Applications of the Experience Sampling Method: A Research Agenda for Hospitality Management¹

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Abstract

Purpose – This study aims to provide researchers in hospitality management with a comprehensive understanding of the experience sampling method (ESM) and to engage them in the use of ESM in their future research. With this critical discussion of the advantages and challenges of the method, researchers can apply it appropriately to deepen and broaden their research findings.

Design/methodology/approach – This study chooses an empirical example in the context of hotel employees' surface acting, tiredness and sleep quality to illustrate the application of ESM. Based on the example, this paper conducts two-level modeling in Mplus, including a cross-level mediation analysis and mean centering.

Findings – This paper demonstrates the applicability and usefulness of ESM for hospitality research and provides a detailed demonstration of how to use the statistical program Mplus to analyze ESM data. With this paper, researchers will be able to consider how to engage ESM in their future studies.

Originality/value – This paper is among the first to provide a hands-on demonstration of ESM to hospitality researchers. We call for more research in hospitality management to use ESM to answer complex and pressing research questions.

Keywords

Experience sampling method, multilevel model, hospitality management

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1 Introduction

Most of the existing research in hospitality management has applied a cross-sectional design to collect data, which benefits the collection process but ignores the causal effect (Min and Kim, 2016). A cross-sectional design usually investigates the prevalent outcome of a specific topic for a given population, thus providing a “snapshot” of the outcome at a specific point in time (Levin, 2006). However, collecting data for one-time only cannot explain whether the conclusion is changeable as time goes by (Kothari, 2004), such as the relationship between emotional exhaustion during work and tiredness or sleep quality afterwards. In addition, when the research questions refer to past experiences, participants’ answers may be incomplete or biased because of memory errors, such as the emotional state at work or the sleep quality a couple of weeks ago. Meanwhile, thoughts, feelings and action intentions are highly likely to fluctuate in the short term (Bird, 1992), and when the research is related to those variables, the findings may vary across different points in time during data collection. For example, the participants may feel very frustrated the first time they are questioned, but they may report that they are motivated by the frustrating situation as time goes by, or they may not remember it a week later. To summarize, cross-sectional design cannot satisfy the requirements of every type of research, especially when the research investigates variables with a high possibility of fluctuation over time.

To investigate how an individual’s emotions, thoughts and feelings fluctuate, the experience sampling method (ESM) is an applicable option. ESM is an intensive longitudinal design, which takes measurement repeatedly throughout the daily life of the same participant, focusing on evaluating variables that may fluctuate during short time periods (Vogelsmeier et al., 2019). Due to the hospitality industry’s labor-intensive nature, individuals’ attitudes and behaviors may change dramatically, thus requiring accurate and comprehensive measurement in order to deepen and broaden the research findings in this context (Gröschl, 2011). The ESM is designed to examine fluctuations in daily or occasional individual states and to explain the causes and consequences of those variables (Hektner et al., 2007). This approach allows new research pathways that can contribute to the development of hospitality research. For instance, as an important feature of hospitality employee, high turnover rate can be further investigated through ESM (e.g. how does an employee’s feelings fluctuate when he/she has intentions to quit; how does a customer’s impolite behavior influence an employee’s turnover intention). Many influential management and psychology journals, such as the *Academy of Management Journal*, *Journal of Applied Psychology*, *Journal of Occupational Health Psychology*, and *Journal of Organizational Behavior*, are increasingly publishing studies that used the ESM to collect data. However, very few studies in hospitality management have applied this advanced method to explore short-term fluctuating variables (e.g., Ritchie and Hudson, 2009; Quinlan et al., 2018). The purpose of this paper is to introduce ESM to researchers in hospitality management and engage them in the use of ESM in their future research. Therefore, this paper provides hands-on demonstration and an agenda for future applications of ESM in hospitality research.

This paper begins with an overview of ESM and a critical discussion of its benefits and challenges, especially highlighting the issues that need paying attention to in hospitality ESM research. In addition, we then present a specific illustrative example of how we designed an ESM study that aimed to explain the relationships among surface acting, tiredness and sleep quality. This example is developed from the conservation of resources theory (Hobfoll, 1989) and contains a ten-working-day design with 50 frontline employees in the hospitality industry. This example identifies resources to help hospitality researchers learn how to use Mplus to

analyze ESM data. Finally, the paper concludes with implications and suggestions for future research.

