# The Effects of Family Support and Smartphone-Derived Homestay on Daily Mood and Depression Among Sexual and Gender Minority Adolescents

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Sexual and gender minority (SGM) adolescents are at elevated risk for depression. This risk is especially pronounced among adolescents whose home environment is unsupportive or nonaffirming, as these adolescents may face familial rejection due to their identity. Therefore, it is critical to better understand the mechanisms underlying this risk by probing temporally sensitive associations between negative mood and time spent in potentially hostile home environments. The current study included adolescents ($N = 141$; 43% SGM; 13–18 years old), oversampled for depression history, who completed clinical interviews assessing lifetime psychiatric history and depression severity as well as self-report measures of social support. Participants also installed an app on their personal smartphones, which assessed their daily mood and geolocation-determined mobility patterns over a 6-month follow-up period. Over the 6-month follow-up period, SGM adolescents reported elevated depression severity and lower daily mood relative to non-SGM youth. Interestingly, SGM adolescents who reported low family support experienced lower daily mood than non-SGM adolescents, particularly on days when they spent more time at home. Current findings reinforce evidence for disparities in depression severity among SGM adolescents and highlight family support as a key factor. Specifically, more time spent in home environments with low family support was associated with worse mood among SGM adolescents. These results underscore the need for clinical interventions to support SGM youth, particularly interventions that focus on familial relationships and social support within the home environment.

*General Scientific Summary*

Depression risk is elevated among sexual and gender minority (SGM) adolescents, particularly those who live in unsupportive home environments. It is therefore critical to examine how time spent in a non-identity-affirming home might be associated with worse clinical outcomes in SGM youth. Adolescents provided smartphone-derived geolocation and daily mood surveys for 6 months, providing an opportunity to explore associations between time spent in unsupportive homes and same-day mood. Results show that relative to their heterosexual peers, SGM adolescents with low family support reported lower mood on days when they spent more time at home, underscoring the need for digital interventions that may be accessible from within nonaffirming home environments.

Extensive research has established that adolescents identifying as sexual and gender minorities (SGMs), which include identities such as lesbian, gay, bisexual, transgender, queer, questioning, intersex, asexual, nonbinary, or gender-nonconforming (LGBTQIA+), are at increased risk for depression (Marshal et al., 2011). Rates of depression are estimated to be ~2–4 times higher among SGM youth compared to their cisgender, heterosexual peers, a trend observed in both community (di Giacomo et al., 2018; Kimball et al., 2022) and clinical samples (Bettis et al., 2020; Peters et al., 2020). Leading theories have proposed that these heightened rates of depression may be attributable to disproportionate experiences of rejection, discrimination, and stress that are unfortunately common among SGM populations. In particular, the minority stress model (Brooks, 1981; Meyer, 2003) posits that SGM mental health disparities are driven by stigma, negative social evaluation, and/or discrimination relating to one's sexual or gender identity. Similarly, the rejection sensitivity model for understanding minority mental health suggests that past experiences of rejection increase future rejection sensitivity (Feinstein, 2020), a known risk factor for depression. Indeed, SGM adolescents disproportionately face rejection from family and peers due to their identity (Salerno et al., 2023; Scheer et al., 2021), which may contribute to increased depression severity.

Identity-related challenges can be particularly salient during adolescence, which is a critical developmental period when many youth first begin to understand their gender, sexual identity, and attractions (Hall et al., 2021). For gender minority adolescents, adolescence may be associated with an increase in gender dysphoria as puberty onsets (Bonifacio et al., 2019). Furthermore, many SGM youth must undergo this transitional period while living in home environments that are nonaffirming—namely, environments in which SGM individuals may need to conceal their identity to avoid negative social consequences such as discrimination or rejection (Baams et al., 2015; McDonald, 2018). A nonaffirming home environment can also be conceptualized as a lack of family support for SGM youth who are open about their identity (Fish et al., 2020), a key factor that shapes their mental health outcomes (Clark et al., 2022; Kiekens & Mereish, 2022). Indeed, SGM youth often report low levels of perceived family support (McCurdy & Russell, 2023; Scheer et al., 2021) with only 38% of SGM adolescents nationally describing their home as lesbian, gay, bisexual, transgender, queer/questioning -affirming (Trevor Project, 2023). The adverse consequences of living in nonaffirming homes were especially salient during the COVID-19 pandemic, as many SGM adolescents were unable to access identity-affirming spaces that previously served as protective factors, such as LGBTQIA+ school affinity groups and identity-aligned peer groups.

Given the importance of family support (or lack thereof) on SGM youth mental health outcomes, it is critical to understand how time spent in the home may affect SGM adolescents' well-being. Past work examining associations between home environment and mood has primarily relied on cross-sectional, self-report assessments. However, advancements in smartphone technology provide a unique opportunity to objectively monitor geographic mobility patterns, particularly time spent at home. Furthermore, smartphone-based experience sampling methods (ESMs) allow researchers to assess participants' mood outside of the lab and over time with greater temporal specificity. Accordingly, researchers can now examine fine-grained associations between participants' daily mood and time spent at home (referred to here as homestay).

