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## **The Adolescent Stress Experiences over Time Study (ASETS): A Prospective Longitudinal Study of Sexual Minority Adolescents in the United States**

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Manuscripts

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3 **The Adolescent Stress Experiences over Time Study (ASETS):**  
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5 **A Prospective Longitudinal Study of Sexual Minority Adolescents in the United States**  
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10 Sheree M. Schrager, PhD, MS,<sup>1</sup> Mary Rose Mamey, PhD, MA,<sup>2</sup>

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12 Harmony Rhoades, PhD,<sup>2</sup> and Jeremy T. Goldbach, PhD, LMSW<sup>2</sup>  
13  
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15  
16  
17 <sup>1</sup>California State University, Dominguez Hills, Carson, California  
18

19 <sup>2</sup>Suzanne Dworak-Peck School of Social Work, University of Southern California, Los Angeles,  
20  
21 California  
22

23  
24  
25 **Address correspondence to:**

26 Sheree M. Schrager, PhD, MS  
27 California State University, Dominguez Hills  
28 1000 E. Victoria St., I&I 3206  
29 Carson, CA 90747  
30 Phone: (310) 243-2553  
31 Email: sschrager@csudh.edu  
32  
33

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## Abstract

**Introduction:** Sexual minority adolescents (SMA) report higher rates of anxiety, self-harm, depression and suicide than heterosexual peers. These disparities appear to persist into adulthood and may worsen for certain subgroups, yet the mechanisms that drive these concerns remain poorly understood. Minority stress theory, the predominant model for understanding these disparities, posits that poorer outcomes are due to the stress of living in a violently homophobic and discriminatory culture. Although numerous studies report associations between minority stress and behavioral health in adolescence, no study has comprehensively examined how minority stress may change throughout the course of adolescence, nor how stress trajectories may predict differences in health during this critical developmental period.

**Methods and analysis:** Between May 15, 2018 and April 1, 2019, we recruited a U.S. national sample of diverse SMA ( $N = 2,559$ ) age 14-17 through social media and respondent-driven sampling strategies. A subset of participants ( $N = 1,076$ ) enrolled in the longitudinal component and will be followed each six months until July 1, 2022. Primary outcomes include symptoms of depression, anxiety, and PTSD; suicidality and self-harm; and substance use. The key predictor is minority stress, operationalized as the Sexual Minority Adolescent Stress Inventory. We will use parallel cohort-sequential latent growth curve models to test study hypotheses within a developmental framework.

**Ethics and dissemination:** All participants provided assent to participate, and longitudinal participants provided informed consent at the first follow-up survey after reaching age 18. All study procedures were reviewed and approved by the institutional review board at the authors' home institution, including a waiver of parental permission given the potential for harm due to unintentional "outing" to a parent during the consent process. The final anonymous data set will

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be available upon request, and research findings will be disseminated through academic channels and products tailored for the lay community.

For peer review only

## Strengths and Limitations of This Study

### Strengths:

- This study leverages a newly developed, valid and psychometrically sound measure of minority stress in a large, diverse national sample of adolescents.
- The longitudinal cohort design permits the first examination of change in minority stress experiences over time.
- The cohort sequential modeling approach also supports the first examination of how minority stress influences health across adolescence.

### Limitations:

- All outcome measures are self-reported and may be subject to recall and responses biases; no confirmatory behavioral data will be collected.
- Generalizability of study findings may be constrained by study eligibility criteria, strict data quality procedures, and recruitment methods.

# The Adolescent Stress Experiences over Time Study (ASETS): A Prospective Longitudinal Study of Sexual Minority Adolescents in the United States

## Introduction

Sexual minority (e.g., lesbian, gay, bisexual, pansexual) adolescents (SMA) experience significant behavioral health disparities compared to their heterosexual peers. In particular, SMA experience higher rates of internalizing psychopathology including depression, anxiety and self-harm<sup>(1-3)</sup> and externalizing behaviors such as substance use,<sup>(4-6)</sup> suicide attempt and completion<sup>(7, 8)</sup> Longitudinal studies suggest that these disparities persist into young adulthood and may even worsen. For example, data from a national study of adolescents (Add Health) showed that average longitudinal trajectories for substance use among SMA are disparate from heterosexual youth beginning in early adolescence and increase as youth transition into young adulthood.<sup>(9)</sup> When examining individual trajectories of suicidality, all sexual minority groups (lesbian, gay, bisexual, mostly heterosexual) reported higher rates of suicidality across all four waves than their heterosexual peers, from mid-adolescence to early adulthood.<sup>(10)</sup>

There are also behavioral health disparities among SMA by demographic subgroup. For example, sexual minority girls are more likely to report both considering and attempting suicide than sexual minority boys,<sup>(11, 12)</sup> and bisexual youth show larger substance use disparities than other sexual minority groups.<sup>(9)</sup> SMA living in rural areas also experience different behavioral health outcomes than their urban counterparts due to confidentiality concerns, values, and limited access to cities with more extensive peer networks<sup>(13)</sup> and a more comprehensive social support system.<sup>(14)</sup> While there are likely to be subgroup differences among racial and ethnic lines as well, scholars have noted a relative absence of racial and ethnic diversity in sexual minority research,<sup>(15-17)</sup> and even in large meta-analytic studies, the lack of racial and ethnic diversity in