2 An overview of ESM

The experience sampling method became popular in clinical research, health research, and social psychology research during the 1990s, and recent decades have seen an explosion in the use of ESM for organizational behavior research (Scollon et al., 2003). The acknowledged earliest researcher to use a precursor of today's ESM was Flügel (1925), who conducted a 30-day study of emotion. Later studies that used a method that best resembled the current form of ESM include Csikszentmihalyi et al.'s (1977) study on adolescents, which coined the terminology ESM and Brandstätter's (1983) research on mood across situations. In some disciplines, ESM is also known as Ecological Momentary Assessment (EMA; Shiffman et al., 2008). Although ESM and EMA arose from different research traditions, they are similar in terms of collecting self-reported real-time data on emotions, behaviors and cognitions (Trull and Ebner-Priemer, 2009). Introducing random signaling and attempting to explore intrapsychic phenomena distinguish the current forms of ESM from earlier forms (Scollon et al., 2003). Data collection for ESM includes both qualitative data, such as repeated open-ended questions (e.g., Cutler et al., 2018) and quantitative data, such as repeated questionnaires (e.g., Sloboda et al., 2001). In this paper, the quantitative data approach is discussed, including the issues relating to data collection and data analysis. In our illustrative example, a quantitative ESM design is used to give an easy-to-follow demonstration.

The advantages of applying ESM include enhancing ecological validity, investigating within-person variables and avoiding memory biases. Ecological validity refers to the extent to which the research results can be generalized to the natural occurrence of the phenomenon being investigated (Brunswick, 1949). The use of ESM can circumvent the scenario-based research limitation, which enhances the ecological validity (Beal, 2015; Scollon et al., 2003; Uy et al., 2010). Meanwhile, an ESM design usually involves dynamic, personal, and internal processes. Participants need to report their recent or current emotions, behaviors, ideas, and/or surrounding events on a daily basis for one or more weeks (Kleiber et al., 1986; Stone and Shiffman, 1994). The method involves several days of frequent personal-experience sampling in order to accumulate comprehensive representative data on how people experience life, how they react to discrete events, and how they evaluate their perceptions, attitudes, and behaviors. In other words, ESM allows exploring within-person variation. For instance, Juslin et al. (2008) applied ESM to explore the emotions to music. Based on a two-week ESM design with 32 students, they found the prevalence of musical emotions were related to personality and different situations. ESM offers the opportunity to discover emotional fluctuations in response to music.

In addition to exploring within-person variation, ESM can also reduce memory errors in the data collection process. Considerable evidence has shown that retrospective answers of past behaviors and emotions can be influenced by memory errors (Schwarz et al., 2009). For example, a retrospective pain review was not conducive to acquiring data on peak and late pain effects (Redelmeier and Kahneman, 1996). Additionally, when individuals in a previous study were asked, during their vacation and again a few weeks later, to report how many holidays they had enjoyed, they reported more later than they reported during the vacation itself (Mitchell et al., 1997). Miner et al. (2005) employed ESM to further develop event-mood-behavior relations. ESM helped them capture the real-time mood and investigate the within-person variance. They found hedonic tone was related to work events, and the relationship

between negative work events and mood was five times stronger than the relationship between positive work events and mood. Robinson and Clore (2002, p. 935) pointed out that “any delay between experience and its report necessarily implies a loss of information.” Real-time reports are assessed as being more impactful than memory-based reports. More accurately, ESM is known as the “golden standard” for measuring the impact of an experience (Schwarz et al., 2009).

3 Critical issues in applying ESM

Many key decisions are required in planning and conducting research that uses ESM. According to Conner and Lehman (2012), when plan and conduct ESM research, scholars should determine the timetable for data collection, develop measures, select a technology platform (if needed), and recruit research participants. In this section, we will critically discuss the processes for data collection and data analysis. Based on those discussions, we will determine suitable research topics for using the ESM in hospitality management research.

3.1 Data collection

It is important to clarify the structure of the target questions (e.g., the time frame and measurements) in any research. Inappropriate measurement or delineation of time frame will influence the research validity disproportionately (Dimotakis et al., 2013). In an ESM design, specifically, researchers should clearly define the time frame in which participants will respond. The choices of time frame could include the previous moment, the time since the last report, and a specific time interval, e.g., the last 30 minutes, the last three hours, or the current day (Fisher and To, 2012). Additionally, the questions must be clearly stated to reflect the time frame required, such as “How frustrated do you feel now?”, “Did you comply with company rules and regulations since the last signal?” or “Are you satisfied with your work today?” For establishing measurements of variables, ESM usually requires a shorter scale in order to avoid overburdening participants (Song et al., 2008; Zohar et al., 2003). In general, a daily report with one response per day should be limited in length to 5-10 minutes, and if a report needs up to five responses per day for one week, the length per response should be limited to 2-3 minutes (Hektner et al., 2007). Although in past research some variables already have had a shortened scale for ESM, it is important to decide which item(s) should be included in that shortened scale. Fisher and To (2012) suggested considering the highest factor loading from pre-existing scales, or choosing items that fluctuate between reports.

