



# Refining an ecological momentary assessment study of binge eating among sexual minority and heterosexual young women: a mixed methods pilot study

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**Background:** Ecological momentary assessment (EMA) is used to capture daily lived experiences, states, and environments. Although EMA is commonly used in behavioral health research, there remains a dearth of literature on how researchers account for design considerations of EMA techniques when designing studies. The goal of this formative mixed methods study was to elicit feedback on EMA study procedures and materials from the target populations for a larger study about binge eating among sexual minority and heterosexual young women, in which data are collected entirely remotely.

**Methods:** Sexual minority (n=12) and heterosexual (n=9) women ages 18–30 who binge ate took part in a pilot EMA study and exit interview and survey. As part of the consent and orientation process, participants reviewed video and written materials describing the study purpose and procedures. Using a smartphone app, for seven consecutive days they completed a survey each morning, 5 random surveys per day, and self-initiated a survey each time they binge ate. Participants then provided feedback on the study via a 1-hour virtual interview and online survey. Interviews were transcribed and reviewed by two coders to identify themes on the acceptability and feasibility of the EMA procedures with a focus on: (I) the training and study description materials; (II) general smartphone app and survey preferences; and (III) specific EMA survey question content and wording.

**Results:** The qualitative and quantitative data converged to suggest participants were able to easily download and use the app to complete surveys and report on binge eating events. Participants provided feedback that was incorporated into revisions on general study procedures, the training video content, and EMA question content for binge eating, identity-related stressors, and appearance-related pressures. No systematic themes in the quantitative or qualitative data emerged to suggest questions were perceived differently by sexual minority and heterosexual young women.

**Conclusions:** These findings provide evidence for the feasibility of conducting a remote EMA study to assess young women's experiences around binge eating. This formative study provides an example of how a mixed methods approach can be used to refine EMA study methods and questions to improve study design.

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## Introduction

Ecological momentary assessment (EMA) methods are often used to assess real-world behavioral and health-related processes in people's natural environments. Very broadly, EMA approaches provide a method for measuring features of people's daily experiences, states, and environments as they are going about their everyday lives. Although EMA can take many forms, collectively these methods share three general characteristics: data are collected in people's natural environments; events and experiences are assessed close to when they happen; and assessments occur intensively, often from one to several times per day over multiple consecutive days (1,2). EMA studies often, but not always, use mobile technology, such as smartphones or wearable sensors, to collect data more easily from people as they go about their daily lives. As described elsewhere (1), EMA approaches also can include both self-report surveys, which require active participation from people in the study, as well as passive

sensing approaches (e.g., wearable accelerometer, heart rate monitor, etc.), which can passively collect data with more minimal participation from study participants.

There are a wide range of design decisions that researchers must make when conducting an EMA study, including selecting a sampling schedule, designing self-report surveys, selecting hardware and software, and developing study-specific materials (e.g., training materials, compensation thresholds and schedules) (2). However, there is often limited prior research identifying optimal study design features, particularly when assessing novel constructs, or when conducting research among new populations (3). For example, for self-report EMA surveys, the ideal survey length, and type and/or number of surveys per day is not always clearly prescribed and depends on a combination of the research questions, constructs being assessed, and sample characteristics. For self-report surveys, the wording of questions and number of items needed to assess constructs is also highly dependent on the individual study and sample; validated EMA measures are far less common than for more traditional survey research designs. Furthermore, when a study uses mobile technology for data collection, attention to the hardware and software selected, as well as the associated training procedures, is important during the study planning. In order to gather information about optimal study design, formative research with the populations of interest can be useful for informing the design and implementation of the study. In the present study, we gathered preliminary mixed methods data on the acceptability and feasibility of EMA procedures with young women ages 18–30, which we used to inform the design of a larger EMA study assessing binge eating among young adult sexual minority (e.g., lesbian, gay, bisexual) and heterosexual women.

### Highlight box

#### Key findings

- It is feasible to conduct an ecological momentary assessment (EMA) study among sexual minority and heterosexual young women who binge eat.
- Qualitative and quantitative feedback was important for refining the study procedures and materials (e.g., EMA questions).

#### What is known and what is new?

- There is limited empirical evidence available to guide the development of EMA studies more generally.
- Given the dearth in EMA research examining binge eating among sexual minority women, this study was critical for providing insight into the optimal study procedures and materials, in preparation for a larger EMA study.

#### What is the implication, and what should change now?

- This study highlights the importance of soliciting quantitative and qualitative feedback from participants in target samples prior to conducting larger studies and provides evidence confirming the feasibility of an EMA study of binge eating among sexual minority and heterosexual young women.

### EMA design considerations

The timing and frequency of assessments is a critical aspect of EMA study design, and although they should primarily be driven by the research questions being examined, it is

also critical that participant burden be considered. Such consideration has been thoughtfully described in a study by Burke and colleagues (4) where they discuss preliminary work conducted in preparation for a 12-month EMA study. In their 21-day pilot study, adult participants reported that a maximum of five prompted surveys per day would be feasible and acceptable without being burdensome. Following this design recommendation, during a 12-month EMA study examining lapses and relapses after weight loss in adults, compliance rates for randomly prompted surveys were at least 85% (4). This study provided evidence that their sampling frequency (i.e., number of prompts per day) and timing (i.e., when prompting began and ended each day) was acceptable to participants and yielded appropriate compliance with the EMA protocol. This study also highlights the role pilot work can play in designing a study that will yield acceptable compliance with the study's EMA procedures.

In addition to the timing and frequency of assessments, it is also important to consider the content of assessments. Whereas many traditional forms of research rely on existing validated questionnaires to measure various constructs, these are often not feasible for EMA studies due to length and inappropriate time frames for intensive data collection. Thus, researchers must create specific assessment items to use in EMA studies, often adapting items from existing (non-EMA) measures. For example, in recent years researchers have developed and validated EMA measures that can be used to assess suicidal ideation (5), sexual minority stressors (6,7), and social perceptions (8). This work is often conducted in a series of steps or studies, with items first being developed and refined when conducting formative work, prior to being validated. Such work often benefits from piloting newly constructed items with participants to ensure understanding, and several groups have recommended using both qualitative and quantitative methods when designing and refining items (8,9).