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3 sampling is noted as a significant limitation.<sup>(12, 18)</sup> Understanding the experience of these youth is  
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5 increasingly relevant, as recent national survey data suggest that racial and ethnic minority youth  
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7 are more likely than white segments of the U.S. population to identify as SMA.<sup>(19)</sup>  
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10 The primary theoretical framework for understanding the disparities found among sexual  
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12 minorities is the minority stress theory (MST),<sup>(20-22)</sup> which has been endorsed by the Centers for  
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14 Disease Control and Prevention,<sup>(23)</sup> the National Academy of Medicine,<sup>(24)</sup> and Healthy People  
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16 2030.<sup>(25)</sup> MST suggests that discrimination, violence, and victimization due to a pervasive  
17  
18 homophobic culture are the primary sources of stress and most probable driving mechanisms of  
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20 mental health disparities among sexual minorities, including SMA.<sup>(21, 26-28)</sup> Numerous cross-  
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22 sectional studies have attributed poor behavioral health outcomes among adolescents to minority  
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24 stressors, such as negative disclosure experiences with family and peers,<sup>(1, 27-29)</sup> becoming  
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26 homeless upon disclosure,<sup>(30)</sup> in-school victimization (bullying) by students and faculty  
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28 members,<sup>(31, 32)</sup> and experiences of violence.<sup>(12, 33, 34)</sup> However, no study has ever comprehensively  
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30 examined this relationship longitudinally. Despite recognition that stigmatizing experiences can  
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32 disrupt adolescent development and contribute to negative outcomes,<sup>(35)</sup> the gap between  
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34 theoretically predicted relationships and empirical evidence to support them is largely due to four  
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36 key concerns:  
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- 42 (1) Studies of minority stress during adolescence have been fraught with *poor psychometric*  
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44 *measurement*.<sup>(13, 36)</sup> A review of psychometric measurements assessing discrimination  
45  
46 against sexual minorities found that across 162 articles, nearly all had suboptimal  
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48 psychometric properties.<sup>(37)</sup> Few studies have used empirically validated measures, and most  
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50 measures had been developed using small investigator-led samples or adapted from  
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52 measures with adults in other minority populations.<sup>(18)</sup> Previously available general stress  
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3 measures, even those validated for use with adolescents, do not allow us to differentiate  
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5 between common developmental stressors and those associated with minority stress.  
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- 7  
8 (2) There is an absence of studies examining minority stress and behavioral health in  
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10 adolescents *over time*. Only six studies (with four unique samples) have examined the  
11  
12 relationship between minority stress and subsequent behavioral health outcomes, and each  
13  
14 has several major limitations: (a) lack of a well-constructed comprehensive measure of  
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16 minority stress for adolescents; (b) reliance on small regional samples; and (c) lack of  
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18 repeated-measures analyses and trajectory modeling to assess patterns of change in minority  
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20 stress during this critical developmental time period.<sup>(22, 38-40)</sup> Although the field has  
21  
22 generally assumed minority stress is the most probable cause of persisting behavioral health  
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24 concerns among SMA, no study has examined this directly.  
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28 (3) Although some *subgroup differences* in behavioral health outcomes have been documented,  
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30 their determinants are not well understood. As previously described, differential outcomes  
31  
32 are noted in sexual minority samples by race, ethnicity, gender, and geography, and authors  
33  
34 have called for increased attention to subgroup analyses in future research with SMA.<sup>(10, 12,</sup>  
35  
36 18, 41) These experiences have been explored in only a handful of studies, primarily with adult  
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38 samples.<sup>(42-44)</sup> Although the assumption is that minority stress also drives these disparities,  
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40 no studies have systematically explored subgroup differences in minority stress over time.  
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44 (4) The presence or absence of *protective factors* may add to the confusion. Some studies  
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46 suggest avoidance strategies<sup>(45)</sup> or emotionally focused cognitive restructuring<sup>(46)</sup> may be  
47  
48 helpful; others have recommended finding accepting friends, having supportive parents or  
49  
50 family members, identifying supportive adults at school, and relying on SMA community  
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52 resources (e.g., gay–straight alliances, SMA community centers) as methods for coping with  
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3 minority stress.<sup>(14)</sup> However, not all subgroups of SMA may have these opportunities. For  
4 example, youth who live in rural areas may have less access to affirming resources<sup>(13)</sup> and be  
5 more likely to live in areas with less protective school policies.<sup>(47)</sup> Thus, the relationships  
6 between minority stress, demographics, protective factors and outcomes remain poorly  
7 understood.  
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15 The current study is the first to address these four major gaps in the extant literature. We  
16 can now measure minority stress in adolescents with a psychometrically sound instrument, the  
17 Sexual Minority Adolescent Stress Inventory (SMASI), which was developed and validated by  
18 the research team in prior work funded by the National Institutes of Health (NIH).<sup>(48-50)</sup> Using  
19 this measure, we will conduct a systematic investigation of minority stressors and behavioral  
20 health over time in a large, diverse national sample. With repeated measures of minority stress  
21 and a modeling approach (cohort sequential latent growth curve modeling – see *Data Analysis*)  
22 that considers change across age rather than time, we can answer questions not previously  
23 addressed, such as whether minority stress increases over time as young teenagers develop  
24 throughout adolescence; when do minority stressors peak; whether there are demographic  
25 differences in the frequency, severity and pattern of minority stressors; and whether changes in  
26 minority stressors over time predict corresponding changes in health outcomes over time.  
27 Furthermore, we can test whether trajectories of minority stress are inversely associated with  
28 protective factors over time and if they too differ by demographic subgroup.  
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47 Thus, the present study will serve as one of the first longitudinal studies conducted with  
48 this vulnerable population. We address critical methodological design factors necessary to  
49 conduct high-quality longitudinal research with SMA, including: (a) a safe and effective  
50 recruitment approach, with built-in mechanisms to protect SMA from being “outed” via study  
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3 participation, which could increase risk of victimization (e.g., kicked out of home); (b) repeated  
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5 measures over time of important psychosocial predictors and outcomes; (c) recruitment of  
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7 participants at ages 14–17, because they are a particularly neglected subpopulation in SMA  
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9 studies;<sup>(51)</sup> and (d) a mechanism for recruiting “hidden youth” who have not disclosed their  
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11 sexual orientation to others, including their parents, resulting in a lack of both scientific and  
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13 clinical understanding about them. Upon completion, the study will provide critical information  
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15 needed to inform the nature and timing of intervention efforts for this high-need, underserved,  
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17 and difficult-to-reach population of youth.  
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## 21 **Methods and Analysis**

### 22 **Sample Selection**

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26 *Population Definition.* Recent studies suggest that upwards of 10% of youth do not  
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28 identify as exclusively heterosexual.<sup>(10)</sup> Throughout this protocol, we use the term *sexual*  
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30 *minority adolescents*, or SMA, to refer to adolescent individuals who endorse same-sex attraction  
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32 or identity. Attraction includes romantic or sexual feelings, whereas identity describes how youth  
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34 label themselves (e.g., lesbian, gay, bisexual).<sup>(52)</sup> These are consistent with constructs commonly  
35  
36 used to operationalize sexual orientation.<sup>(53, 54)</sup> We recognize *adolescents* generally as youth aged  
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38 13 to 20, a common international convention.<sup>(55)</sup> However, we restricted recruitment in this study  
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40 to youth aged 14 to 17, as we have in our preliminary work, given literature suggesting youth  
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42 commonly begin to define their sexual identity during these years.<sup>(56)</sup>  
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47 *Study Eligibility.* Youth were eligible to participate in the study if they were at least 14  
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49 and no more than 17 years old; were cisgender male or female (i.e., reported a current gender  
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51 identity consistent with their sex assigned at birth); resided in the United States, as determined by  
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53 ZIP code; identified as not 100% heterosexual using *Add Health* guidelines (i.e., identified as  
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3 mostly heterosexual, bisexual, gay, lesbian, or unsure);<sup>(57)</sup> and were willing and able to provide  
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5 assent to participate.  
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8 *Stratification Variables.* To ensure geographic diversity, ZIP code was recoded into two  
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10 additional variables: region and urbanicity. Region (West, Southwest, Midwest, Northeast, and  
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12 Southeast; see Table 1) was based on the state associated with the participant's reported ZIP  
13  
14 code. Urbanicity (rural or urban) was determined based on the Rural Urban Commuting Area  
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16 (RUCA)<sup>(58)</sup> codes. Specifically, "urban" was defined as a ZIP code corresponding to RUCA  
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18 codes of 1.0, 1.1, 2.0, 2.1, 4.1, 5.1, 7.1, 8.1, and 10.1. "Rural" was defined as all other valid  
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20 RUCA codes. When a ZIP code was associated with a RUCA 3.1 score, that score was used; for  
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22 ZIPs that were not assigned a RUCA 3.1 score due to changes in the classification system  
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24 between RUCA versions 2 and 3, the RUCA 2.0 score was used.  
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29 Table 1. Assignment of U.S. states to regions.