The issue of sample size for an ESM design needs to be highlighted. Most ESM studies decide the size of the sample of participants by considering the modest size that meets social science standards (Aguinis and Harden, 2009). Because participants respond multiple times over the course of the research, the total sample size is usually sufficient for accurate and meaningful analysis. In general, due to the character of ESM, the number of participants in the sample size can consider multilevel data group sample suggestions (i.e., more than 50), because it has been shown that a small sample size at level two (50 or fewer) can lead to biased estimates of second-level standard errors (Maas and Hox, 2005; Moineddin et al., 2007). However, the number of participants may be decreased according to the number of response times. For example, Ilies and Judge (2002) conducted a study with only 27 participants, but the total number of observations was 1907 because they measured variables four times a day for nineteen days. Notably, researchers can generally expect the participants to answer above 70% of the measurement items (e.g., Christensen et al., 2003; Courvoisier et al., 2012). However, in ESM research, due to the required multiple responses, the compliance is likely to decline

over time and may also vary significantly across assessments depending on the time within a day (Rintala et al., 2019). Researchers should consider the research design and select the duration and response time carefully.

Several general sampling options are available in ESM research: an interval-contingent protocol, a signal-contingent protocol, an event-contingent protocol, and combinations of those approaches (Bolger et al., 2003). In an interval-contingent protocol, participants are asked to answer questions at predetermined intervals (e.g., every two hours) or at the same time every day. In an event-contingent protocol, respondents only need to respond when the event of interest happens. In a signal-contingent protocol, respondents are asked to respond promptly when signaled, and the signal time points happen randomly throughout the day. In hospitality research, all three of those protocols can be used in different topics. For example, for topics related to the diurnal fluctuation in employees' moods, an interval-contingent protocol is more suitable; when the topic emphasizes accurate reports of current states and prefers a large number of signals (up to 10 times) per day, the signal-contingent protocol is appropriate (e.g., "how do you engage in your work now?"); and when participants recognize exactly what they should report about events, an event-contingent protocol is applicable (e.g., an employee's accurate mood when facing a rude customer).

Technological advances offer new possibilities in ESM data collection (Zirkel et al., 2015). In the early 1990s, several researchers adopted personal digital assistants (PDAs) in their ESM studies. However, due to the PDA devices' limited battery life, high cost, and unstable data storage, pen-and-paper data collection remained the primary approach with ESM until recently (Van Berkel et al., 2018). With the widespread availability of personal mobile devices nowadays, they have been deployed as efficient research tools (Raento et al., 2009). The first several studies (e.g., Andrews et al., 2011; Berkman et al., 2011) that used mobile devices in ESM required participants to encode and text their answers back to the researchers (Fisher and To, 2012). With the development of smartphones, wireless connectivity, and touch screens, smartphone-based ESM is much easier to conduct. Participants can open and complete their survey through their smartphones when signaled and can then send the response directly to the researcher (Fisher and To, 2012; Kubiak et al., 2011; Uy et al., 2010).

Additionally, Van Berkel et al. (2019) noted that the quality of participant responses in smartphone-based ESM research is crucial. Six strategies are identified to improve the accuracy of ESM mobile self-report data: limiting duration to two weeks; prioritizing sending questionnaires to participants when their phones are not in active use, and their phones are connected to a Wi-Fi network; prohibiting the completion of the questionnaire during a phone call; combining cognition-aware scheduling with a time-based interval schedule of questionnaires to improve accuracy in self-report studies; and removing responses with completion time two standard deviations above the mean because this may indicate multi-tasking. In future ESM studies, choosing smartphone-based ESM and following the above strategies can help improve the response quality. Meanwhile, several ESM data collection platforms and applications have been developed, such as PACO and Experience sampler. Because such ESM platforms are being developed, future research can consider collecting data from them, and that will help simplify the data preparation process (e.g., changing the classic form of data to a multilevel form).