Beyond frequency and content of EMA assessments, training is a unique aspect of EMA study design needed to ensure that participants are correctly completing study procedures. Doherty and colleagues (10) highlighted the importance of training participants in EMA studies to encourage study engagement as well as valid data collection. Christensen and colleagues (11) suggested that providing participants with more detail about study questions and opportunities to practice may increase participant compliance. A systematic review of the use of EMA in physical activity and sedentary behavior research noted that

some studies provide training in the form of researcher guided assessments, while others implemented test periods where participants pilot the EMA procedures prior to beginning data collection (12). Training materials can be shared with participants in a variety of formats, including during in-person sessions as well as remote sessions either occurring synchronously using video capabilities or asynchronously using recorded or written materials. The optimal training format and method varies based on the sample and other study design features, but there have been some studies evaluating ideal training methods. For example, in a 14-day daily diary study focusing on alcohol use among same-sex female couples, participants were randomized to either receive video and written introductory materials or written materials only (13). Although there were no differences between groups in terms of consent, dropout, or compliance, those participants who spent more time watching videos also had higher rates of survey completion. This type of information acquired during the training period can be used by researchers to screen out participants who may be non-compliant or to identify participants who may need a higher level of support throughout the study (13). As with assessment items, it is important for pilot training materials to assess participant understanding and make data-informed adjustments to training and other study materials (8).

### *Rationale for the present study*

The goal of the present study was to describe a formative mixed methods study used to elicit feedback on EMA study procedures and materials from the target populations for a larger study. Sexual minority women (e.g., lesbian, bisexual, queer) are at greater risk for obesity and binge eating than their heterosexual peers. Previous studies have consistently found that, in comparison to their heterosexual counterparts, sexual minority women are more likely to be obese (14-16). Although studies of binge eating behaviors among sexual minority women are more limited, the existing literature indicates that sexual minority women engage in binge eating at higher rates than heterosexual women (17,18). It is important to understand binge eating in sexual minority women given disordered or unhelpful eating behaviors contribute to obesity (19).

Despite documented disparities between sexual minority and heterosexual women (e.g., obesity rates, binge eating), relatively little is known about factors contributing to these disparities. In the eating disorder literature more broadly,

over the last several decades there has been increased attention on assessing disordered eating behaviors in daily life using EMA approaches. Previous studies of general samples of young women (where sexual orientation is not known or reported) suggest binge eating is associated with affective states (20,21), social processes (22,23), and health behaviors (e.g., alcohol use, physical activity) (24,25) in daily life. However, it remains unclear whether associations between these factors and binge eating function similarly for sexual minority women and heterosexual women. Thus, one of the aims of the larger study is to examine associations between affect, social processes, and health behaviors and binge eating in daily life among groups of both sexual minority and heterosexual young women (ages 18–30 years) in an effort to identify similar and/or differential patterns of associations between these groups.

In addition to these potential general predictors of binge eating (i.e., affect, social processes, health behaviors), to date there has been relatively limited research exploring unique factors that may contribute to binge eating in sexual minority women specifically, with two recent exceptions. First, Mason and colleagues (26) conducted a daily diary study with 30 young (18–30 years old), lesbian women reporting binge eating within the past week and examined associations among gender- and sexual orientation-based discrimination, negative affect, self-awareness, and binge eating. Results indicated that experiences of gender and sexual orientation discrimination were indirectly associated with binge eating through increased negative affect and reduced self-awareness. In addition, Panza and colleagues (27) conducted a 5-day EMA study with 55 overweight/obese sexual minority women (18–60 years old) to examine associations between sexual orientation- and gender-based minority stress and disordered eating. These authors found that experiences of sexual minority stressors were associated with more over-eating and binge eating episodes. Although these studies provided some initial evidence for potential associations between minority stressors and binge eating, the impact of minority-specific factors in daily life (e.g., minority stress) on binge eating warrants further attention. Specifically, longer EMA studies with larger sample sizes and direct comparisons to heterosexual women are needed to gain a greater understanding of minority stress and additional factors' associations with binge eating in sexual minority women. The longer-term goal of this line of research is to use the information gathered from EMA studies to identify potential intervention targets to reduce binge eating for both heterosexual and sexual minority

women.

To address these research questions regarding real-world predictors of binge eating in daily life, we are conducting a large EMA study with young sexual minority (target  $n=150$ ) and heterosexual (target  $n=150$ ) women ages 18–30 from across the United States. Prior to beginning this work, a pilot study was conducted, which included collecting quantitative data via EMA reflecting the anticipated measures and procedures for the larger study, combined with an end of study survey and qualitative data during an in-depth exit interview to gather opinions on these methods. The aims of this formative pilot study were to gather data on the acceptability and feasibility of the EMA procedures with a specific focus on feedback on: (I) the training and study description materials (e.g., downloading smartphone survey app, instructional videos, etc.); (II) general smartphone app and survey preferences; and (III) EMA survey questions related to binge eating, identity-related stressors, and appearance-related pressures. EMA methods have been used for many years to study binge eating and other related disordered eating behaviors (28). However, it can be challenging for participants to self-identify and record binge episodes in daily life (29,30), and thus, as part of this study we sought feedback on participants' experiences regarding reporting on binge eating via EMA. In this study, we report the steps taken to refine study materials and procedures based on participant feedback to be implemented in a larger trial. This study is presented in accordance with the STROBE reporting checklist (available at <https://mhealth.amegroups.com/article/view/10.21037/mhealth-23-16/rc>).

## Methods

### *Recruitment and participants*

A total of 30 participants consented to participate in this pilot study. The eligibility criteria for all participants were: (I) age 18–30 years; (II) identify as a cisgender woman (i.e., were born female and identify as a woman); (III) report binge eating (“overeating and feeling like you lost control of your eating”) at least two times in the past two weeks; (IV) not currently receiving treatment for an eating disorder; (V) have an Apple or Android smartphone; and (VI) be willing to complete brief smartphone surveys for one week and take part in an exit interview. Given we were interested in enrolling sexual minority and heterosexual women, we used a combination of participants reported sexual attraction and identity to select participants. In addition to the above

criteria, potential participants were required to report either: (VII) being only or mostly attracted to women and identify as lesbian, gay, or queer; or (VIII) being only or mostly attracted to men and identify as heterosexual or straight.