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<b>U.S. Region</b>	<b>U.S. States</b>		
West	Alaska	Idaho	Utah
	California	Montana	Washington
	Colorado	Nevada	Wyoming
	Hawaii	Oregon	
Southwest	Arizona	Oklahoma	Texas
	New Mexico		
Midwest	Illinois	Michigan	North Dakota
	Indiana	Minnesota	Ohio
	Iowa	Missouri	South Dakota
	Kansas	Nebraska	Wisconsin
Northeast	Connecticut	Massachusetts	Pennsylvania
	Delaware	New Hampshire	Rhode Island
	Maine	New Jersey	Vermont
	Maryland	New York	
Southeast	Alabama	Kentucky	South Carolina
	Arkansas	Louisiana	Tennessee
	Florida	Mississippi	Virginia
	Georgia	North Carolina	West Virginia

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## Participant Recruitment

*Targeted Advertising.* Initial participants were recruited through advertising on Facebook/Instagram (which now share a single advertising platform) and YouTube. Advertisements varied slightly by platform, but all included language asking youth to “Share Your Voice” and described basic details of the research study and incentives that participants could earn. Advertising was stratified by gender, geographic region, and urbanicity. This resulted in 20 target cohorts, as each of the five regions encompassed four unique groups: rural males, rural females, urban males, and urban females. We used two different sets of advertising images: one featuring females (for the female groups) and one featuring males (for the male groups). To reach each of these groups, general specifications included age (14-17 years), gender (women or men), and location. Facebook/Instagram allows bulk uploading of up to 2,500 ZIP codes per ad. A total of 44 targeted ads were required to reach all possible combinations of region, urbanicity, and gender, as some combinations included nearly 10,000 eligible ZIP codes. Facebook/Instagram also allows advertisers to target audiences based on interests. Using keywords enumerated by members of the research team, we identified specific interest terms by gender. Male-targeted interests included Gay-friendly; Gay, Lesbian, Bisexual, Transgender, Straight Alliance; Homosexuality; LGBT community; LGBT symbols; and Pansexuality. Female-targeted interests included all of the male-targeted interest keywords plus Lesbian Connection and Lesbian Romance.

Simultaneously, the research team identified YouTube channels for review using keywords including LGBTQ, gay, coming out, transition, and trans. Channels were reviewed for visibility, reach, and engagement of each channel, operationalized as the number of subscribers per channel and number of video views for each channel’s three most-viewed videos. We

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3 initially identified 47 possible YouTube channels that had high visibility and engagement among  
4 LGBTQ+ adolescents, using a combination of keyword searches (e.g., LGBTQ, gay, coming out,  
5 transition) and subscriber and video view counts; after reviewing this list, we advertised to 23  
6 channels that were verified YouTube accounts, able to accept advertisements, and agreed up on  
7 by the study team as being relevant to sexual minority adolescents. Using the Google advertising  
8 system, we placed advertisements for the ASETS study directly on the pages of those channels.  
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17 *Respondent-Driven Sampling.* Respondent-Driven Sampling (RDS) is a type of chain-  
18 referral sampling that allows for identified members of a hidden group, called “seeds,” to recruit  
19 other group members from their personal networks.<sup>(59)</sup> Participants who completed their survey  
20 and were initially deemed eligible for retention were asked if they might be interested in  
21 referring friends who they thought might be eligible to participate. Participants who confirmed  
22 their interest in referring friends to the study were provided with an email that contained three  
23 unique survey links as well as two different language prompts to encourage peers to participate.  
24 In return for successfully recruiting an eligible participant who completed the survey, the  
25 recruiter participant (seed) was paid \$10 per referral for up to three eligible participants.  
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### 33 **Baseline Study Procedures**

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40 *Initial Eligibility Screening.* Advertisement clicks and referral links all directed youth to a  
41 screening page in Qualtrics that asked a series of demographic questions to determine their  
42 eligibility based on age in years, gender, ZIP code, and sexual attraction. Ineligible participants  
43 were thanked for their interest in the study and then re-routed to a separate Qualtrics survey  
44 where they could optionally provide contact information (email and/or phone number) to be  
45 included in outreach for future studies. Eligible participants were shown the IRB-approved study  
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3 assent text and asked to confirm assent in order to proceed with the main survey, implemented in  
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5 Qualtrics (see *Measures*).

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7 *Post-Survey Data Collection.* After completing the survey, the participant was re-routed  
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9 to a separate Qualtrics survey for payment in order to keep their personally identifiable  
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11 information separate from their main study data. This payment survey asked the participant for  
12  
13 information separate from their main study data. This payment survey asked the participant for  
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15 their private email address at which to receive an electronic gift card. Participants were also  
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17 asked if they knew other sexual minority youth, and if so, whether they would consider referring  
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19 any of those youth into the study, to aid RDS recruitment. Finally, participants were asked  
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21 whether they would be interested in participating in the longitudinal study and given fields to  
22  
23 provide up to five different contact methods if so. Contact options included email, phone  
24  
25 numbers for call/text, and usernames for Facebook, Twitter, Snapchat, and any other social  
26  
27 media accounts that allow for personal messaging. Participants were able to rank their provided  
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29 methods of contact in order of preference.  
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33 *Final Eligibility Determination.* Each business day a study team member downloaded any  
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35 new surveys from Qualtrics. Variables were created to represent region, urbanicity, response  
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37 declinations (total number of “Decline to answer” responses across the entire survey); survey  
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39 duration, and attention validation (number of attention-control questions the respondent  
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41 answered correctly).<sup>(60)</sup> Participants who failed to complete the entirety of the survey—that is,  
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43 they exited the survey prior to completing and being routed to the payment survey—were  
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45 excluded and could not be paid due to lack of contact information. Participants determined to  
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47 have engaged in any type of fraudulent activity were also immediately excluded from both study  
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49 eligibility and pay. “Fraudulent activity” included providing information or response patterns,  
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51 either within the main survey data or on the payment and contact information survey, that  
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3 confirmed duplicate response by a previous participant, or screening out of a first survey attempt  
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5 (i.e., determined to be ineligible) and immediately re-accessing the survey with false responses in  
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7 an attempt to access the full survey.<sup>(61-64)</sup> Fraudulent participants were identified by duplicate IP  
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9 address, duplicate email and/or contact information, similar patterned responses throughout  
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11 survey (including open-ended responses with identical or unique wording), and/or survey time  
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13 stamps. Fraudulent participation was not compensated even if sufficient contact information was  
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15 provided.  
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19 Participants who completed the survey but provided very low quality data, defined as  
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21 either an unrealistically short survey completion time ( $\leq 10$  minutes), a low attention-control  
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23 score ( $\leq 1$  out of 4 correct responses), or very high ( $\geq 35$ ) “Decline to answer” response count,  
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25 were compensated for their participation but were excluded from the baseline dataset and not  
26  
27 invited to participate in the longitudinal study or refer peers via RDS. Participants who had  
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29 survey duration times of 10 – 15 minutes, attention-control scores of 2, and moderately high  
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31 ( $\geq 25$ ) responses of “Decline to answer” were compensated for participation and further evaluated  
32  
33 for inclusion on a case-by-case basis. By applying all of the above-described procedures prior to  
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35 longitudinal recruitment, we ensured that only participants who provided valid and trustworthy  
36  
37 data would be enrolled in the longitudinal study.  
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42 *Incentive Compensation.* All baseline participants who were eligible for compensation,  
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44 whether or not their data were retained for analysis, were sent a \$15 Amazon gift card to the  
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46 private email address they provided in the payment survey. Participants whose data were retained  
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48 for analyses were assigned a unique four-digit participant identifier at this time.  
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3 All participants were recruited into the study and completed their baseline surveys ( $N =$   
4 2,559) between May 15, 2018 and April 1, 2019. Figure 1 illustrates the number of individuals  
5 retained and excluded at each step of the baseline recruitment and data collection process.  
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## 8 9 10 **Longitudinal Study Procedures**