Prior work has shown associations between smartphone sensor-derived mobility patterns and clinical outcomes in adults (for a review, see Rohani et al., 2018). Among adults with depression history, depressive symptoms have been linked to greater homestay behavior (Laiou et al., 2022; Stamatis et al., 2024), reduced regularity of daily routine, and less daily distance traveled (Auerbach et al., 2022). Similarly, in nonclinical samples, research has shown that depressive symptom severity is related to greater homestay behavior and more irregular daily routine (Saeb et al., 2015). These findings have largely been attributed to links between depression and alterations in sleep and sedentary behavior, resulting in increased homestay. Yet, this research has primarily been conducted in adults; accordingly, whether these findings generalize to adolescents remains unclear. Furthermore, for SGM youth, homestay may play a uniquely complex role in depression severity that is yet unstudied. Specifically, among SGM adolescents, the home may function as the primary locus for nonaffirming familial interactions. Thus, it may be that increased time spent in a nonaffirming home is associated with worse mood among SGM youth. Yet, to the best of our knowledge, no research has leveraged geolocation features to understand the associations between mobility patterns and daily mood among SGM youth, work which may help guide targeted clinical interventions.

The current study included adolescents oversampled for depression. Participants installed an app on their personal smartphone to facilitate self-report of daily mood and objective assessment of

homestay patterns over a 6-month period. In line with prior work in adolescents, we hypothesized that SGM adolescents would report lower family support as well as worse depression severity than non-SGM adolescents. Accordingly, we examined whether SGM identity and baseline family support predicted worsening of depression from baseline to 6-month follow-up. We also hypothesized that during the 6-month follow-up period, SGM adolescents would report lower daily mood compared to non-SGM adolescents. Finally, given prior research on the impact of nonaffirming home environment (Clark et al., 2022), we hypothesized that, relative to non-SGM adolescents, SGM adolescents would report lower mood on days with more homestay. Furthermore, we hypothesized that this association would be strongest among SGM adolescents reporting low family support, compared to non-SGM youth.

## Method

Adolescents (ages 13–18 years old; $N = 148$) were recruited from the greater New York City and Chicago communities through social media advertisements, as part of a multisite longitudinal study of social processes in adolescent depression (Li et al., 2023). No SGM-targeted recruitment strategies were employed. All participants owned a personal smartphone (Android, or iPhone 7 or newer). Participants were excluded if they met criteria for an active substance use disorder, lifetime bipolar disorder, psychosis, or reported psychotropic medication use (other than antidepressants or stimulants). Additionally, given the broader study goals, participants were excluded for a range of electroencephalography-related criteria (e.g., left-handedness, neurological disorder, or incompatible hairstyles). Participants with a history of depression were recruited to compare those with current depression (past 2 weeks) or remitted depression (lifetime but not past 2 months). Potential participants with depression evident in the past 2 months but not past 2 weeks (i.e., neither current nor remitted) were not eligible. Data collection remains ongoing, and only participants who have completed baseline and 6-month assessments as of June 2023 were included in the current analyses. Adolescents who declined to state their sexual orientation were not included in the current study ($n = 5$). Additionally, participants who were missing measures of family support were excluded ($n = 2$). The final sample ($N = 141$) included 13- to 18-year-old adolescents who met criteria for either current depression ($n = 29$; 20%), past depression ($n = 65$; 46%), or had no lifetime history of psychiatric disorders ($n = 47$; 33%).

## Procedure

The New York State Psychiatric Institute Institutional Review Board (IRB) approved the study procedures, which was the IRB of record for both sites. Data were collected from September 2020 through June 2023. Adolescent assent and parental permission were obtained for 13- to 17-year-old participants. Informed consent was obtained for 18-year-old participants. At the baseline and 6-month follow-up assessment, participants were administered clinical interviews to assess lifetime psychiatric disorders and depression severity. Participants also completed self-report measures assessing psychiatric symptoms and risk factors for depression. Additionally, at baseline, participants installed the Effortless Assessment Research Systems (EARS; Lind et al., 2023) app on their personal smartphone, which was used to assess daily mood and acquire geolocation data during the 6-month follow-up period.

## Clinical Interviews

At the baseline and 6-month follow-up assessments, participants were administered modules of the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS; Kaufman & Schweder, 2004) to assess the *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition diagnoses. Interrater reliability for disorders assessed was high ($k = 0.90$) based on review of 18 interviews. Additionally, participants were administered the Children's Depression Rating Scale-Revised (CDRS-R; Poznanski & Mokros, 1996) to evaluate current depressive symptoms, and total scores were converted to standardized T scores. In the event that participants reported elevated suicidal ideation or imminent suicide risk, a licensed clinician on the research team conducted a risk assessment, contacted the participant's parent/guardian, and discussed safety measures and referral to clinical care as needed.