Recruitment was completed in two phases. First, local recruitment in southeastern Virginia took place in February and March 2020 using flyers and online postings at local businesses and colleges, resulting in 42 potential participants completing the screening survey, of whom 12 were eligible to participate in the study. Nine heterosexual women (and no sexual minority women) consented to participate, and all nine went on to complete all phases of the study, including the demographics questionnaire, smartphone EMA surveys, exit interview, and end of study survey.

Given no sexual minority women were recruited locally, as well as the emergence of the coronavirus disease 2019 (COVID-19) pandemic requiring all procedures to be conducted online, in April 2020 we began a second phase of recruitment, which involved recruiting sexual minority women by emailing potentially eligible women from across the U.S. who had participated in previous cross-sectional survey studies conducted by our research group. These online recruitment efforts resulted in 66 potential participants completing the screening survey and of these 26 were eligible to participate. Of the 26 eligible sexual minority women, 21 consented and completed the demographics questionnaire, and 15 began the smartphone surveys. After completing the smartphone surveys, 10 completed both the exit interviews and end of study survey, 2 were unable to participate in the exit interview (due to scheduling) but did complete the end of study survey, and 3 did not complete either the exit interview or survey. Given that the focus of this paper was reporting on data from the exit interviews and end of study survey, in *Table 1* we report demographic information, body mass index (BMI), and number of binge episodes in the past two weeks for the 21 women (9 heterosexual, 12 sexual minority) who completed the exit interview and/or the end of study survey. The sample size was determined when we reached saturation in the interviews.

### **Procedure**

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Institutional Review Board of Old Dominion University (No. 1493285) and informed consent

was obtained from all participants. Prior to providing consent, participants were emailed an introductory video that explained the purpose of the study and smartphone surveys. They also reviewed written materials describing the study and procedures. After providing consent and completing the demographics questionnaire, they were given instructions for downloading the RealLife Exp app from the Apple or Android app store onto their smartphone and for installing the study-specific surveys. Over the following 7 days, participants utilized a smartphone app to complete brief smartphone surveys, which included a user-initiated morning survey to be completed when they woke up and five prompted surveys that occurred at random times throughout the day between 9 am and 9 pm. They were also instructed to complete a user-initiated binge eating survey after experiencing a binge eating episode. Morning surveys assessed sleep quality, alcohol consumption, mood, and upcoming experiences. Prompted surveys included current mood state, body image, stress, eating, health behaviors, and social interactions. Binge surveys assessed reported start and end time of the binge episode and whether participants were with other people during their binge episode. Once participants completed the smartphone surveys for 7 days, they were asked to provide qualitative feedback through a 1-hour interview, followed by an online end of the study survey. We elected to include the end of study survey after the interview as a way for participants to share any additional feedback in a more private, anonymous manner than allowed by a face-to-face interview. Participants earned \$50 for completing the week of EMA surveys, and those with an 85% compliance rate on EMA survey completion were awarded a \$10 bonus. Also, participants earned \$20 for completing the interview and the end of the study survey. Altogether, participants could earn up to \$80 for completing all study activities.

### **Measures**

#### **Demographic questionnaire**

A demographic questionnaire contained questions to assess age, employment status, educational level, income, financial hardship, ethnicity/race, and sexual identity (select all that apply), and attraction. Participants were asked about the gender(s) of their partner(s) within the past year and their lifetime (e.g., “During the past year, with whom have you had sex?” and “With whom have you had sex in your lifetime?”). Participants were asked to describe their current relationship status. Participants also self-reported their



**Table 1** Demographic information

Variables	Sexual minority (n=12)	Heterosexual (n=9)	Total (n=21)
Age (years)	24.33 (3.03)	22 (3.64)	23.33 (3.43)
BMI (kg/m <sup>2</sup> )	29.23 (9.97)	28.08 (4.64)	28.73 (7.98)
Binge episodes in previous 2 weeks	5.42 (3.37)	5.25 (2.25)	5.35 (2.91)
Ethnicity			
Not Hispanic, Latina or Spanish origin	8 (66.7)	8 (88.9)	16 (76.2)
Hispanic, Latina, or Spanish origin	4 (33.3)	1 (11.1)	5 (23.8)
Race			
African American or Black	0	4 (44.4)	4 (19.0)
Asian, Asian American Native, Hawaiian or Pacific Islander	1 (8.3)	1 (11.1)	2 (9.5)
European American, Caucasian, or White	9 (75.0)	4 (44.4)	13 (61.9)
Multiracial	2 (16.7)	0	2 (9.5)
Employment (select all that apply)			
Part time	2 (16.7)	1 (11.1)	3 (14.3)
Full time	4 (33.3)	2 (22.2)	6 (28.6)
Student	5 (41.7)	7 (77.8)	12 (57.1)
Homemaker	1 (8.3)	0	1 (4.8)
Unemployed	2 (16.7)	2 (22.2)	4 (19.0)
Income			
\$0–\$9,999	3 (25.0)	6 (66.7)	9 (42.9)
\$10,000–\$19,999	3 (25.0)	1 (11.1)	4 (19.0)
\$20,000–\$29,999	2 (16.7)	1 (11.1)	3 (14.3)
\$30,000–\$39,999	1 (8.3)	0	1 (4.8)
\$40,000–\$49,999	1 (8.3)	0	1 (4.8)
\$50,000–\$59,999	2 (16.7)	0	2 (9.5)
\$60,000–\$69,999	0	0	0
\$70,000–\$79,999	0	0	0
\$80,000–\$89,999	0	1 (11.1)	1 (4.8)
Education			
Some college	3 (25.0)	5 (55.6)	8 (38.1)
Associate's degree	0	1 (11.1)	1 (4.8)
Bachelor's degree	6 (50.0)	1 (11.1)	7 (33.3)
Master's degree	3 (25.0)	1 (11.1)	4 (19.0)
Doctoral/professional degree	0	1 (11.1)	1 (4.8)

**Table 1** (continued)

Table 1 (continued)