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12 *Longitudinal Enrollment.* Approximately one week from the date of a participant's  
13 baseline survey completion, participants who expressed interest in longitudinal participation  
14 were entered into a master tracking log file. This artificial delay helped ensure that we could  
15 detect participants willing to engage in fraudulent behavior, including participants who were  
16 trying to take the baseline survey multiple times in an attempt to receive multiple payments, prior  
17 to inviting them to be part of the longitudinal study. Participants who reached this longitudinal  
18 recruitment stage were contacted by a research assistant in real-time via the participant's  
19 preferred contact method, using a study-specific username or account shared by the research  
20 team. Participants were first reminded that they recently completed an online survey.  
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33 In an effort to protect their privacy and ensure that we were speaking with the right  
34 individual, we asked them to please tell us what that survey was about. Participants who  
35 provided the correct information (e.g., "LGBT youth") were asked if they were interested in  
36 learning more about the longitudinal study. Participants who expressed interest were given  
37 information about the study outlining their involvement, including a written information sheet.  
38 Those who agreed to participate were then asked to confirm or update their contact information,  
39 and the research assistant verified the participant could receive emails from the study team that  
40 did not end up in their spam/junk folders. Participants were reminded that the study team's next  
41 contact with them would be through an automated monthly check-in survey every month (see  
42 *Monthly Check-In Surveys*) and that they would receive an email in approximately six months for  
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3 their next full survey. Finally, they were provided with all methods of contact to reach the study  
4 team and were encouraged to reach out in the event they had questions, concerns, or comments.  
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8 *RDS Referrals.* Longitudinally enrolled participants were given the option to refer peers  
9 into the baseline survey for an additional incentive, i.e., RDS referrals. Participants who stated  
10 they may know others who might be interested were provided three custom Qualtrics referral  
11 links, which contained an embedded RDS code that both identified the new participant as an  
12 RDS referral and allowed the study team to link the new survey to the referring participant for a  
13 referral payment. All referred participants went through the same validation, eligibility, and  
14 payment process as those who entered the study through direct outreach methods. Additionally,  
15 the participant who referred them was provided with a \$10 Amazon gift card as a referral  
16 incentive. Referrers were not paid referral incentives for distribution of survey links to youth  
17 who were ineligible for participation or those whose surveys were excluded from retention due to  
18 low data quality. Participants who attempted to refer themselves were easily identified by the  
19 quality assurance protocol previously described; in the case of self-referrals, the participant was  
20 immediately excluded from both the baseline and longitudinal study due to their demonstrated  
21 willingness to defraud the study team.  
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40 *Monthly Check-In Surveys.* Because the study was conducted entirely online, having up-  
41 to-date contact information for all participants was of critical importance. Additionally, with six  
42 months in between full surveys, it was important to have more regular contact with participants  
43 in order to maintain rapport and interest in the study. Thus, a brief check-in survey, consisting of  
44 one item asking whether any of the participant's contact information had changed within the last  
45 30 days, was automatically emailed to each longitudinal participant near the first day of every  
46 month. If a participant indicated that their contact information had changed, they were then  
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3 prompted to provide any new or updated contact information. If a participant failed to respond  
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5 to the automated check-in survey by the 15th of each month, a research assistant would manually  
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7 reach out to them once through each of the participant's preferred contact methods. Each check-  
8  
9 in survey was accompanied by a raffle where all respondents to the check-in survey within the  
10  
11 calendar month were entered into a random drawing to receive a \$100 Amazon gift card,  
12  
13 regardless of whether their contact information had changed.  
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16  
17 *Longitudinal Follow-Up Surveys.* A unique link to each Qualtrics follow-up survey was  
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19 created by the study team for each participant. This link, provided to the participant once they  
20  
21 became eligible to complete the survey, contained embedded information about the date on  
22  
23 which they completed their previous survey along with their assigned unique participant  
24  
25 identifier. This allowed information about prior participation dates to be pre-populated in survey  
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27 items requesting retrospective information in an effort to aid in recall.  
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31 At the start of every week, all participants whose follow-up survey date fell within that  
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33 week (i.e., a multiple of 6 months after their baseline survey date) were sent an automated survey  
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35 link in an email from the Qualtrics platform. Automated messages were sent on Monday,  
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37 Wednesday, and Sunday of the first week of eligibility. Participants who failed to complete their  
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39 follow-up survey by the third automated attempt would begin to receive manual messages from  
40  
41 research assistants containing their unique embedded survey link. Manual attempts to contact the  
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43 participant were first sent via the participant's most recently indicated preferred contact method.  
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45 After three months, their survey window would close and participants would not be able to  
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47 complete that wave of data collection to ensure any two consecutive waves of data collection  
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49 would reflect a minimum time difference of three months apart. Follow-up data collection began  
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3 on August 15, 2018, and will conclude on July 1, 2022 when the three-month window of the 36-  
4 month survey closes.  
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7 *Longitudinal Eligibility and Payment Determination.* When a participant completed a  
8 follow-up survey, the participant was re-routed to the separate Qualtrics survey page for payment  
9 using the same procedures as at baseline. Each business day a study team member would access  
10 the main survey through Qualtrics and download the previous day's surveys. Variables were  
11 again created in each follow-up dataset including survey duration, attention control score, and  
12 count of "decline to answer" responses. Participants who failed to complete the entire survey or  
13 who had very low quality data (as defined above), were encouraged to retake the survey with an  
14 explanation provided as to why they were asked to retake the survey. This outreach process  
15 continued for five total manual attempts alternating every other day. This process was replicated  
16 at all subsequent survey waves. The longitudinal enrollment and retention diagram is shown in  
17 Figure 2; to date, five participants have withdrawn from continued follow-up, bringing the  
18 longitudinal sample to  $N=1,071$ .  
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### 35 **Measures**