In the hospitality industry, certain issues need to be noted in relation to the data collection process. First, because most employees in the hospitality industry work in shifts, an interval-contingent protocol should be handled carefully. For example, if the researchers would like to

collect data every working day from employees when their shift is over, they cannot send the questionnaire to participants at a fixed time (e.g., 5 pm). Researchers would need to become acquainted with every participant's timetable and send the questionnaire to each person individually, which will increase the researchers' workload significantly. Meanwhile, when the participants work on night shifts, researchers need to find a platform which could help send questionnaires at scheduled time. Second, smartphone-based ESM is often recommended to ease researchers' workload. However, when participants are guest-service employees, they cannot access their smartphones at all times (e.g., when serving customers). That constraint also limits using a signal-contingent protocol in hospitality research. Finally, seasonality requires hotels to hire a number of temporary workers, which makes the employee turnover rate high (Ferreira et al., 2017; Terry, 2016). Researchers need to ensure that the participants will be able to complete the whole survey, and they must consider whether the research outcome will be influenced by the participants' short-time experience.

3.2 Data analysis

Bliese et al. (2007) stated that because of the hierarchical structure of the ESM, where data include multiple responses nested within an individual, multilevel modeling is an appropriate statistical method for data analysis. Multilevel modeling takes the relevant structure of the data into account when multiple reports have been obtained from the same person during an ESM study (Walls and Schafer, 2006). Many statistical programs have features of multilevel modeling to analyze ESM data: Mplus, R, HLM, SAS, and Stata, among others; this research used Mplus. Figure 1 shows a normal two-level ESM data structure. In most cases, the use of a two-level model means that level 1 is relevant to the subject itself, and level 2 is relevant to the relationship between subjects. However, sometimes a three-level model is needed, for instance when the signal level is nested within the day and the day is nested within the person, or when the person who responds repeatedly is nested in a workgroup. To analyze this kind of nested data, multilevel modeling is required (e.g. Ferreira et al., 2017).

Figure 1. Regular two-level ESM data structure

Furthermore, ESM data need to be handled carefully. Prior to the start of data analysis, researchers have to clean up the data to eliminate significant errors, such as over-range responses (e.g., a participant reports 0 when the question scale is 1-10), repeated reports (e.g., a participant reports twice for one time point), or reports that are completed too long after the signal was received (e.g., the report was completed two days after the required time point) (McCabe et al., 2012). Researchers should organize their data in a multilevel form (like the one shown in Figure 2). In addition, they must decide on the variable centering at each level (Zhang et al., 2009). Due to their nested data structure, ESM data need to be centered when moderators or mediators are involved. Grand-mean-centering refers to subtracting the mean of the full sample from each score, and person-mean-centering refers to subtracting the individual participant's mean from each of their scores (Aiken et al., 1991). In general, we group-mean center the level 1 predictors and grand-mean center the level 2 scores (Luke, 2004; Paccagnella, 2006). Predictors are centered to reduce the risk of confounding effect (Enders and Tofighi, 2007).

Figure 2. Reshaping of the data structure

y_{ij} is the response at occasion i for individual j

Typical				Multilevel		
				Individual j	Occasion i	y_{ij}
Occasion Individual	1	2	3	1	1	y_{11}
	1	y_{11}	y_{21}	y_{31}	2	y_{12}
	2	y_{12}	y_{22}	y_{32}	3	y_{13}
	3	y_{13}	y_{23}	y_{33}	1	y_{21}
				2	2	y_{22}
				2	3	y_{23}
				3	1	y_{31}
				3	2	y_{32}
				3	3	y_{33}

In addition, researchers must consider how to deal with the unavoidable loss of data (Black et al., 2011; Little and Rubin, 2002). Early discussions in the field of psychology (e.g., Stone et al., 1991) mentioned two common options to deal with missing data: listwise deletion and pairwise deletion. A multilevel model can handle missing data using maximum likelihood estimation or multiple imputation, instead of deletion. The basic idea of multiple imputation refers to replacing the missing values by forming an “informed guess” that is based on the received data and the imputation model (Grund et al., 2018). Maximum likelihood estimation is closely related to the normal distributional assumption of the model (Bentler et al., 2011). Both of those modern missing data techniques for working with multilevel data have been established and verified to be superior to the traditional techniques, e.g., listwise deletion or single imputation (Black et al., 2011).