Variables	Sexual minority (n=12)	Heterosexual (n=9)	Total (n=21)
Sexual identity (select all that apply)			
Heterosexual or straight	0	9 (100.0)	9 (42.9)
Lesbian	9 (75.0)	0	9 (42.9)
Bisexual	0	0	0
Queer	5 (41.7)	0	5 (23.8)
Asexual	0	0	0
Pansexual	2 (16.7)	0	2 (9.5)
Questioning	0	0	0
Gay	4 (33.3)	0	4 (19.0)
Attraction			
I am only attracted to women	5 (41.7)	0	5 (23.8)
I am mostly attracted to women	7 (58.3)	0	7 (33.3)
I am mostly attracted to men	0	2 (22.2)	2 (9.5)
I am only attracted to men	0	7 (77.8)	7 (33.3)
Relationship status			
Single (not dating)	2 (16.7)	3 (33.3)	5 (23.8)
Dating one partner	2 (16.7)	4 (44.4)	6 (28.6)
Dating several partners	1 (8.3)	0	1 (4.8)
In a monogamous relationship	6 (50.0)	1 (11.1)	7 (33.3)
Engaged to be married or married	1 (8.3)	1 (11.1)	2 (9.5)
Partner gender (if not single)			
A woman	9 (75.0)	0	9 (42.9)
A man	0	6 (66.7)	6 (28.6)
Both a woman and a man	1 (8.3)	0	1 (4.8)

Data are presented as mean (standard deviation) or n (%). n = sample size. BMI, body mass index.

height and weight. Lastly, to assess community resources available to participants, they were asked to provide their address and the type of city or community in which they lived (e.g., urban, rural).

### EMA surveys

For the purpose of this study the EMA surveys were used to calculate compliance with the EMA protocol. The number of completed morning and prompted surveys were used to calculate compliance. In addition, the number of completed binge surveys both overall and per person was calculated.

### Interview

At the end of the survey, participants provided qualitative feedback through a 1-hour in-depth interview via an online video-conferencing platform. This interview aimed to get feedback from participants on the general study procedures and smartphone questions. Questions regarding the smartphone app examined participants' experiences with downloading the RealLife Exp app and installing the survey (e.g., "Did you have any problems with finding or installing the app?"). Then, questions regarding the instructional videos that described study procedures were referenced (e.g.,

“Are there other materials you think we should provide to help you understand the study procedures and process better?”). In addition, as part of this interview, participants were asked to express their impressions on EMA questions related to identity, appearance-related pressures, and binge eating, and whether the EMA questions captured their overall experiences. Participants were also asked about their experience with completing the binge eating surveys (e.g., “Was it hard to remember to do the binge surveys? Is there anything we could do to help make this easier?”). A copy of the interview guide, including the smartphone questions participants were asked embedded within the guide, can be found in the supplement online (available at <https://cdn.amegroups.cn/static/public/mhealth-23-16-1.pdf>).

### End of study survey

An end of study survey included both quantitative and qualitative questions to gather additional feedback on the study procedures and participant experiences. The following items used a 7-point scale to indicate the feasibility of the binge eating EMA surveys [e.g., “Did you think the length of the morning survey was:” (0= too short to 6= too long)]. Participants also rated their experiences identifying binge eating episodes and completing the binge eating survey after every episode on a 5-point scale (1= disagree to 5= agree). Then, participants reported whether the surveys captured their overall experiences [e.g., “Do you think that there were other identity-related experiences that we did not ask about, that you would have liked us to ask about?” (yes or no)]. In addition, participants reported their physical and mental health state using a 7-point scale [e.g., “I would like to improve my physical health” (1= strongly disagree to 7= strongly agree)]. Lastly, questions asked about participant’s willingness to use mobile technology to track physical and mental health through a 7-point scale [e.g., “I am willing to use mobile technology for tracking my health” (1= strongly disagree to 7= strongly agree)].

### Statistical analysis

All interviews were transcribed, and each was independently reviewed by two coders using NVivo 12 software (<https://qsrinternational.com/nvivo/nvivo-products/>). An initial codebook was developed based on the interview guide (see the supplement online for the interview guide; available at <https://cdn.amegroups.cn/static/public/mhealth-23-16-1.pdf>), with a focus on: (I) feedback on the training videos, smartphone app, and survey length; (II) feedback on survey

content related to binge eating, identity, and appearance-related pressure; (III) suggestions for changes in the general study procedures, training videos, and EMA question wording and meaning. The coders met on a weekly basis to ensure consistency across their analysis of the recorded interviews, and any coding discrepancies were discussed and resolved through consensus. Quantitative data from the demographic questionnaire and end of study survey were analyzed with descriptive statistics calculated in SPSS 26.0 (IBM Corp., Armonk, NY, USA). Compliance rates for the morning and prompted surveys were calculated and descriptive statistics for the number of EMA binge eating surveys completed were calculated. Qualitative and quantitative feedback and suggestions were reviewed together by the team to identify revisions to the study process and survey content, including identifying any unique suggestions that differed between the sexual minority and heterosexual participants.

## Results

### *EMA compliance rates and binge survey frequency*

Participants completed an average of 83.7% of the morning surveys and 80.0% of the prompted surveys. The mean number of binge surveys completed was 1.81 (median =2, range =0 to 7), with 17 (81.0%) participants reporting at least one binge episode during the 1-week EMA period.

### *Study feedback results*

Feedback on the training videos, smartphone app, and survey length was compiled from the in-depth interviews and end of study survey and is presented in *Table 2*. Participants generally found the instructional videos describing the study to be clear and helpful and they similarly thought that downloading the smartphone app from an app store was easy to do. Regarding the survey length, participants on average indicated the morning survey was an appropriate length. Participants that commented on the end of study survey and interview stated that the prompted survey was a bit too long and described the binge survey as being too short (i.e., there was room to accommodate more questions). There were no notable differences in patterns of responding between the heterosexual and sexual minority participants.