36 Beginning with baseline data collection and at each follow-up survey, the following  
37 measures were collected:  
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42 *Outcomes.* We focus analysis on understanding behavioral health, consistent with  
43 terminology from the Substance Abuse and Mental Health Services Administration,<sup>(37)</sup> to  
44 describe an integrated approach focused on the promotion of emotional health and prevention of  
45 mental illness, alcohol and other drug use, and associated outcomes (e.g., suicide). Behavioral  
46 health outcomes included: *depressive symptoms*, measured with the CESD-4;<sup>(65)</sup> *anxiety*,  
47 assessed with the Generalized Anxiety Disorder 7-item measure (GAD-7);<sup>(66)</sup> symptoms of *Post-*  
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3 *Traumatic Stress Disorder* (PTSD),<sup>(67)</sup> using the Abbreviated PTSD Checklist-Civilian (PCL-C);  
4  
5 and five questions from the Youth Risk Behavior Survey (YRBS) to assess *suicidality and self-*  
6  
7 *injury*.<sup>(68)</sup> All responses were recoded to binary indicators of suicidal ideation, plan, attempt,  
8  
9 attempt resulting in injury, and self-injurious behavior. Finally, YRBS items were also used to  
10  
11 assess lifetime and past-30-day *substance use*,<sup>(68)</sup> including binary indicators of whether a  
12  
13 participant had used alcohol, tobacco, marijuana, prescription pain relievers, prescription  
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15 tranquilizers, and prescription stimulants.  
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19 *Key Predictor: Minority Stress.* The focal measure in this study is the Sexual Minority  
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21 Adolescent Stress Inventory<sup>(48-50)</sup> (SMASI; whole-scale omega ( $\omega$ )=.97), which relies on 54 main  
22  
23 items to measure 10 domains of minority stress: social marginalization (8 items,  $\omega$ =.93), family  
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25 rejection (11 items,  $\omega$ =.94), internalized homonegativity (7 items,  $\omega$ =.94), identity management  
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27 (3 items,  $\omega$ =.77), homonegative climate (4 items,  $\omega$ =.88), intersectionality (3 items,  $\omega$ =.82),  
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29 negative disclosure experiences (5 items,  $\omega$ =.77), religion (5 items,  $\omega$ =.93), negative  
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31 expectancies (3 items,  $\omega$ =.81), and homonegative communication (5 items,  $\omega$ =.77). An optional  
32  
33 subscale assessed stress experiences at work among youth with any work history (10 items,  
34  
35  $\omega$ =.96). At baseline, youth were asked if they have had each experience “ever” and “in the past  
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37 30 days;” the stem language changes to “since [they] last took the survey” and “in the past 30  
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39 days” at subsequent time points.  
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45 *Demographic Covariates.* Variables used for eligibility screening included *age* (in years).  
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47 *Sex assigned at birth* (male or female) was used in concert with *gender identity* (response options  
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49 included: male; female; trans male/trans man; trans female/trans woman; genderqueer; gender  
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51 nonconforming; nonbinary; gender identity not listed here) to determine cisgender status. For  
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53 eligibility screening that depended on survey programming logic, *sexual minority identity* was  
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3 determined with the recommended item from Add Health guidelines:<sup>(57)</sup> “If you had to pick one  
4 of the following options, please choose the description that best fits how you think about  
5 yourself,” with all response options other than “100% heterosexual (straight)” qualifying for  
6 eligibility. ZIP code was assessed to verify *U.S. residence* and subsequently recoded for  
7 stratification into *urbanicity* and *region* as previously described.  
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15 Additional demographic variables included open-ended *sexual identity*, assessed by  
16 asking “What would you say is your sexual orientation or identity?” and a text box for an open-  
17 ended responses that could be recoded for later analyses. *Race and ethnicity* was a forced-choice  
18 item with response options of Native American/American Indian/Alaska Native; Asian/Pacific  
19 Islander; Black or African American; White/Caucasian; Latino/Hispanic; Multi-racial (with a  
20 text box to specify); and Race/ethnicity not listed here (with a text box to specify). Gender  
21 expression was captured with one item asking, “A person's appearance, style, dress, or the way  
22 they walk or talk may affect how people describe them. How do you think other people would  
23 describe you?” Response options were on a 7-point Likert-type scale from “Very feminine” to  
24 “Very masculine.” *School enrollment* was captured with a binary indicator of whether  
25 participants are currently enrolled in school, and *educational attainment* measured the highest  
26 grade already completed (less than 7th grade; 7th grade; 8th grade; 9th grade; 10th grade; 11th  
27 grade; High school graduate or GED; Some college; Trade school certification or Associate's  
28 (AA) degree; Bachelor's (BA/BS) degree or higher). Additionally, participants were asked  
29 whether they were eligible for free or reduced price lunch at the school they most recently  
30 attended as a proxy for *socioeconomic status* (response options: “Yes,” “No,” “I don't know”).  
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*Work status* was assessed with one item asking whether participants are currently working, with  
response options of “Yes, full-time”; “Yes, part-time”; “No, but I have previously had a job”; or

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3 “No, and I have not previously had a job”. In follow-up surveys, participants were asked  
4 whether they had worked since the last time they took the survey (“Yes” or “No”). *Living*  
5 *situation* was assessed by asking participants with whom do they currently live. Response  
6 options included: two parents; mother only; father only; grandparents or other relatives; foster  
7 parents; group home; alone or with roommates in own apartment or home;  
8 boyfriend/girlfriend/romantic partner/spouse; with friends or couch-surfing; homeless or on the  
9 street; and other (with a text box to specify). Participants were asked whether they had become  
10 involved in the *foster care system* (“Yes”, “No”, or “Unsure”). Participants were asked about  
11 their *primary language* spoken a) at home and b) with their friends; response options included  
12 English; Spanish; or another language (with text box to specify). Participants were asked to  
13 indicate their personal and family religion from a comprehensive list.<sup>(69)</sup> Although not used in the  
14 eligibility process, sexual attraction to men, women, and gender nonconforming people was also  
15 assessed with Likert-type response options ranging from “Not at all” to “Extremely.”

