opportunities

Cultural Factors are Understudied in EMA Research.

The discussion of sociocultural determinants in EMA studies usually remains at the surface level; insightful, in-depth discussions regarding how sociocultural determinants can influence the feasibility of using EMA in mHealth studies or how using EMA can uncover sociocultural determinants are lacking. For example, several prior studies [40,46,47] found that females tended to

have a higher response rate compared to men; however, possible explanations for this finding were missing. Simply stating that women tend to be more responsive to prompts fails to provide a deeper understanding of how sex can affect EMA compliance.

A Personalized and Contextualized Approach Is Needed.

Findings from previous research are inconsistent in examining the impact of social determinants, such as age, language, and socio-economic status, on EMA compliance. Inconsistencies may be a result of the type of health behavior being studied. For instance, family support can encourage the likelihood of prompt response for eating behavior-related studies [34] but discourage participation when studying sex behavior [62].

Sociocultural determinants become further complicated when considering individual preferences in a specific context. Thus, research teams should consider multiple factors, such as the participant's sex, race, age, socioeconomic status, personal preference, and the unique sociocultural environment they reside in. Failing to do so, for example, by not sending EMA prompts at an appropriate time, can lead to missed responses or jeopardize the trust between the research team and the participants, leading to unsatisfactory research results. Therefore, the research team should consider a personalized timing schedule when sending EMA notifications by discussing with participants their preferences before the study or using a personalized calendar to better match their daily schedules.

Health-related issues are never standalone problems; instead, they are often embedded into the immediate sociocultural environment [82-84]. Although prior studies have shown that sociocultural determinants affect health-related issues, deeper analysis is lacking. For example, multiple American studies have shown that increased drinking or cannabis use is associated with social facilitation [70,71,73]. However, drinking alcohol in other countries, such as China, can be a way to show respect to authoritative figures, such as supervisors or business partners [85]. Hence, findings may not translate when considering the cultural context. A more nuanced examination of these sociocultural determinants enables researchers to obtain a deeper understanding of the health problem studied. To do so, research teams should collaborate with scholars from various backgrounds, such as community engagement, cultural studies, and other experts in the field of social science.

Possible Behavioral and Perception Change regarding Health and Technology.

The usage of mHealth technology can affect behavior and perceptions, such as being more active, improved self-worth, enhanced self-reflection, and a stronger feeling of being supported [86,87]. More importantly, the prevalence of mHealth technology might induce social and cultural change in the community and at the societal level. As indicated by prior studies, embracing new technology has brought many sociocultural transformations in the past [88,89]. For example, the arrival of social media introduced the digital culture, which features participation and connectivity [89]. The prevalent usage of social media has changed how people communicate, exchange knowledge, and share information [90]. Depression, anxiety, and psychological stress are associated with longer time spent on social media, such as repeated checking of messages [91]. WeChat users have become more reliant on the platform than their family and friends when needing help to complete their daily tasks [92]. By the same token, researchers in public health can consider examining how mHealth technology and EMA practices, such as using wearable devices and mobile-based applications, can shape people's behaviors and perceptions regarding health-related issues, such as exchanging health-related information, privacy, data ownership, and other ethical issues, particularly with historically marginalized groups.

Limitations

This review has several limitations. First, we may have overlooked some articles due to the choice of the search strings. It is possible that prior studies are not included due to the selection of keywords and abstract expressions, as well as journal or indexing bias. For example, only five papers were retrieved if we directly used the search string *(("ecological momentary assessment ")) AND ("feasibility") AND ("cultural") or ("culture"))*. However, when we conducted hand searches for additional relevant studies, we found a few studies that explicitly focused on the sociocultural determinants that influence the feasibility and acceptability of using EMA in health.

Thus, hypothetically, there might be more articles that we were able to retrieve that might have addressed sociocultural determinants. However, we could not retrieve them, as those papers did not use any relevant keywords. Instead, the keywords in these studies are often exclusively health-oriented and/or method-centered. This implies that sociocultural determinants are not always one of the primary objectives when conducting EMA studies. To further demonstrate this limitation, we provide some examples of articles that cannot be retrieved via our search string even though they discuss sociocultural-related issues.

Table 13. A demonstration of how some EMA studies discuss culture without using any keywords associated with culture.

Study	Topic	Population	Lessons Learned	Keywords
Han et al., 2018 [20]	Feasibility of using EMA for substance use disorders	People between the ages of 18 and 65 who are dependent on heroin or amphetamine-type stimulant (ATS) in Shanghai	Acceptability was low, as drug addiction is treated as immoral in China.	mHealth; substance use; heroin dependence; amphetamine-type stimulant (ATS) dependence; mobile app; China
Hubach et al.,2021 [22]	Feasibility of using EMA for data collection	MSM between the ages of 18 and 36 who live in rural communities in Oklahoma	MSM were afraid of unwanted disclosure of their homosexuality due to a lack of identified social resources, nondiscrimination policies, and inclusive faith in rural Oklahoma.	mobile research; men who have sex with men; rural; data privacy; sexual orientation; EMA
Tonkin et al., 2023 [23]	Evaluating the EMA time course and exploring the predictors of compliance rates	Cigarette-using adults between ages of 43 and 63	African American participants exhibited lower compliance rates. which may be due to daily stress and mistrust attributed to institutional racism.	ecological momentary assessment; compliance; health behavior; methodology; longitudinal; health behavior; smoking; smoker; cessation; quit; adherence; dropout; RCT; cigar; retention
Berge et al., 2018 [93]	Using EMA to understand parent feeding practices	Children between the ages 5 and 7 and their parents from six racial groups	EMA messages should be culturally tailored to different racial/ethnic groups, since food is culturally specific.	parent feeding practices; ecological momentary assessment; minority; low-income; immigrants

Conclusion

EMA is a popular research method in health studies, enabling researchers to monitor real-time health-related data in real-world environments that involve particular social norms and cultural practices. Yet, an overview of how sociocultural factors can affect the EMA compliance rate has been

lacking in the literature. This systematic review provides a comprehensive understanding of how various sociocultural factors affect EMA compliance rates in health studies and how EMA studies can uncover the embedded, hidden, yet crucial sociocultural factors in health issues.

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Conflicts of Interest

The authors declare no conflicts of interest.

Abbreviations

DP: dedicated participators
EMA: ecological momentary assessment
MSM: men who have sex with men
OP : occasional participators
OR: odds ratio
TW: trans women

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Supplementary Files

Figures

PRISMA flow diagram illustrating the steps of this systematic literature review.