Participant feedback on the survey content related to binge eating, identity, and appearance-related pressure



**Table 2** Interview and survey data describing instructional materials and survey app use

Topic	In-depth interviews—illustrative quotes	End of study survey		
		Sexual minority, M (SD)	Heterosexual, M (SD)	Scale range
<b>Training videos</b>				
Clarity and helpfulness of instructional videos	<i>“I think I like the video a lot because it had graphics, and it had pictures and it wasn’t just like someone standing there and just talking to me a lot because I feel like I would have zoned out.”</i> —Participant 5, heterosexual	–	–	–
	<i>“It was really great, especially kind of outlining what the different steps are going to be and what the time frames are.”</i> —Participant 14, sexual minority			
	<i>“I thought the video was informative...Really helped to fully understand like what all my responsibilities would be. I thought it was helpful and I think probably even more helpful than just reading instructions.”</i> —Participant 22, sexual minority			
<b>Smartphone app and surveys</b>				
Ease of app use	<i>“It was easy to download and it was started with the instructions of a step by step so I could figure it out.”</i> —Participant 1, heterosexual	5.75 (0.45)	5.78 (0.44)	0= not at all easy; 6= very easy
	<i>“I think the videos and the instructions made downloading the app easy.”</i> —Participant 20, sexual minority			
Morning survey length, timing, and appropriateness	<i>“The thing that I did like about the morning survey was that you could complete it at any time.”</i> —Participant 6, heterosexual woman	3.27 (0.79)	3.38 (1.06)	0= too short; 3= the right length; 6= too long
	<i>“No, I think in the mornings it was pretty easy to do, especially once you were kind of aware that you had to do it.”</i> —Participant 7, heterosexual woman			
Prompted survey length, timing, and appropriateness	<i>“I definitely think the surveys are a little bit long to be doing them five times a day.”</i> —Participant 24, sexual minority woman	4.36 (0.81)	4.44 (0.53)	0= too short; 3= the right length; 6= too long
Binge survey length, timing, and appropriateness	<i>“I think you guys had it pretty short, which was good. I think if you add, like maybe one or two questions, it wouldn’t be too long.”</i> —Participant 8, heterosexual woman	2.58 (0.51)	3.38 (0.52)	0= too short; 3= the right length; 6= too long
	<i>“I did notice it was short and I definitely felt like it could have been a few questions longer if needed.”</i> —Participant 33, sexual minority woman			

M, mean; SD, standard deviation.

from both the interview and survey are presented in *Table 3*. Regarding the binge eating survey and content, participants expressed an understanding of the definition of binge eating that was provided in the survey. Mean ratings of their ability to identify when binge eating were between 3.86 (heterosexual) and 4.00 (sexual minority) and completion of the binge survey after binge eating agreement was rated between 3.29 (heterosexual) and 4.00 (sexual minority)

indicating that they generally agreed they were able to both identify binge episodes and remember to complete the binge eating survey (where 4 is agree; 1= strongly disagree, 5= strongly agree; see *Table 3*). However, as is illustrated in both the illustrative quotes and the mean ratings not endorsing strong agreement (anchor rating of 5), participants indicated some trouble either identifying that they were binge eating or remembering to complete the survey, an issue we return

**Table 3** Interview and survey data describing survey content

Topic	In-depth interviews—illustrative quotes	End of study survey		
		Sexual minority, M (SD)	Heterosexual, M (SD)	Scale range
<b>Binge eating survey and content</b>				
Clarity of binge definition	<p><i>“The description of it was really good and really helpful, especially differentiating between eating large quantities of one food or eating a lot like a lot of small amounts of different food. I feel like I don’t always think of that as binge eating, but I like seeing it written like that. It makes me think a lot more.”</i>—Participant 21, sexual minority</p> <p><i>“[It would help to give] an actual example. Say for instance you take a certain food item saying that Sarah ate such and such amount of this and Sarah ate such and such amount of this- this would be binge eating and this would not.”</i>—Participant 6, heterosexual</p>	–	–	–
Ability to identify when binge eating	<p>[Interviewer: “Were you able to identify when you were engaging in a binge eating episode?”] <i>“Absolutely.”</i>—Participant 13, sexual minority</p> <p>[Interviewer: “So, were you able to identify when you were engaging in a binge episode?”] <i>“Yeah, I think I was mostly able to.”</i>—Participant 20, sexual minority</p> <p><i>“I’d never really realized that I was binge eating until that I would do the regular scheduled surveys and would get to the eating part.”</i>—Participant 5, heterosexual</p>	4.00 (1.35)	3.86 (1.68)	1= strongly disagree; 5= strongly agree
Completion of binge survey every time binge ate	<p><i>“[The most difficult part of completing the study was] remembering to complete the binge eating part of it. For me, it was a bit hard for me; I’d forget to do it if I wasn’t reminded, too, or it just like randomly popped into my head.”</i>—Participant 7, heterosexual</p> <p><i>“I feel like [it was easy to remember] because of the constant nature of the surveys, it was it was very often on my mind, you know?”</i>—Participant 13, sexual minority</p> <p><i>“Yeah, most of the times I remembered whenever I was doing the prompted survey and then I was like, oh yeah, I need to go back and do the other one.”</i>—Participant 21, sexual minority</p>	4.00 (1.33)	3.29 (1.89)	1= strongly disagree; 5= strongly agree
Binge eating questions captured daily experiences	<p><i>“I feel like it’s a really good set. Yeah. I can’t think of any [changes]... I think it’s really good to keep it short because I feel like when you keep a very short and factual. It avoids like this really intense shame reaction.”</i>—Participant 13, sexual minority</p> <p><i>“I think overall they were pretty good. Like I remember, like they were, I guess, like easy to think about.”</i>—Participant 8, heterosexual</p> <p><i>“I feel like it [the binge eating survey] was mainly just asking about specifically the binge eating like what happened. It wasn’t more like “okay was this caused by such and such? Or how does this affect you?”</i>—Participant 6, heterosexual</p>	–	–	–
<b>Identity-related question content</b>				
Clarity of identity definition	<p><i>“It was pretty clear- most of the questions were straightforward and direct which I do appreciate. I think that it is pretty self-explanatory. Like for me in my case I read the questions and I was like “Okay does this apply to me? No. No. No...”</i>—Participant 6, heterosexual</p> <p><i>“Yeah, I think it’s clear pretty much whatever you think the reason is that someone might have been exclusionary, like which part of your identity that was clear.”</i>—Participant 25, sexual minority</p>	–	–	–