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33 *Theoretical Covariates and Protective Factors.* Participants completed the Perceived  
34 Stress Scale (PSS), a measure of *general stress*,<sup>(70, 71)</sup> to ensure we can control for other common  
35 adolescent stress experiences unrelated to minority stress. *Social support*<sup>(72)</sup> from friends, family,  
36 and a significant other was measured with the Multidimensional Scale of Perceived Social  
37 Support. *Disclosure* questions were asked to understand who, if anyone, knows the participant is  
38 LGBTQ (baseline) or who, if anyone, the participant has disclosed their sexual orientation to for  
39 the first time since the last survey (follow-up surveys). Options included: mother; father;  
40 siblings; other adult relatives; peers/supervisor(s) at work; members of the participant’s religious  
41 community; teacher(s); peers at school, childhood friends; heterosexual friends; LGBTQ friends;  
42 and girlfriend/boyfriend/partner. Response options were “Yes,” “No,” or “Not Applicable” (if  
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3 they did not have the listed person in their life). A series of binary items assessed the presence of  
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5 supportive resources such as *gay-straight alliances (GSA)* and *mentorship*, as follows:  
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8 Three items captured whether the person currently had regular access to a GSA; whether their  
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10 current (or most recently attended) school has a group or club specific to the LGBTQ+  
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12 community; and whether they participated in meetings or activities sponsored by an LGBTQ+  
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14 club at their school (or most recently attended school). Participants were also asked whether  
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16 there is an adult 25 years or older, currently in their life, who they consider to be a mentor. Those  
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18 who responded “yes” were asked whether this person is part of their immediate family; if they  
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20 responded yes, they received an additional question asking, “Other than an immediate family  
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22 member (or the person who raised you), is there an adult 25 years or older who you consider to  
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24 be your mentor?” These items were recoded into a binary item reflecting the presence or absence  
25  
26 of a non-family mentor age 25 or older. Finally, adolescent *coping strategies* were captured with  
27  
28 the Coping Strategies Inventory-Short Form,<sup>(73)</sup> which includes 16 items on four subscales  
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30 (problem-focused engagement; problem-focused disengagement; emotion-focused engagement;  
31  
32 and emotion-focused disengagement). An additional 20 items assessed *LGBT-specific coping*  
33  
34 *strategies*. The first ten questions asked about potentially recurring events, such as “I spent time  
35  
36 with the LGBTQ community” and “I tried to gain new knowledge about the LGBTQ  
37  
38 community.” Response options for these statements included “Never,” “Sometimes,” “Often,”  
39  
40 and “Regularly.” The second ten questions asked participants for a binary response indicating if  
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42 they had ever had the positive experience, such as “I went to an LGBTQ pride event” and “I’ve  
43  
44 been in a romantic relationship.”  
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51 *Additional Measures.* Although not the primary focus of the study, additional measures  
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53 were added at later waves of data collection to probe emerging findings in the literature on SMA  
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3 behavioral health. These included a more thorough investigation into the experiences of  
4 homeless and precariously housed youth; intersectionality of SGM status with cultural identity;  
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6 experiences with body dysmorphia; sexual behavior, intimate partner violence, and  
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8 nonconsensual distribution of explicit images (“revenge porn”); healthcare access and utilization;  
9  
10 and specific forms of marijuana or nicotine used in the past 30 days.  
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### 14 **Data Analysis Plan**