## Self-Report Instruments

Demographic information was obtained from each participant at baseline, including gender identity and sexual orientation. SGM versus non-SGM identity was coded for analysis purposes based on two baseline self-report demographic items regarding sexual orientation and gender identity. Participants were coded as SGM if they identified as gay, lesbian, bisexual, pansexual, asexual, not sure, or other, and/or if they identified as transgender or nonbinary. Participants were coded as non-SGM if they identified as heterosexual and cisgender.

At the baseline and 6-month follow-up assessment, participants also completed self-report questionnaires related to interpersonal support and clinical symptoms. To assess social functioning within the family unit, adolescents completed the Patient-Reported Outcomes Measurement Information System (PROMIS) Pediatric Family Relationships-Short Form 4a (PROMIS-Family) (Bevans et al., 2017). The PROMIS-Family measure includes four items assessed on a 1–5 Likert scale, with higher mean scores indicating stronger familial relationships and connectedness (standardized Cronbach's $\alpha = .92$). Domains of the PROMIS-Family included sense of family ("I felt I had a strong relationship with my family"), perceptions of value and acceptance ("I felt really important to my family"), tangible support ("I got all the help I needed from my family"), and enjoyment ("My family and I had fun together"). Finally, adolescents reported on current suicidal ideation by completing Beck's Scale for Suicide Ideation (SSI) (Beck et al., 1979). The SSI includes 21 items assessed on a 0–2 Likert scale, with possible sum scores ranging from 0 to 42 ($\alpha = .91$).

## Experience Sampling of Daily Mood

For 6 months following their initial assessment, participants received a single-item daily survey, "In general how have you been feeling over the last day?" which was rated on a visual analog scale ranging from 0 (*very negative*) to 100 (*very positive*). Prompts were delivered each day at noon via the EARS app and were available for completion until midnight. Participant survey completion was monitored daily by research assistants. To encourage compliance, if a participant did not complete a survey for multiple days in a row, a research assistant texted the participant reminding them to complete a survey. Responses that took longer than 20 min to complete were excluded from data cleaning ($n = 52$ responses). Additionally, participants who completed <5 daily surveys over the 6-month follow-up period were excluded from analyses

including daily mood ($n = 4$ participants). This resulted in a total of 137 participants with ESM data.

## Homestay

The EARS app acquired timestamped geolocation recordings, which indicated the coordinates (longitude and latitude) of the phone and the time spent at that position. For iPhones, geolocation coordinates were recorded when the phone position moved >100 m. For Android phones, geolocation coordinates were recorded every 15 min. The main measure of interest was the amount of time each participant spent at home per day (homestay). To accommodate a variety of housing situations (i.e., family home and college) and change over the 6-month follow-up period, two methods were used to identify home locations. When available, the participant-reported address was converted to longitude and latitude coordinates ($n = 26$ missing addresses). In addition, the EARS processing pipeline created a data-driven estimate of participant home location based on where the participant remained stationary most evenings (i.e., a proxy for sleep location). For most participants (62%), data-derived home estimates matched the address provided (within 500 m). For participants residing at college or boarding school ($n = 26$; 18.9%), the coordinates corresponding to family home were used for analysis (as opposed to school residence), given our theoretical interest in experiences in the home environment. Thus, participants away from college were coded as being not at home. There were no participants who reported 0% homestay, meaning that even participants residing primarily at college spent at least some duration of the study at their family home. Two participants were excluded as both their reported and EARS-derived home locations reflected a school residence. Address-derived home coordinates were more frequently used for older participants (Table S1 in the online supplemental materials). There were no other demographic predictors of homestay derivation method.

Individual-level geolocation readings were coded as homestay if they were within 100 m of the participant's home location (either provided address or data-derived coordinates). Days with less than 12 hr of available geolocation data ($n = 123$ days) were excluded. One participant did not provide geolocation data and two participants were excluded because both addresses (data-derived and reported) corresponded to a school residence. This resulted in a total of 138 participants with homestay data. The proportion of time spent at home was calculated for each day for each participant as the sum of time at home divided by the amount of available geolocation data for that given day (scaled as $0.00 = no\ homestay$ to $1.00 = home\ 100\%\ of\ the\ day$).

## Data Availability

Demographic, clinical, and daily mood data are available in the National Institute of Mental Health Data Archive. Geolocation data cannot be made publicly available due to privacy concerns. Code is available upon request.

## Analysis

All analyses were performed in R Version 4.3.0 (R Core Team, 2023). Sample characteristics were characterized using the scipub package (Pagliaccio, 2021). Linear models were outputted to HTML tables using the sjPlot package (Lüdecke, 2023). SGM group differences were compared for sociodemographic, interpersonal, and clinical

outcomes, as well as overall ESM compliance, average daily mood, and survey-to-survey instability of mood (root mean square of successive differences). Potential differences by race (analysis of variance; White, Black, Asian American or Pacific Islander, other) and Hispanic ethnicity ($t$ test) were also examined for main clinical outcomes. Chi-square tests were computed for categorical outcomes (K-SADS diagnosis), and two-sample $t$ tests were performed for continuous outcomes (CDRS-R, SSI, and PROMIS-Family). All models employed listwise deletion of missing data.