In order to understand the degree of variance between each participant, researchers should run an unconditional model (no predictor) for each level-1 variable first to test whether multilevel model is suitable. After that, the model including level-1 and/or level-2 predictors should be tested. When the first-order coefficients are random – which is, when the mean and slopes are allowed to be different from each other – a two-level variable can then be used to predict the mean and slope of the participant (Fisher and To, 2012). More complicated models can investigate complex internal dynamics, such as hysteresis (e.g., the last day’s stress forecasts current work engagement), spilling from one context to another context (e.g., work-family conflict), accumulated experience (e.g., the effect of pressure from repetition), or the effect of one variable on another variable. Most previous ESM studies have ignored that possibility, while others have detected the problem and controlled autocorrelation (Fisher and To, 2012). A common approach is to evaluate whether the outcome variable can be significantly predicted by the previous periods. The lag associated with the current observations is usually involved as a control variable in the model (Beal and Weiss, 2003). The interval between the current observation and the hysteretic observations should also be coded

in the model when the observation interval is uneven or changing, as in the case of accidental or incidental sampling (Beal and Weiss, 2003).

For moderator and mediator analyses, the cross-level moderator or mediator needs to be noted. For cross-level interaction, the between-person variable (i.e., level 2 variable) is proposed to influence the within-person relationship (i.e., level 1). Such analyses can be done with ordinary least squares (OLS) regression approaches (Dimotakis et al., 2013), and either grand-mean or person-mean centering can be used (Krull and MacKinnon, 2001). Because between-person moderators are usually measured only once before the daily surveys, assessing that type moderator can be easily achieved. Moreover, when researchers are conducting cross-level studies, they need to ensure that the between-person moderator is conceptualized as a stable variable. If the moderator is not stable – in other words, if the moderator may fluctuate over time – it should be considered to be a within-person moderator instead. In terms of mediation analyses, multilevel mediation analysis is similar to single-level mediator analysis, and the same approaches can be used to test cross-level mediation (Dimotakis et al., 2013). However, certain statistical issues need to be mentioned in within-person mediation research. For example, specific classic tools for single-level mediation analysis, such as the Sobel test (Sobel, 1982), provide inaccurate results or show low levels of power when they are used to evaluate multilevel models (Krull and MacKinnon, 1999; Zhang et al., 2009).

In hospitality management research, it is worth noting that, because hospitality employees often work in shifts, the data summarization is recommended to use a format such as Day 1, Day 2... or Time 1, Time 2... rather than a format like December 1st, December 2nd, and so on. Meanwhile, when the data sample is sufficient, researchers can add moderators that are related to working in shifts to further investigate the relationships among variables and examine whether different relationships exist in different shifts. For example, employees who work in night shifts may have lower vitality, and that might influence their work performance on next day, whereas those working in the morning shift might perform with a higher work engagement than their colleagues working in the night shift. Many related research questions can be explored through ESM.

3.3 Suitable topics for using ESM in hospitality management

The experience sampling method has been widely applied in clinical research, health research, social psychology research, and organizational behavior research. The common feature in these studies is rooted in the special quality of ESM that allows researchers to measure within-person fluctuations over short periods of time. In other words, research topics related to variables that focus on within-person changes and that might be influenced by other factors in short time periods can choose ESM. In hospitality management research, some empirical studies using hospitality employee samples have adopted ESM to explore the relationships. For example, Beal et al. (2013) investigated the emotion regulation process and affect spin (i.e., fluctuations of emotions) based on a sample of 63 restaurant staff over 10 shifts (four times each shift; 2,051 observations in total). They verified the relationship between emotion regulation and fatigue at work as well as the moderating role of affect spin. Hülshager et al. (2015) employed ESM with 34 restaurant waiters and taxi drivers (166 observations in total) and found emotion regulation was positively related to customer tips. Based on ESM, they extended previous work (e.g. Chi et al., 2011) by linking within-person variation and daily fluctuation in emotional labor strategies to customer tips.