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16 We propose using cohort sequential latent growth curve modeling (LGCM)<sup>(74)</sup> to describe  
17  
18 how minority stress and its associated behavioral health outcomes change over time among  
19  
20 SMA. Compared with traditional longitudinal analysis methods such as comparing pre- and post-  
21  
22 test scores or change by data collection wave, the cohort sequential LGCM approach examines  
23  
24 individual change over age and is more appropriate for modeling developmental processes,  
25  
26 coinciding with theoretical paradigms that are often person-centered longitudinal pathways.<sup>(75, 76)</sup>  
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31 Several preliminary steps and decisions will be made prior to longitudinal model  
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33 estimation and will vary depending on the type of analysis (e.g., ordinary least squares vs.  
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35 logistic regression). Multicollinearity and influential cases will be assessed.<sup>(77)</sup> Distributional  
36  
37 properties of all continuous and categorical variables will be evaluated, and we will apply  
38  
39 appropriate transformation or robust estimation procedures to correct for non- normally  
40  
41 distributed variables.<sup>(123)</sup> Attrition analyses will be conducted to understand missingness. Missing  
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43 data will be handled in all growth models using full information maximum likelihood estimators  
44  
45 in Mplus assuming data are missing completely at random or missing at random.<sup>(78)</sup> Multiple  
46  
47 imputation<sup>(79)</sup> methods will also be used when appropriate. Depending on the analysis and the  
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49 hypothesis being tested, demographic and some substantive variables will be included as  
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51 covariates to increase the specificity of the effects; e.g., geographic region, ethnicity, or general  
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3 stress. Proper functional forms of trajectories will be identified prior to estimating full  
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5 unconditional LGCMs.<sup>(80)</sup> Structural equation models will be evaluated using commonly  
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7 accepted fit indices (e.g., chi-square, CFI, IFI, TLI, and RMSEA) and modification indices (e.g.,  
8  
9 LaGrange multipliers).<sup>(81)</sup> Standard guidelines for small (.2), medium (.5), and large (.8) effect  
10  
11 sizes<sup>(82)</sup> will be adopted. Confirmatory factor analysis will be used to assess measurement  
12  
13 invariance of the SMASI and all outcome measures over time.  
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17 *General approach to hypothesis testing.* LGCMs will be estimated for the SMASI total  
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19 score, the SMASI subscales, and each of the behavioral health outcomes. The use of a cohort  
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21 sequential LGCM will allow for the modeling of change in each outcome trajectory as  
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23 adolescents age during the course of our study by plotting latent means across age to understand  
24  
25 developmental trends among participants. These are useful in examining within-person change  
26  
27 across time and between-person variability.<sup>(80)</sup> Furthermore, LGCMs provide group-level  
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29 statistics, including the average amount of change over time (i.e., slope), the average starting  
30  
31 point (i.e., intercept), and the relationship between the two.<sup>(83, 84)</sup> One important advantage of  
32  
33 LGCM is the implementation and comparison of appropriate functions to best fit the trend of the  
34  
35 data. It is likely that several patterns of growth during the course of adolescence may emerge –  
36  
37 that is, two or more separate slopes may be modeled within the same trajectory to demonstrate  
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39 divergence in trends.<sup>(83, 85)</sup> These separate but related pieces incorporate the piecewise function,  
40  
41 which allows for several linear slopes to be modeled within the same construct (e.g., minority  
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43 stress) and can provide information about differences in construct level (i.e., intercept) and  
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45 growth velocity (i.e., slope) at varying stages of adolescence.  
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52 Due to the hypothesized relationships between minority stress and the behavioral health  
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54 outcomes (depression, suicidality, problem behaviors, and substance use), we propose to analyze  
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3 these trajectories simultaneously via the use of parallel cohort sequential LGCM models.<sup>(85)</sup> By  
4 modeling several growth processes (e.g., minority stress and depression) at once, we can  
5 evaluate the relationship of slopes and intercepts both within and across measures to understand  
6 their interrelated effects over time. This approach will allow us to test the following working  
7 hypotheses (WH):  
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14 *WH1. There will be differences in minority stress across adolescent development. A*  
15 cohort sequential LGCM<sup>(86)</sup> for the total SMASI score and each of its 10 subscales will be  
16 estimated to describe individual and group-level trajectories of minority stress among all SMA  
17 during the course of the study period. This will establish the best-fitting LGCM and allow the  
18 selection and implementation of the most appropriate piecewise function. We will test piecewise  
19 models with one (i.e., linear across development) to four growth trajectories to determine the  
20 number of different stages of adolescence that best represent the data. The best-fitting model for  
21 each of the outcomes will be evaluated according to fit statistics (e.g., AIC, BIC, RMSEA,  
22 CFI/TLI) and by examining differences in chi-square statistics of nested models.  
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35 Once the number of stages is chosen, the intercepts and slopes can be evaluated for each  
36 LGCM. Each model will capture the hypothesized differences in growth by estimating intercept  
37 means (defined as the starting point of the growth stage) and slope means (change over time) for  
38 each of the growth processes and the correlations among and between them. We hypothesize that  
39 the intercepts of all growth functions will show statistically significant residual variance,  
40 indicating that adolescents vary significantly in their minority stress levels at the initial stage of  
41 each growth process. We further hypothesize that the slopes of all of the growth trajectories will  
42 show significant residual variance, indicating that youth experience varied rates of increase or  
43 decrease of minority stress over time. Such findings would demonstrate that trajectories of  
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3 minority stress across adolescence differ among individual youth.  
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5 *WH2.1. Trajectories of minority stress and behavioral health outcomes, including*  
6 *depression, suicidality, behavioral problems, and substance use, will be associated over time*  
7 *(i.e., considered parallel processes). We will estimate cohort sequential piecewise LGCMs for*  
8 *each of the behavioral health outcomes to measure growth over time. Separate models describing*  
9 *depression; suicidality; internalizing, externalizing, and total problem behaviors; and five*  
10 *substance use outcomes (alcohol, tobacco, marijuana, prescription drugs, and hard drugs) will be*  
11 *estimated. A similar process to the analysis for WH1 will be applied to building these models.*  
12 *Subsequently, the LGCMs of both the SMASI total score and behavioral health outcome will be*  
13 *combined in a parallel LGCM to evaluate the relationship between the two variables over time.*  
14 *Significant coefficients corresponding to the regression paths between the SMASI and health*  
15 *outcomes would provide strong evidence that minority stress affects behavioral health outcomes*  
16 *over time.*  
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33 *WH2.2. Reporting higher levels of minority stress in early adolescence will be associated*  
34 *with poorer behavioral health outcomes in later adolescence. Within the parallel LGCM*  
35 *framework, we will regress the intercepts and slopes of all behavioral health outcomes onto the*  
36 *intercept(s) of the SMASI to determine whether and how levels of minority stress predict later*  
37 *health outcomes during adolescence. Specifically, we hypothesize that: (a) The intercept of the*  
38 *SMASI latent variable (or in the case of a multiple trajectory piecewise model, the intercept of*  
39 *the first trajectory) will be positively and significantly associated with the intercept(s) of the*  
40 *behavioral health outcome, indicating that higher levels of minority stress in early adolescence*  
41 *result in worse health at each stage of development. (b) The first intercept of the SMASI will be*  
42 *significantly, positively associated with all outcome slopes, such that high levels of minority*  
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3 stress in early adolescence will result in a steeper increase in behavioral health problems in all  
4 growth stages; and (c) the slope(s) of the SMASI will differentially predict the rate of change in  
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6 later growth stages of behavioral health, such that a steeper increase or decrease in minority  
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8 stress throughout adolescence will predict corresponding increases or decreases in behavioral  
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10 health.  
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14 *WH3.1. There will be significant differences in outcome trajectories by demographic*  
15 *subgroup (race and ethnicity, gender, sexual identity, urbanicity).* Building on the previous  
16 analyses, we will use four demographic stratification variables (race and ethnicity, gender, sexual  
17 identity, and urbanicity) to explore whether there are subgroup differences (e.g., male vs. female;  
18 gay vs. lesbian vs. bisexual) in trajectories of minority stress and behavioral health outcomes  
19 across adolescence. For example, prior literature suggests that girls are more likely to experience  
20 suicidality in adolescence than boys<sup>(12, 15)</sup> and bisexuals are more likely to engage in substance  
21 use than other sexual minority groups.<sup>(16)</sup> We hypothesize that we will see significant group  
22 differences in our data that confirm these findings. In a series of analysis using the multiple  
23 group function in Mplus, we will evaluate the structural invariance of each of our final parallel  
24 LGCMs across the subgroups comprising each of our stratification variables. The intercept and  
25 slope coefficients for each growth process will first be estimated freely across groups; the  
26 loadings will then be constrained to be equal across groups. If there is no decrement in fit (i.e.,  
27 CFI  $\Delta < .01$  or nonsignificant chi-square difference test), we will conclude the model has  
28 structural invariance and thus there are no differences in either minority stress or behavioral  
29 health outcome process across demographic subgroups. If significant decrements in fit emerge  
30 (e.g., when constraining across gender in the suicidality model), we will systematically free  
31 parameters to determine which intercept(s) or slope(s) differ by group and in which direction.  
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3 Because no longitudinal study of this nature has been conducted, there is no evidence to support  
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5 *a priori* hypotheses about minority stress differences by subgroup. Commensurate with the  
6  
7 extant literature, however, we expect to find subgroup differences for each of our behavioral  
8  
9 health outcomes. Therefore, we hypothesize that the parallel LGCMs will not demonstrate  
10  
11 structural invariance.  
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15 *WH3.2: Trajectories of minority stress will be inversely associated with protective factors*  
16  
17 *over time and will differ by demographic subgroup.* Using the approach described under WH2.1,  
18  
19 we will first estimate the LGCM for protective factors (either simultaneously, i.e. with a latent  
20  
21 variable, or as separate measures depending on results of preliminary analyses). Next, we will  
22  
23 model the trajectories of the protective factor(s) and the SMASI total score simultaneously to  
24  
25 estimate a parallel LGCM; minority stress growth parameters will be regressed on protective  
26  
27 factors. Finally, as in WH3.1, we will examine the protective factor/minority stress parallel  
28  
29 process model for differences by demographic subgroup using the multiple group function in  
30  
31 Mplus and examining constrained and unconstrained models. We hypothesize that protective  
32  
33 factors will show an overall inverse trajectory to minority stress; i.e., greater intercepts and  
34  
35 slopes of protective factors will be associated with lower intercepts and slopes of minority stress,  
36  
37 and vice-versa. We further hypothesize that the parallel LGCMs of protective factors and  
38  
39 minority stress will not demonstrate structural invariance – that is, there will be subgroup  
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41 differences in the growth processes, owing to hypothesized sociodemographic differences in  
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43 protective factors (e.g., greater accessibility of social support systems in urban compared to rural  
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45 environments).  
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## 51 **Sample Size Calculation**