### Depression Severity and Family Support

Linear regression models were used to test the associations of SGM identity and family support (PROMIS-Family) on depression severity (CDRS-R T-Scores) at the 6-month follow-up. Models covaried for site (New York City or Chicago), age (years), sex assigned at birth (male and female), and baseline depression severity (CDRS-R T-Score). Continuous predictor variables were mean-centered. Unstandardized regression coefficients are presented.

### Smartphone Experience Sampling

Linear mixed-effects models were used to examine factors relating to daily mood as an outcome variable, leveraging repeated within-person measurements (R lme4 package; Bates et al., 2015). Models included a random intercept for participant and covaried for age and sex assigned at birth. Models also covaried for study site, given the slight over-representation of SGM participants in the New York City site, and for whether the assessment was on a school day (coded for weekdays in September to June), which may influence homestay and mood. Continuous predictor variables were centered at the grand mean. Models included 13,755 observations across participants ($n = 137$; $M = 100$ days per person).

### Paired Smartphone Experience Sampling and Homestay Observations

Additional linear mixed-effects models tested the effects of homestay, SGM identity, family support, and their interactions on same-day mood. Models included a random intercept for participant and covaried for baseline depression (CDRS T-scores), site, age, sex assigned at birth, and school day. Additionally, models covaried for phone operating system (iOS vs. Android) due to system-dependent differences in geolocation capture. Three separate models were performed to test: (a) the main effect of homestay on same-day mood, (b) the two-way interaction between homestay and SGM identity in predicting same-day mood, and (c) the three-way interaction between homestay, SGM identity, and family support in predicting same-day mood. Simple slopes and simple interactions were calculated to parse interaction effects using the interactions R package (Long, 2019). Of the 138 participants who provided geolocation data, participants with <10 days of concurrent geolocation and ESM data were excluded ($n = 8$). Models examined 11,976 data points across participants ($n = 130$; $M = 93$ days per person).

## Results

### Participant Characteristics

Sociodemographic characteristics are summarized in Table 1. Nearly half of the sample ($n = 60$; 43%) self-identified as SGM.

**Table 1**
*Demographics and Clinical Outcomes by SGM Identity*

| Variable | Non-SGM ($N = 81$) | SGM ($N = 60$) | Group difference | $p$ |
|---|---|---|---|---|
| Demographics | | | | |
|   Age in years; $M$ ($SD$) | 16.26 (1.49) | 16.88 (1.28) | $t = 2.67$ | .008 |
|   Site (Northwestern) | 39 (48.15%) | 17 (28.33%) | $\chi^2 = 4.86$ | .03 |
|   Sex (female) | 53 (65.43%) | 53 (88.33%) | $\chi^2 = 8.50$ | .004 |
|   Gender identity | — | — | $\chi^2 = 20.98$ | <.001 |
|     Cisgender female | 53 (65.43%) | 43 (71.67%) | — | — |
|     Cisgender male | 28 (34.57%) | 7 (11.67%) | — | — |
|     Transgender/nonbinary | — | 10 (16.67%) | — | — |
|   Race | — | — | $\chi^2 = 1.49$ | .83 |
|     Asian | 14 (17.28%) | 9 (15%) | — | — |
|     Black | 11 (13.58%) | 7 (11.67%) | — | — |
|     Multiracial | 7 (8.64%) | 9 (15%) | — | — |
|     Other/unknown | 12 (14.81%) | 8 (13.33%) | — | — |
|     White | 37 (45.68%) | 27 (45%) | — | — |
|   Hispanic ethnicity | 29 (35.8%) | 21 (35%) | $\chi^2 = 0.00$ | 1.00 |
|   Sexual orientation | — | — | — | — |
|     Asexual | — | 4 (6.67%) | — | — |
|     Bisexual/pansexual | — | 40 (66.67%) | — | — |
|     Gay/lesbian | — | 7 (11.67%) | — | — |
|     Not sure | — | 7 (11.67%) | — | — |
|     Other | — | 2 (3.33%) | — | — |
| Clinical outcomes | | | | |
|   Lifetime depression (K-SADS) | 41 (50.62%) | 53 (88.33%) | $\chi^2 = 20.40$ | <.001 |
|   Depression severity (CDRS) | 43.09 (13.46) | 49.75 (14.47) | $t = 2.78$ | .006 |
|   Suicide ideation severity (SSI) | 1.91 (4.74) | 4.7 (7.16) | $t = 2.62$ | .01 |
|   PROMIS-family support | 3.67 (1.01) | 3.33 (1.11) | $t = -1.90$ | .06 |

*Note.* Group differences based on SGM identity are indicated. Differences in age (years) were tested by $t$ test. Differences in categorical outcomes were tested by chi-square. For continuous variables, means (standard deviations) are presented by group; group differences were tested by $t$ test with their associated Cohen's d effect size. For depression diagnosis via K-SADS, counts (percent) are presented by group; group differences were tested by chi-squared with their associated odds ratio effect size. SGM = sexual and gender minority; K-SADS = Kiddie Schedule for Affective Disorders and Schizophrenia; CDRS = Children's Depression Rating Scale; SSI = Scale for Suicide Ideation; PROMIS = Patient-Reported Outcomes Measurement Information System.