**Table 3** (continued)

Table 3 (continued)

Topic	In-depth interviews—illustrative quotes	End of study survey		
		Sexual minority, M (SD)	Heterosexual, M (SD)	Scale range
Questions were inclusive/identities captured with the list	<p>“Um, let me see (reads list) ... gender, sexual orientation, appearance, religion... I think that’s a good representation of different parts of identities.”—Participant 26, sexual minority</p>	100%, Yes	100%, Yes	Yes/no
Identity-related questions captured daily experiences	<p>“The options you have here are very thorough in illustrating, I think basically any kind of like feeling of being teased or insecure about one’s weight or appearance, identity, etc., like these were like really there.”—Participant 2, heterosexual</p> <p>“Maybe I would [say] disability status [is missing].”—Participant 22, sexual minority</p> <p>“I think the question is kind of cover everything that I think would fall under that umbrella of discrimination or exclusion or whatever you want to call it. Yeah, I think the list does cover any of those experiences.”—Participant 25, sexual minority</p> <p>“Although there was like one or two that I related to at times, I didn’t, I don’t think I really hit any of those during my week, honestly.”—Participant 8, heterosexual</p> <p>“See, I’ll be honest, I didn’t experience anything at any point. So, a lot of like that question for me was, but I’m also stuck in my house by myself. So, I really don’t have anyone to make me feel crappy. So, yeah, I guess for me, this wasn’t a very relatable question.”—Participant 14, sexual minority</p>	4.50 (0.91)	4.00 (1.32)	1= not at all; 2= a little; 3= somewhat; 4= mostly; 5= a great deal
Appearance-related pressure question content				
Clarity of appearance-related pressure definition and questions	<p>“Yes. Yes. Yeah, I feel like I thought it was pretty clear language.”—Participant 13, sexual minority</p> <p>“I felt like these [questions] were good.”—Participant 10, heterosexual</p> <p>“I would say the one thing that caught me off guard was the significant other, because there wasn’t really an option for I don’t have one.”—Participant 14, sexual minority</p>	–	–	–
Other or additional sources of appearance-related pressures	<p>“I think now with like Instagram and things like that. It’s hard when you’re scrolling and you see people just kind of prevent or presenting themselves and you’re like, oh, why don’t I look like that or something like that? I think that was definitely where I get caught up sometimes with social media.”—Participant 1, heterosexual</p> <p>“So, there’s a lot of people posting [on social media] about, you know, really intensive, restrictive dieting and like hating their bodies. And you know just there’s all kinds of like really self-monitoring, self-hating stuff that applies when you apply it to yourself, it applies to everyone around you.”—Participant 13, sexual minority</p> <p>“I guess like strangers maybe? ... I know when I went to a bigger gym, like I’d be comparing myself to, like, random people who they pass me or something like that.”—Participant 8, heterosexual</p>	–	–	–

M, mean; SD, standard deviation.

to when considering recommendations for changes. In collecting feedback on the specific questions included in the binge eating survey, participants reported the questions captured their experiences, but many also noted that this

survey was short and identified other questions that could be asked in these surveys (specific suggestions for changes are described below). For the identity-related questions, participants reported they were able to understand the

definition described and how to apply it to answer the survey questions, that the identities included in the list were inclusive, and that the questions captured their daily experiences (see *Table 3*). For the appearance-related pressure content, participants understood the definition and questions, but did note some questions that were confusing and highlighted additional sources of appearance-related pressures that were not fully captured in the survey, as illustrated in the interview quotes. Across all the feedback on survey questions, there were no clear patterns of responding that differed between the sexual minority and heterosexual participants.

### ***Recommendations for changes***

Suggestions for changes to the study procedures, training materials, and EMA survey questions were compiled from the interviews and end of study survey responses. These were all reviewed by the research team to make decisions about changes to study procedures or materials. *Table 4* provides a summary of the key recommendations made by participants, the source of those recommendations (interview, end of study survey), and a description of the changes that were made for the full study in response to the participant feedback. As with feedback described above, there were no clear patterns of recommended changes based on sexual identity.

Participants' suggestions for changes that were incorporated into the revised study generally fell into five categories, represented in *Table 4*, including recommendations for: general study procedure, training videos, binge eating question, identity-related stressor questions, and appearance-related pressure questions. For the general study procedures, we created a frequently asked questions page in the app, extended time participants had to respond to prompts from 30 to 60 minutes, added additional email check-ins from our team, added an end of day survey, and reduced the length of the prompted survey. For the training videos we added a transcript for the videos, added more specific study information, and created a separate informational video about the binge eating survey. This latter addition was made based on quantitative and qualitative feedback and speaks to the difficulty in defining and clearly communicating with participants about what qualifies as a binge eating episode. Within the binge eating survey, participants expressed interest in providing us with more information about the context for, and reactions to, their binge eating; thus, we added 11 additional questions

to the binge eating survey (see the supplement for questions added; available at <https://cdn.amegroups.com/static/public/mhealth-23-16-1.pdf>). We also made some minor revisions to the identity-related stressor questions, including adding one additional experience and identity (disability) to the list of questions (see supplement; available at <https://cdn.amegroups.com/static/public/mhealth-23-16-1.pdf>). Finally, we made substantial revisions to the appearance related pressure questions based on participant feedback. Although these EMA items were based on the trait measure of the Sociocultural Attitudes Towards Appearance Questionnaire-4 Revised (SATA-Q4R), during this study we realized that our adaptation was inadequate for EMA administration. The revised questions are provided in the supplement (available at <https://cdn.amegroups.com/static/public/mhealth-23-16-1.pdf>), and include first asking about perceived pressure from four types of people (family members, peers, people of authority, strangers), and then asks about the mode of pressure (in person, or media/social media). Details regarding the revisions made to the study procedures and questions are in *Table 4* and in the supplement (available at <https://cdn.amegroups.com/static/public/mhealth-23-16-1.pdf>).