In hospitality management research, for example, the topics on leadership and employees' psychological well-being can use an ESM design. Because psychological well-being can be influenced by supervisors' behavior over a short time period (Gordon et al., 2019), a future study related to this topic could employ ESM. Using ESM could help reveal how psychological well-being is influenced from the individual's perspective as time goes by. In addition, ESM can capture the instinctive feelings and thoughts that hospitality employees have when specific "leadership behaviors" take place. Otherwise, when researchers ask participants later to respond to their questions by recalling their experiences, the answers may be influenced by memory error. Moreover, applying ESM can gain deeper insights into research questions related to the change of time. For example, "How does an employee's psychological well-being change over five working days within a week?" and "Does an employee's psychological well-being status have an inflexion point when a specific leadership behavior happens?" In addition to leadership and employees' psychological well-being, other topics related to emotions, feelings, and intentions can also employ ESM, such as studies on service performance (e.g., what specific emotions influence employees' service performance and how long the impact lasts), and on customers' continuance intention for the same hotel (e.g., how service failure influences a customer's emotions and satisfaction and changes the trajectory of the customer's attitude toward the hotel), and so on. The key points of data collection, data analysis process and applications in hospitality are summarized in Table 1.

Table 1 Data collection, analysis and applications of ESM in hospitality research

Aspect	Key issue	Application in hospitality
Data collection	<ul style="list-style-type: none"> Specify the structure of target questions (time frame; measurements) Ensure a sufficient sample size Choose a suitable sampling protocol (interval-contingent protocol, signal-contingent protocol, and event-contingent protocol) Apply technology appropriately (smartphone-based ESM; various platforms) 	<ul style="list-style-type: none"> Since most hospitality employees work in shifts, researchers should choose the sampling protocol carefully Carefully consider the use of technology, especially when the participants have limited access to smartphone Need to handle data carefully when using temporary workers as participants
Data analysis	<ul style="list-style-type: none"> Prepare for data analysis (cleaning up data; reshaping data; dealing with missing data) Use multilevel modeling to analyze ESM data Take mean-centering when doing moderator and mediator analysis 	<ul style="list-style-type: none"> Summarize the data in the format that involves the discrepant working schedule Researchers may consider more moderators/mediators related to hospitality characteristics (e.g., shifts) when the sample size is sufficient

4 Illustrative example of hospitality study that uses ESM

This section provides an illustrative example of how the current authors have used ESM for hospitality research. The example reported here was designed to examine how one of the emotional labor strategies (surface acting) influences employees' daily sleep quality through their daily negative emotion: tiredness. Assumptions about the relationship among surface acting, tiredness and sleep quality are based on the conservation of resources theory, which describes the impetus for humanity to maintain existing resources (Hobfoll, 1989). When resources could not be reacquired, employees would feel pressurized. Emotional labor referred to "the management of feeling to create a publicly observable facial and bodily display" (Hochschild, 1983, p.7). Inspired by Goffman's (1978) dramaturgical approach, Hochschild (1983) proposed two strategies for employees to manage emotions: surface acting and deep acting. Surface acting is defined as employees' adjustment of emotional expression to match the requirements of the organisation, which involves "faking" the expected emotions. Surface acting can be considered as a type of resource loss, which will lead to negative results, such as tiredness and poor sleep quality. In addition, studies have verified that low energy level (e.g., feeling tired) is negatively related to the sleep quality (e.g., Andrykowski et al., 1997; Knudsen et al., 2007). Because individuals' daily negative emotions and daily sleep quality could be correlated, and negative emotions and sleep quality are changeable over short periods of time, ESM is appropriate for investigating such relationships. Figure 3 presents the theoretical model of this example.

Figure 3 Theoretical model of the example

A multilevel mediation model is applied in this case, and the formulas are presented as follows (Kenny et al., 2003):

$$M_{ti} = d_{Mi} + (a + u_{0i})X_{ti} + e_{ti} \quad (1)$$

$$Y_{ti} = d_{Yi} + (c + u_{1i})X_{ti} + (b + u_{2i})M_{ti} + e_{ti} \quad (2)$$

where X represents the explanatory variable, M represents the mediator, Y represents the outcome, d represents the random intercepts, a, b and c represent the fixed effects, u_{0i} , u_{2i} and u_{1i} represent the random effects, $a + u_{0i}$ represents the total effect of X on M, $b + u_{2i}$ represents the total effect of M on Y, and $c + u_{1i}$ represents the total effect of X on Y.

In this example, the sample consists of 50 frontline employees of five-star hotels in China. Because the participants got off from work at different times, we sent the questionnaire link to each participant individually after his/her work through a popular communication app (Wechat). Each employee was asked to report his or her sleep quality of the previous night (one item, 10-point scale, adapted from Buysse et al., 1989) and to evaluate his or her negative emotion of tiredness (one item, 7-point scale, adapted from Frone and Tidwell, 2015) for the current day when their shift is over. Before the daily survey, participants were asked to evaluate

surface acting (seven items) using a 7-point scale (adapted from Bhawe and Glomb, 2016, a sample item: “I pretend the emotions I need to display for my job”). The daily survey lasted for two weeks with 10 working days. Because we chose the current day’s negative emotion to match sleep quality reported on the following night, the total number of observations was 50 (participants) X 9 (days) = 450. We lagged the dependent variable (sleep quality) by one day, because the sleep quality was reported a day after negative emotion (tiredness).