Among SGM participants, the majority (67%) identified as bisexual or pansexual. Furthermore, 17% of the sexual minority (SM) participants also identified as gender minorities; specifically, two identified as transgender male, seven identified as genderqueer/gender-nonconforming, and one identified as nonbinary. All gender minorities participants also identified as SM. Relative to non-SGM participants, SGM participants were slightly older on average, more likely to be assigned female at birth, and more likely to be recruited from the New York site. SGM and non-SGM participants did not differ significantly by self-identified racial or ethnic identity. No significant differences were observed in depression severity by race, $F(4, 136) = 2.18$, $p = .067$, or Hispanic ethnicity, $t(87.9) = -1.14$, $p = .26$. Similarly, no significant differences in daily mood were noted by race, $F(4, 134.24) = 0.272$, $p = .896$, or Hispanic ethnicity, $F(1, 135.33) = 0.800$, $p = .373$.

## Baseline Clinical and Interpersonal Outcomes

Clinical and interpersonal support variables are summarized in Table 1. Relative to non-SGM adolescents, SGM adolescents reported higher depression (CDRS-R) and SSI. SGM adolescents also reported lower family support than non-SGM adolescents, though this difference was only marginally significant ($p = .06$) (Figure S1 in the online supplemental materials).

## Predictors of Depression Severity

A multiple linear regression was performed to test prospective associations from baseline to 6-month follow-up. Results showed that lower family support and SGM identity both predicted worse depression severity (CDRS T-score) at the 6-month follow-up, above and beyond baseline symptoms (Table 2). Given nonnormality of the depression severity outcome variable, a supplemental Poisson regression was performed, which yielded the same pattern of findings.

## Experience Sampling of Daily Mood

The average completion rate of daily surveys was 56% over the 6-month follow-up period. Daily survey missingness increased over the course of the 6 months of participation ($OR = 1.01$, 95% confidence interval [CI] [1.01, 1.01], $p < .001$). There were no group differences in the number of surveys completed, $t(135) = 0.66$, $p = .51$. Additionally, instability of daily mood did not differ significantly by group, $t(135) = -0.70$, $p = .48$. A linear mixed-effects model was performed to examine the effects of SGM identity and family support on daily mood, covarying for demographics and whether the survey was completed on a school day. The model revealed main effects of school day, SGM identity, and family support on daily mood (Table 3). Average daily mood was lower on school days relative to nonschool days. Furthermore,

**Table 2**

*SGM Identity and Family Support as Predictors of Depression Severity at the 6-Month Follow-Up Assessment*

| | Depression symptoms | | | |
|---|---|---|---|---|
| Predictors | B | t | p | $\eta_p^2$ |
| Depression (baseline) | **0.30** | **4.72** | **<.001** | .29 |
| Age (years) | −0.78 | −1.36 | .176 | <.01 |
| Sex (female > male) | 0.78 | 0.41 | .682 | .01 |
| Site (Illinois > New York) | −0.09 | −0.05 | .958 | .01 |
| SGM identity | **5.78** | **3.36** | **.001** | .08 |
| Family support | **−2.21** | **−2.64** | **.009** | .05 |
| $R^2$/adjusted $R^2$ | .360/.332 | | | |

*Note.* Linear regression results are presented examining associations with depression severity at the 6-month follow-up (Children's Depression Rating Scale T scores). Unstandardized beta coefficients are presented along with their corresponding $t$ value, $p$ value, and partial eta squared ($\eta_p^2$). Model includes data from $n = 141$ participants. Significant predictors ($p < .05$) are bolded. SGM = sexual and gender minority.

SGM participants exhibited lower mood ($M = 59.89$) than non-SGM participants ($M = 69.70$). Moreover, participants reporting lower family support exhibited lower daily mood (Table 3, Column 1). There was also a significant interaction among SGM identity and family support in predicting daily mood (Table 3, Column 1; Figure 1A). Follow-up analyses showed that non-SGM adolescents exhibited a positive association between family support and mood, $b = 9.12$, $t(8198) = 5.66$, $p < .001$, whereby higher family support was associated with better mood. However, this association was nonsignificant among SGM adolescents, $b = 3.88$, $t(5557) = 1.85$, $p = .064$.