### **Discussion**

The present study was a formative, mixed methods pilot study that was conducted to elicit feedback on proposed methods to be used in a large EMA study of binge eating among sexual minority and heterosexual young women. The goal of the larger study is to examine the real-world affective (e.g., negative mood, stress), social (e.g., social interactions, comparisons), health behavior (e.g., alcohol, physical activity), and minority-specific (e.g., sexual minority stressors) factors that may contribute to binge eating among young adult young women who identify as either heterosexual or sexual minority (i.e., cisgender women attracted to women). Given the dearth in EMA research examining binge eating in real time, especially among sexual minority women, this study was critical for providing insight into the optimal training materials, informing general study procedures, and refining EMA question wording. The quantitative and qualitative feedback supported the general feasibility of this EMA protocol; participants were also instrumental in identifying key areas in our study protocols and materials warranting revisions.

One area where we particularly sought feedback was on the EMA surveys that inquired about binge eating,

**Table 4** Study changes based on participant recommendations in the interview and end of study survey

Recommendation	Feedback format		Description of changes made
	Interview	Survey	
General study procedure recommendations			
Add more details about study specifics regarding procedures	x		Created a Frequently Asked Questions (FAQ) page answering questions identified by participants, distributed at start of the study and available in the app
Make window for completing prompted survey longer	x		Increased the time participants have to complete survey after prompt from 30 to 60 minutes
Add a survey at the end of day or have prompted surveys later than 9 pm	x		Added a survey to be completed before participants go to bed to capture later experiences and include reminders about completing binge survey
Reduce length of prompted survey	x	x	Removed some questions and moved others to the (newly added) end of day survey to reduce length
Add reminders/encouragement from research staff during the study	x		Added email check-ins within first few days of study, at mid-way point, and at the end of assessment period
Training video recommendations			
Include written version of instructions with the videos	x		Created written copy of video text to accompany the videos sent to participants
Add information about study purpose, types of questions, survey length, and reason for random prompts	x		Edited videos to include more details about the study purpose and how the information provided will be used, the types of question formats and content, survey length, and why randomly promoting people to complete surveys is important for answering the research questions
Add more details about binge eating definition and examples within the videos	x	x	Created a separate video describing binge eating for participants to watch at the start of study, and available in the app throughout the study
Binge eating question recommendations			
Clarify binge definition within the EMA survey, particularly who is a “peer”, the timeframe for binge eating, and provide examples	x	x	Revised written instructions for binge eating for the video and at the start of the binge eating survey
Add reminder for completing binge survey	x		Included question about binge eating and reminder about the survey within each prompted survey and in the (newly added) end of day survey
Add more questions to the binge survey—about reason for binge eating, what doing before/ during/after binge eating, feelings about binge eating	x	x	Added questions to the binge eating survey regarding perceived trigger, aspects of eating (speed, fullness, with others, emotions after eating), purging/intended purging, perceived mood before, during, and after binge eating. See supplement for specific question revisions
Identity-related stressor question recommendations			
Add additional negative experiences	x	x	Added additional options for possible negative experiences, including experiencing family/friend disapproval and feeling misunderstood, ashamed, or silenced. See supplement for specific question revisions
Add disability and spirituality as identity options	x		Added disability and revised religion to include both religion/spirituality as an aspect of identity. See supplement for specific question revisions

**Table 4** (continued)



Table 4 (continued)

Recommendation	Feedback format		Description of changes made
	Interview	Survey	
Appearance-related pressure question recommendations			
Clarify in definition that pressures may not be overt	x		Revised definition in question instructions to include both overt pressure and perceived appearance-related pressures. See supplement for specific question revisions
Add some missing sources of pressure, including strangers in public places, peers at school, and co-workers/authorities at work	x		Originally included 4 questions about pressure from family, peers, significant other, and the media. Revised question structure to first ask about types of people from whom pressure was felt (family members, peers, people of authority, strangers), followed by the format of communication (in person vs. media/social media). See supplement for specific question revisions
Clarify difference between media and social media	x		Used revised question structure and grouped media and social media together based on participant feedback. See supplement for specific question revisions
Add option for skipping not applicable questions (regarding pressure from significant others)	x		Removed question explicitly asking about pressure from significant other (with this information captured in family member or peers/friend category for those with a significant other). See supplement for specific question revisions

The supplement is available at <https://cdn.amegroups.cn/static/public/mhealth-23-16-1.pdf>. “x” indicates the source of information that was used to inform the change described. FAQ, Frequently Asked Questions; EMA, ecological momentary assessment.

specifically when participants were asked to complete a self-initiated survey each time they binge ate. As expected, some participants reported having difficulty identifying binge episodes for themselves and remembering to complete the survey, which emerged both in quantitative ratings at the end of the study and in the in-depth interviews. This finding that binge episodes can be challenging to identify and record in the moment is consistent with previous studies (29,30). Based on this feedback, for the larger EMA study we adjusted the language describing and defining binge eating that was embedded within the survey and created a separate training video about binge eating for participants to view during the consent process, and it is also available within the EMA survey app during the study. To assist with remembering to self-initiate the binge eating survey, we also include reminders about it in each of the five daily prompted surveys, and in the end of day survey. One unexpected finding was that participants thought that the binge eating survey was too short, and they identified a wide range of topics related to their binge eating that they wanted to share with us in that survey. Based on this feedback, we expanded the binge survey from a set of three questions (time of episode, location, whether with others) to include questions about their perceived trigger(s) and

features of the episode (speed, fullness, emotions after, purging/intended purging, mood before, during, and after episode). Although we were trying to limit the questions to reduce burden and improve compliance, participants overwhelmingly reported they were interested in reporting these details as part of the study, as they saw it as potentially helpful for improving our understanding of the factors that may contribute to binge eating.