For our analysis, we first reshaped the data into the multilevel form shown in Figure 2. The total dataset consists of 450 negative emotion and sleep quality reports. The mean of surface acting score is 4.334, the mean of tired emotion score is 3.036, and the mean of sleep quality score is 5.980. Cronbach’s alpha for the 7-item scale of surface acting is .92. We centered the level 2 predictor (surface acting). Table 2 presents the descriptive statistics and intercorrelations among the focal variables on the day-level (above the diagonal) and person-level (below the diagonal levels). At the day-level, we found a negative correlation between tiredness and sleep quality (day-level $r = -0.444$, $p < .01$). At the person-level, surface acting is positively and significantly related to aggregated tired emotions (person-level $r = 0.311$, $p < .05$), and aggregated tiredness is negatively related to aggregated sleep quality (person-level $r = -0.561$, $p < .01$).

Table 2 Means, standard deviations and correlations

Variable	M	SD	Cronbach’s alpha	1	2	3
SA	4.334	1.113	.92	-	-	-
Tired	3.036	1.973	-	0.311*	-	-0.444**
SQ (lagged)	5.980	2.543	-	-0.118	-0.561**	-

Note. Day-level correlations ($n = 450$) appear above the main diagonal, and individual-level correlations ($n = 50$) appear below the main diagonal. Surface acting, as an individual-difference variable, cannot correlate with intraindividual variables.

SA = Surface acting; SQ = Sleep Quality

** $p < .01$; * $p < .05$.

In this study, the repeated assessments (level 1) were nested within individuals (level 2). We set up a 2-1-1 mediation model (where surface acting is at level 2 and tiredness and sleep quality are at level 1) in Mplus Version 7.4 (see Appendix 1 for Mplus Syntax). The multilevel analysis and indirect effect results of investigating the relationships among surface acting, tiredness, and sleep quality are given in Table 3. Except for the relationship between surface acting and sleep quality at the between level, all relationships are statistically significant.

It can be concluded that on the within-person level, tiredness is negatively related to sleep quality ($\gamma = -0.294$, $p < 0.01$). On the between-person level, surface acting is positively related to tiredness ($\gamma = 0.448$, $p < 0.01$), and tiredness is negatively related to sleep quality ($\gamma = -0.776$, $p < 0.01$). Moreover, the indirect effect of surface acting on sleep quality through tiredness is significant ($\gamma = -0.348$, $p < 0.05$). It is consistent with the conservation of resources theory and previous studies (e.g. Thomsen et al., 2003; Zhang et al., 2016) which suggest that surface acting induces negative emotions, which in turn lead to sleep deprivation. In this example, employing ESM can help researchers capture the real-time emotions of the participants and decrease the memory bias. Meanwhile, the multilevel analysis allows us to explore both within- and between-person variations.

Table 3 Results of the multilevel mediation model

Parameter	2-1-1 mediation model	
	Estimate	SE
<i>Within</i>		
Tired→SQ	-0.294**	0.112
Residual variance	1.489**	0.237
<i>Between</i>		
SA→Tiredness	0.448**	0.155
Tiredness→SQ	-0.776**	0.159
SA→SQ	0.131	0.299
Intercept-SQ	8.336**	0.595
Intercept-Tiredness	3.036**	0.215
Residual variance-SQ	2.534**	0.828
Residual variance-Tiredness	2.146**	0.428
Indirect effect	-0.348*	0.144

** $p < 0.01$; * $p < 0.05$

5 Conclusions, implications and future research

This paper provides an overview of the development and application of the experience sampling method, with a special focus on hospitality management research. Researchers can benefit from using ESM when their research topics are related to fluctuations in short-term variables. Although one extant paper (Quinlan et al., 2018) introduced ESM to the tourism field, that paper is qualitative in nature and did not explain how to use ESM to examine the relationships among variables. Thus, this paper is the first in the hospitality field to provide a hands-on demonstration of ESM, and it shows in particular how to use a multilevel model to analyze ESM data. We hope that this paper will contribute to a wider use of ESM in the hospitality disciplines. The usage of this method is still in development, and we believe that with increasing understanding and engagement of ESM, researchers in the hospitality field will be able to answer more complex research questions and, in so doing, will enrich the development of ESM in turn.