## Homestay, Mood, and Family Support

In linear mixed-effects models, age was the only significant demographic predictor of homestay, whereby older participants spent less time at home, $b = -0.08$, $t(19069) = -7.24$, $p < .001$, $\eta_p^2 = 0.28$. As expected, homestay was lower on schooldays relative to non-schooldays, $b = -0.05$, $t(19069) = -11.06$, $p < .001$, $\eta_p^2 < .01$. However, there was no significant association between baseline depression severity (CDRS) and homestay, $b = 0.00$, $t(19069) = 0.22$, $p = .828$.

A linear mixed-effects model tested the effects of homestay, family support, and SGM identity on same-day mood, controlling for baseline depression. All three effects were significant (Table 3, Column 2). As seen in the previous models, SGM identity was associated with worse mood, and higher family support was associated with better mood. Moreover, greater homestay was associated with worse same-day mood. An additional linear mixed-effects model tested a series of two-way interactions among homestay, family support, and SGM identity in predicting same-day mood (Table 3, Column 2). In line with our previously reported results, there was a significant interaction among SGM identity and family support in predicting same-day mood. However, there were no significant two-way interactions (SGM by homestay, nor family support by homestay) in predicting same-day mood.

A final linear mixed-effects model tested the three-way interaction between homestay, SGM identity, and family support in predicting same-day mood. As hypothesized, there was a significant three-way interaction among SGM identity, family support, and homestay in relation to same-day mood (Table 3, Column 2; Figure 1B; Figure S2 in the online supplemental materials). We probed this three-way interaction by testing the two-way interaction among

**Table 3**

*SGM Identity, Family Support, and Homestay Predicting Daily Mood*

| | 1. Daily mood | | | | 2. Daily mood | | | |
|---|---|---|---|---|---|---|---|---|
| Predictors | B | t | p | $\eta_p^2$ | B | t | p | $\eta_p^2$ |
| Covariates | | | | | | | | |
| Age (years) | 1.05 | 1.21 | .226 | .01 | 1.48 | 1.61 | .107 | .02 |
| Sex (female > male) | −3.26 | −1.15 | .251 | .01 | −3.45 | −1.17 | .244 | .01 |
| Site (Illinois > New York) | −1.44 | −0.55 | .582 | <.01 | −3.28 | −1.22 | .223 | .01 |
| School day (yes > no) | **−1.56** | **−5.22** | **<.001** | <.01 | **−1.30** | **−4.08** | **<.001** | <.01 |
| Operating system (Apple > Android) | — | — | — | — | 1.71 | 0.48 | .630 | <.01 |
| Baseline depression severity | — | — | — | — | **−0.27** | **−2.63** | **.008** | .05 |
| Main effects | | | | | | | | |
| SGM identity (yes > no) | **−7.96** | **−3.01** | **.003** | .06 | **−6.68** | **−2.40** | **.016** | .05 |
| Family support | **6.13** | **5.16** | **<.001** | .17 | **4.49** | **3.33** | **.001** | .08 |
| Homestay | — | — | — | — | **−1.12** | **−2.12** | **.034** | <.01 |
| Two-way interactions | | | | | | | | |
| Family Support × SGM | **−4.88** | **−2.08** | **.038** | .03 | **−5.49** | **−2.26** | **.024** | **.04** |
| Home Stay × SGM | — | — | — | — | −0.47 | −0.43 | .667 | <.01 |
| Home Stay × Family Support | — | — | — | — | −0.17 | −0.35 | .726 | <.01 |
| Three-way interaction | | | | | | | | |
| Home Stay × Family Support × SGM | — | — | — | — | **3.56** | **3.50** | **<.001** | <.01 |
| N | 137 | | | | 130 | | | |
| Observations | 13,755 | | | | 11,976 | | | |
| Marginal $R^2$/conditional $R^2$ | .125/.484 | | | | .155/.500 | | | |

*Note.* Linear mixed-effects model results are presented here examining smartphone experiencing sampling of daily mood (scale ranging from $0 = $ *very negative* to $100 = $ *very positive*). Models included a random intercept for participant. Unstandardized beta coefficients are presented along with their corresponding $t$ value, $p$ value, and partial eta squared ($\eta_p^2$). Marginal $R^2$ indicates the variance explained by the fixed effects; conditional $R^2$ indicates the variance explained by the fixed and random effects. Significant predictors ($p < .05$) are bolded. SGM = sexual and gender minority.