One other survey content area where we sought feedback during the in-depth interviews was regarding our assessment of sociocultural appearance pressures. When initially designing this set of EMA questions, we modeled the questions after the pressure subscales on the Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ-4R) (31), which assesses pressures from family, peers, significant others, and the media. We adapted questions to be brief and appropriate for administration multiple times per day. Based on the interview feedback, we came to realize that this adaptation for EMA was insufficient. In particular, participants who did not currently have a significant other could not answer that question and noted other people from whom they experienced pressure in their daily lives (e.g., authority figures, strangers, co-workers), which were not captured with our original options. They also questioned

whether media was inclusive of social media and identified complex situations that were hard to capture appropriate with our initial question set (e.g., if perceived pressure from a family member on social media, should this be family or media?). Based on this feedback, we reconceptualized our EMA measure of sociocultural pressures to first assess types of people from whom pressure was felt (family members, peers, people of authority, strangers), followed by the format of communication (in person *vs.* media/social media). This example highlights the importance of pilot testing novel EMA items, consistent with previous calls for quantitative and qualitative testing on EMA item content (8,9). In particular, as shown in *Table 4*, many of the changes we chose to make for the larger study came from qualitative feedback, underscoring the importance and utility of this mixed methods approach, as suggested by Arigo and colleagues (8). Although the quantitative feedback was helpful for providing ratings of acceptability and feasibility, the qualitative feedback in particular was helpful for identifying whether something was viewed as not ideal, or identifying how to make it better.

The quantitative and qualitative findings from this study both suggested that the prompted survey was too long. In the early interviews, participants also noted that they would often binge eat later in the evening, which is common with binge eating (32), and they would then forget to complete a binge eating survey because the prompted surveys were done for the day. Based on this feedback early in the interviews, in later interviews we probed whether adding a brief survey before participants went to bed would be useful for reminding them about the binge eating survey; this suggestion was largely supported by participants. In the revised protocol for the larger study, we include a before bed EMA survey, where we were able to move some questions that were previously included in the prompted survey and include a reminder about the binge eating survey. Thus, this additional daily questionnaire served several purposes and allowed use to address multiple concerns raised by participants at once.

Sexual minority and heterosexual young women participated in both this formative work and are participating in the larger study. Thus, we were considering any differential patterns in responding based on women's sexual identity. We did not see any clear evidence that particular materials, procedures, or questions were more or less acceptable to either group. One reason this may be the case is that when designing the EMA questions, we did so in such a way that all the questions were applicable

to all participants. For example, when initially selecting measures to assess minority-related stressors via EMA, we considered using measures specifically developed for sexual minority individuals (33-35) for the sexual minority women in our study, but then would also need to identify suitable alternative items for the heterosexual women. Therefore, we instead opted to craft questions based on a study by Panza and colleagues (27) and similar to the Everyday Discrimination Scale (36) format, where we first inquired about a range of experiences, and then asked about aspects of one's identity that contributed to these experiences. Based on this preliminary work, although participants had some minor suggestions for revisions that we incorporated (see *Table 4*), it appeared that these questions were generally well received by participants based both on the quantitative and interview feedback (see *Table 3*).

In *Table 4*, we present the key changes that we made to the study moving forward, based on the present study. However, it should also be noted that there were recommendations for changes that participants made that we did not use in the revision process. The reasons for not making these changes generally fell into three categories. First, some suggestions, although potentially interesting components for future EMA work, were outside the scope of the scientific questions we aimed to answer in the study. For example, during the interviews some participants suggested adding food and exercise logs throughout the day or adding a survey for people to complete every time they had an urge to binge eat. Second, because we were using an "off the shelf" EMA program, we were technologically limited to the software we selected and unable to accomplish some suggested revisions. For example, several participants suggested having customizable schedules for participants (instead of the 9 am to 9 pm schedule) and adding a progress bar on the surveys. Although these would both have been nice features to add, these were not feasible with the app software at the time. Third, some of the suggestions for revisions appeared ideographic and it seemed unlikely they would have widespread appeal. For example, one participant suggested we create a video of how to download an app from the app store and use the app; based on quantitative ratings of the ease of app use, and the vast majority of participant interview feedback, we did not opt to make this addition. There were also instances where we received conflicting feedback (e.g., some participants wanted the morning survey reminder earlier than 10 am, others wanted it much later), and in such cases we tried to make the decision that would be best suited for most people.

### Strengths and limitations

Although this study had many strengths, including its use of a mixed methods approach to evaluate feasibility and acceptability of using EMA methods for understanding binge eating among an at-risk group of young women, there are also limitations that need to be acknowledged. First, this was a small pilot feasibility study and thus we recruited small samples of sexual minority and heterosexual young women. It was important to have individuals with diverse sexual identities to gain varying perspectives, but this study was not powered to quantitatively test for differences in feasibility or acceptability between these two groups (because this was not the primary study aim). Second, most participants in our sample were White and non-Latina, which made it difficult to ensure that the feedback received was from sufficiently diverse racial/ethnic voices. In the larger study, our goal is to more heavily over-recruit racial minority participants, particularly Black women, which will be an important contribution to the disordered eating literature. Third, because of the nature of the data collection process (i.e., initially not having any eligible sexual minority women sign up through local recruitment, then needing to pivot to fully virtual national data collection due to the COVID-19 pandemic), the recruitment sources varied across sexual minority versus heterosexual women. However, because there were no observed differences across these groups, attribution of differences was not an issue. Moreover, the larger study currently underway is using virtual recruitment for all participants. Finally, participants had to be willing to use a smartphone to complete an EMA protocol, which can be intensive, and some people may not be willing to do.

### Conclusions

This mixed methods study was designed to collect formative data regarding the practicality and acceptability of a larger EMA study focused on the binge eating behaviors of young sexual minority and heterosexual women. Although many aspects of the design were rated as acceptable and appropriate, based on participant recommendations, changes were made to the procedures and training materials to increase compliance (e.g., email encouragement) and understanding of participant tasks (e.g., reasoning behind random prompts). As binge eating is the central focus of the larger study, revisions were also made to provide clarity on the definition of binge eating, increase completion of the

self-initiated survey following binge episodes, and provide more context around binge eating episodes. Overall, this study emphasizes the importance of soliciting both quantitative and qualitative feedback from participants in the target sample prior to the larger study and provides evidence confirming the feasibility of a larger EMA study.

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### Footnote

*Reporting Checklist:* The authors have completed the STROBE reporting checklist. Available at <https://mhealth.amegroups.com/article/view/10.21037/mhealth-23-16/rc>

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*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Intuitional Review Board of Old Dominion University (No. 1493285) and informed consent was obtained from all participants.

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