As the first demonstration of ESM quantitative research, this study provides a comprehensive understanding of the method and how to apply it appropriately in hospitality studies. The hospitality industry includes specialties in many aspects of human resource management, as was discussed critically earlier, and those specialties make the use of an ESM design appropriate. In addition, as a service sector, hospitality companies need to pay special attention to customer satisfaction and service quality – topics that also are appropriate for an ESM approach because the customers' thoughts and evaluations can change over short periods of time, e.g., influential factors on customer satisfaction and revisit intentions. The ESM design can be applied to investigate how participants' emotional status influences their choices and what factors influence customer satisfaction within a certain period of time. By following this study, researchers can apply ESM to their areas of research and can also raise new research ideas.

ESM is also useful for hospitality practitioners in their human resource and operation management. Applying an ESM design to discover employees' thoughts, emotions, and intentions can help supervisors to manage their staff efficiently, and using ESM to investigate how customers feel about the services they receive can help marketers to improve their services.

For example, in the workplace, using ESM to determine how new workers become familiar with hotel management can provide supervisors with guidelines for leading new employees in familiarizing themselves with their working environment. Additionally, using ESM to investigate how frontline employees' emotional labor fluctuates will help human resource departments to improve their training program, and consequently to further improve the service quality. In conclusion, researchers and practitioners alike can benefit from this design in various occasions.

This paper is not free of limitations. It discusses only quantitative research using ESM and does not introduce or demonstrate the application in qualitative analysis. Although qualitative data are important to ESM research, this study chose not to discuss qualitative data because qualitative data analysis differs from quantitative analysis in ESM research. In quantitative analysis, ESM requires a multilevel model for the analysis, which from an analytic perspective is more difficult than a cross-sectional design. In addition, certain challenges remain for researchers in the application of ESM in the hospitality field. The primary challenges include data collection and data analysis. From the data collection perspective, hospitality employees are different from employees of other industries in terms of their working time, working conditions, and the use of temporary workers – differences that require researchers to handle data more carefully than in other industries. Meanwhile, multilevel analysis requires skills in statistics and coding that are not easy to learn. This study aims to give an easy-to-follow demonstration, and hospitality researchers who are interested in using an ESM design will need to learn multilevel data analysis thoroughly.

Through its benefits to future research in hospitality management, we hope this paper can inspire researchers to investigate additional suitable topics and to engage ESM to further explore the hospitality industry's existing relationships and its deeper features. We also hope that researchers can further develop suitable hospitality management topics to which they can apply ESM – topics that are not limited to the traditional ESM research areas (such as human resource management or organizational behavior) – but also, those that extend its use to other investigative areas, such as consumer behavior. Research topics related to people's emotions, thoughts, and intentions are recommended for consideration in applying ESM. Finally, we hope that researchers can further elucidate the special issues in hospitality research that are suggested to use the design of ESM.

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Appendix 1: Mplus Syntax

The command (TITLE) provides the title for the analysis and the command (DATA) identifies the input dataset. The dataset for Mplus analysis includes the variable names, which are labelled by the command (NAMES) in syntax. The command (DEFINE: CENTER) offers the centering option. The command (MODEL) is to explain the estimated model. The commands %WITHIN% and %BETWEEN% distinguish different effects. The indirect effect is computed (MODEL CONSTRAINT) and the output command (OUTPUT) is to request parameter specifications, starting values, optimization history, and confidence intervals for all effects.

TITLE: 2-1-1 mediation

DATA: FILE = esmlong-50.csv;

VARIABLE:

NAMES = number day sq sa tiredness;
USEVARIABLES = number sq sa tiredness;
CLUSTER = number;
BETWEEN = sa;
DEFINE: CENTER sa (GRANDMEAN);
ANALYSIS: TYPE IS TWOLEVEL RANDOM;

MODEL:

%WITHIN%
tiredness sq;
sq ON tiredness;

%BETWEEN%
sa tiredness sq;
tiredness ON sa(a);
sq ON tiredness (b);
sq ON sa;

MODEL CONSTRAINT:

NEW(indb);
indb=a*b;

OUTPUT: TECH1 TECH8 CINTERVAL;

Note. sa = surface acting; sq = sleep quality