**Figure 1**

*Two- and Three-Way Interactions of Family Support, SGM Identity, and Homestay Predicting Daily Mood*
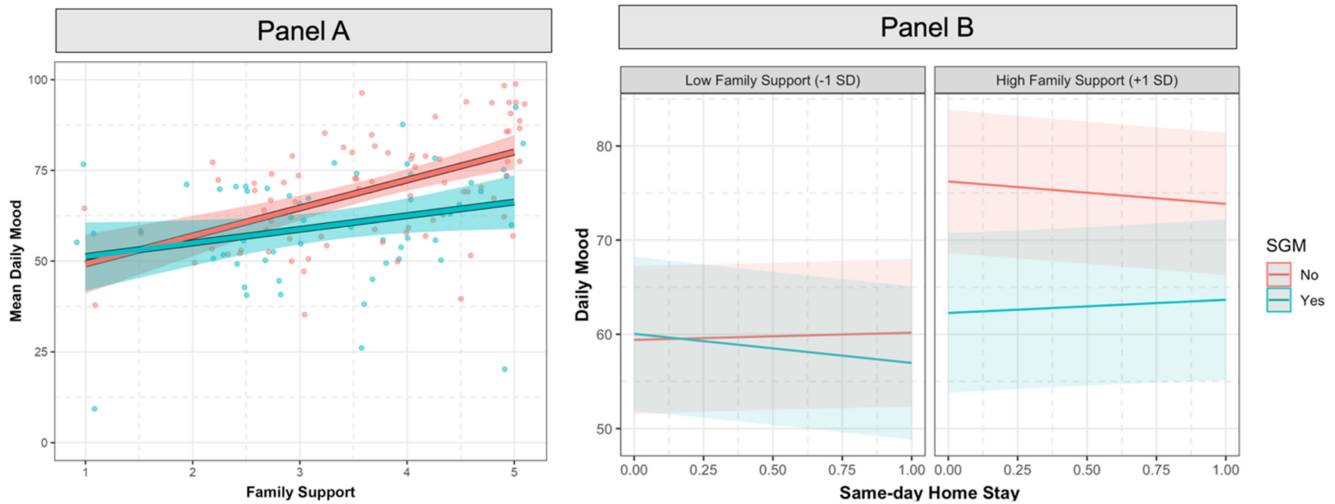


*Note.* In Panel A, the association between family support (PROMIS) and daily mood is shown by SGM identity. Individual responses are jittered to enhance visual clarity. The interaction between family support and SGM identity was significant (Table 3), such that there was a positive association among non-SGM youth. However, this was not significant among SGM youth. In Panel B, the association between homestay and daily mood is shown by family support and SGM identity. Simple slopes from the linear mixed-effects model (Table 3) are displayed for: low (−1 *SD*) and high (+1 *SD*) values of family support (PROMIS). Slopes for SGM youth are shown in the lower blue lines and non-SGM youth are shown in upper red lines. SGM = sexual and gender minority; PROMIS = Patient-Reported Outcomes Measurement Information System. See the online article for the color version of this figure.

SGM identity and homestay at low (−1 *SD*) and high (+1 *SD*) levels of family support. There were significant two-way interactions (Figure 1B) between SGM identity and homestay in predicting daily mood both at low family support, $b = -3.83$, $t(11960) = -2.62$, $p = .009$, and high family support, $b = 3.76$, $t(11960) = 2.30$, $p = .022$, indicating that the association between homestay and same-day mood significantly differed between SGM and non-SGM youth at low and high family support. Simple slopes indicate that among SGM adolescents with low family support, more time spent at home was associated with worse mood, $b = -3.08$, $t(11960) = -2.84$, $p = .004$. However, among non-SGM adolescents with low family support, this association was nonsignificant, $b = 0.75$, $t(11960) = 0.76$, $p = .446$. Among SGM adolescents with high family support, the association between homestay and daily mood was not significant, $b = 1.46$, $t(11960) = 1.05$, $p = .295$. Conversely, among non-SGM adolescents with high family support, more time spent at home was associated with worse mood, $b = -2.30$, $t(11960) = -2.36$, $p = .008$.

## Discussion

In line with prior findings (di Giacomo et al., 2018; Gamarel et al., 2020; McCurdy & Russell, 2023; Trevor Project, 2023), relative to non-SGM adolescents, SGM adolescents reported elevated depression severity and worse daily mood prospectively over 6 months. Critically, based on reported levels of family support, SGM and non-SGM youth exhibited differential associations between time spent at home (as determined by geolocation) and daily mood. Specifically, among adolescents reporting lower family support, SGM participants exhibited lower mood on days with more time spent at home, whereas this association was nonsignificant among non-SGM youth.

Across both clinical interview and smartphone-based means of assessment, family support emerged as an important factor in relation to depression, which is consistent with prior findings in SGM adolescents (Baams et al., 2015; McDonald, 2018; Rivas-Koehl et al., 2022). In our study, lower family support was concurrently and prospectively associated with depressive symptom severity. Additionally, lower family support predicted worse daily mood as reported via smartphone-based assessments over 6 months. Interestingly, the association between family support and daily mood varied as a function of SGM identity. Specifically, non-SGM youth exhibited a positive association whereby greater family support related to more positive mood over the subsequent 6 months. In contrast, this protective association was not observed among SGM youth, as there was no significant effect of family support on daily mood. The lack of a protective effect of family support on daily mood among SGM youth may be understood in the context of the rejection sensitivity model for understanding minority mental health (Feinstein, 2020). This model suggests that early experiences of rejection may prime SGM individuals to more readily perceive and react to future rejection. Among SGM youth who have experienced rejection, it may be adaptive to withdraw from social relationships to buffer against the potential negative effects of future rejection (Downey & Feldman, 1996). However, an unintended consequence of this self-protective strategy may be a blunted protective effect of affirming support when it is present, including from family. Similarly, in line with the social safety model (Diamond & Alley, 2022), SGM youth who feel socially unsafe may display hypervigilance and social withdrawal, which may in turn blunt the otherwise protective effect of family support. Further research should examine whether rejection sensitization and lack of social safety may contribute to the blunted protective effect of family support on mood in SGM adolescents.

Notably, the daily association between homestay and mood varied as a function of SGM identity and family support. Specifically, SGM adolescents reporting low levels of family support reported worse mood on days when spending more time at home, whereas this association was nonsignificant among non-SGM adolescents reporting low levels of family support. This suggests that the association between homestay behavior and mood varies as a function of both SGM identity and reported family support. SGM adolescents reporting lower family support may disproportionately experience their home environment as nonaffirming (Fish et al., 2020; Ryan et al., 2010), and thus time spent at home might be accompanied by family-based minority stressors, such as identity concealment (i.e., being closeted) and rejection, which have been shown to bear negative mental health consequences for SGM youth (Baams et al., 2015; McDonald, 2018). It also is possible that this association may be accounted for by time spent outside the home. SGM adolescents with low family support may receive greater support outside of the home (i.e., school affinity groups, friends' homes) than at home (Baams & Russell, 2021), and thus exhibit higher mood on days with less homestay. Further research should directly probe identify-affirming and nonaffirming interactions, both within and outside the home, to clarify their effect on mood.

Surprisingly, non-SGM adolescents reporting high family support in our sample exhibited worse mood on days with more homestay. This association was nonsignificant among non-SGM youth reporting low family support. Though this interaction with family support was not hypothesized, this negative association between homestay and mood was also observed in the overall sample and is in line with prior work showing that reduced mobility and distance traveled relates to depression (Auerbach et al., 2022; Laiou et al., 2022; Saeb et al., 2015). It is possible that greater homestay may reflect other depressive behaviors or withdrawal from peer interaction, rather than indicating family-related risk factors. Further research should examine the generalizability of this finding and probe potential moderators.

There are several important limitations. First, the study did not include assessments of SGM-specific stressors, such as discrimination, identity concealment, or stigma, which limits our ability to determine the SGM-affirming or nonaffirming nature of participant's home environment. Similarly, we used a brief self-report measure of general family support, potentially explaining the lack of a protective effect of family support on daily mood in SGM youth. Future work should further probe SGM identity-specific experiences of affirmation or rejection. Second, the response rate of daily mood surveys over 6 months was relatively modest (56%); however, it is noteworthy that this rate is comparable to other projects probing daily mood over a 6-month period (Auerbach et al., 2023). Third, given the sample size, we utilized a two-level variable of SGM versus non-SGM identity for analyses. This dichotomous variable does not reflect the diverse spectrum of sexual and gender identity. It may be that there are important clinical differences between identity subgroups—particularly between SM and gender minority participants—but the current project was not sufficiently powered to examine more specific analyses. Last, we were unable to covary for whether participants lived at home full-time, which may moderate associations between homestay, mood, and family support. Specifically, for SGM youth who do not live with unsupportive family full-time, homestay may be less distressing because it is experienced as transient.

Alternatively, it could be more distressing as these youth are less habituated to the home environment. Given these limitations, future research should build on our findings by employing a more fine-grained approach to SGM identity-specific experiences of affirmation and rejection, particularly distinguishing between SM and gender minority adolescents. Critically, given that our samples were recruited from areas surrounding major cities, future studies should also include youth residing in rural and/or politically conservative areas, who report heightened identity-related discrimination (Trevor Project, 2021).

Taken together, our findings underscore the pressing need for targeted interventions for SGM youth, who are at increased risk for depression and other mental health issues. Family support emerged as a critical variable that is likely to influence clinical- and mood-related outcomes, underscoring the well-researched need for family-based interventions in bolstering SGM youth mental health (Newcomb et al., 2019; Seager van Dyk et al., 2024). Furthermore, the SGM-specific link between low family support, increased homestay, and lower mood underscores the need for designing and testing interventions that are accessible from within potentially nonaffirming home environments, such as online support programs (Bauermeister et al., 2022; Egan et al., 2021; Lucassen et al., 2015). This avenue of intervention is increasingly critical as anti-LGBTQIA+ legislation is enacted across the United States (Trans Legislation Tracker, 2023), which has demonstrable effects on mental health in SGM populations (Flentje et al., 2022; Hatzenbuehler et al., 2009). Furthermore, continued use of smartphone-based monitoring techniques may allow for a more nuanced and temporally fine-grained understanding of SGM adolescents' lived experiences across social and geographical domains, which over time, may support the development of strategic targeted just-in-time interventions to bolster affirming support and well-being in SGM youth.

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