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3 For LGCM analyses, statistical power depends on sample size, degrees of freedom (the  
4 number of known minus free parameters), variable distributions, amount of missing data,  
5 measure reliabilities, and strength of the relationships among variables. Based on the code  
6 provided by Preacher and Coffman (2006),<sup>(87)</sup> we used the hypothesis-testing framework for  
7 Root-Mean-Square Error of Approximation (RMSEA) as a vehicle to estimate the power for  
8 LGCM in our study. For the first, simplest models to be implemented (i.e., one intercept, one  
9 linear slope), we expect 34 degrees of freedom; this value will decrease with each additional  
10 trajectory estimated in the piecewise models (e.g., a 4- slope trajectory will have 7 degrees of  
11 freedom). With  $\alpha=0.05$ , null hypothesis RMSEA of 0.05 and alternative hypothesis RMSEA of  
12 0.08, degrees of freedom ranging from 7 to 56, and nominal statistical power of 0.80, a  
13 longitudinal sample size of up to 1,075 may be needed to achieve adequate power for all  
14 analyses depending on the exact size of the model. The range of statistical power for all proposed  
15 models provided by a sample of this size is between .80 to .99, depending on the closeness of the  
16 null and alternative hypotheses.

### 35 **Patient and Public Involvement**

36  
37 Youth advisors were first involved in 2013 during an initial qualitative study funded by  
38 the Zumberge Foundation. That study provided the original basis for closed-ended items that  
39 eventually evolved into the SMASI measure. The current study design is a direct result of  
40 interviews conducted with SMA between 2013-2015, a small study of minority stress conducted  
41 between 2014-2016, and a set of focus groups conducted in 2016-2017 to understand stress and  
42 health patterns among the population. Youth were not directly involved in the choice of outcome  
43 measures; however, youth at several LGBTQ+ drop-in centers were involved in the development  
44 of study protocols (e.g., advertisements used) and helped provide guidance on recruitment and  
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3 retention methods. Some study participants were also directly involved in recruitment via their  
4 choice to refer other youth through RDS procedures. We are in the process of forming a youth  
5 advisory board that will assist with choosing the methods and developing plans for dissemination  
6 of study results to participants and linked communities.  
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## 12 **Ethics and Dissemination**

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14 A comprehensive informed assent document was provided to eligible youth immediately  
15 upon screening into the study, and indeed, assent to participate was required in order to begin  
16 survey data collection. All study participants were willing and able to provide assent at the  
17 baseline survey. Because SMA constitute a vulnerable group whose parents may not be aware of  
18 their sexual minority status, we were granted a waiver of parental consent. At the beginning of  
19 each follow-up survey, participants who had reached age 18 since completing the previous  
20 survey were consented using adult protocols for informed consent. All study procedures for both  
21 baseline and longitudinal follow-up activities were reviewed and approved by the institutional  
22 review board (IRB) at the authors' home institution. Because the study is purely observational  
23 with no researcher-controlled intervention, there is no external data safety monitoring board for  
24 the study. However, a member of the research team reviews study data immediately upon  
25 downloading the new data files each business day, and any open-ended statements or data that  
26 could potentially suggest participant safety concerns are immediately brought to the attention of  
27 the study investigators, who are considered mandated reporters in the State of California.  
28  
29 Statements are reviewed and assessed for information concerning abuse or neglect of a child;  
30 abuse or neglect of an elder; or threat that the participant will harm themselves or someone else.  
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32 A IRB-approved standard operating procedure is in place in the event of a positive disclosure;  
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3 however, to date, no participant has disclosed any imminent safety concerns, and no other  
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5 adverse events have been reported.  
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8 To enhance protection for study data, we obtained an NIH Certificate of Confidentiality  
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10 The final dataset will include self-reported demographic and behavioral health data, as described  
11  
12 above, from surveys completed by the research participants. All identifying data will be  
13  
14 destroyed at the end of the study after analysis. The final anonymous data set will be made  
15  
16 available to other qualified members of the scientific community upon request per policies of the  
17  
18 NIH and the IRB at the authors' institution. We are committed to participating in the sharing and  
19  
20 building of research knowledge, and will adhere to the NIH Policy on Sharing of Unique  
21  
22 Research Resources including the Guidelines for Recipients of NIH Grants and Contracts.  
23  
24 Requests for research resources that are generated as part of this project (e.g., qualitative  
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26 outcomes, the stress measurement instrument) will be distributed in a timely manner.  
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31 Finally, the purpose of the current research is to examine pathways that may predict  
32  
33 differing behavioral health outcomes in sexual minority adolescents. To that end, the overarching  
34  
35 purpose is to share our developed resources with the community. As the research team completes  
36  
37 analyses and arrives at empirical results, we have contracted with a creative graphics firm to  
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39 develop infographics that cleanly summarize research findings with terminology suitable for the  
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41 lay public. In addition to presenting our work in peer-reviewed manuscripts and scientific  
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43 meetings, we are pursuing opportunities to share our findings with the broader community,  
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45 including hosting the infographics and other study materials and derivatives on the website of the  
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47 University of Southern California Center for LGBTQ+ Health Equity.<sup>(88)</sup>  
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### Figure Captions

Figure 1. CONSORT flow diagram for enrollment into baseline study phase (final  $N=2,559$ ).

Figure 2. CONSORT flow diagram for enrollment and retention in longitudinal study phase (current  $N=1,071$ ).

For peer review only

## References

1. Haas AP EM, Mays VM, Mathy RM, Cochran SD, D'Augelli AR, Silverman MM, Fisher PW, Hughes T, Rosario M, Russell ST. Suicide and suicide risk in lesbian, gay, bisexual, and transgender populations: Review and recommendations. *Journal of homosexuality*. 2011;58(1):10-51.
2. Hendricks M, Testa R. Model for understanding risk and resiliency in transgender and gender-nonconforming individuals. *Professional Psychology: Research and Practice*. 2012;43(5):460-7.
3. Anhalt K MT. Developmental and adjustment issues of gay, lesbian, and bisexual adolescents: a review of the empirical literature. *Clin Child Fam Psychol Rev*. 1998;1(4):215-30.
4. Marshal MP, Friedman MS, Stall R, King KM, Miles J, Gold MA, et al. Sexual orientation and adolescent substance use: a meta-analysis and methodological review. *Addiction*. 2008;103(4):546-56.
5. Moon MW, Fornili K, O'Briant AL. Risk comparison among youth who report sex with same-sex versus both-sex partners. *Youth & Society*. 2007;38(3):267-84.
6. Goldbach JT, Mereish EH, Burgess C. Sexual orientation disparities in the use of emerging drugs. *Substance use & misuse*. 2017;52(2):265-71.
7. Coker TR AS, Schuster MA. The health and health care of lesbian, gay, and bisexual adolescents. *Annual review of public health*. 2010;31:457-77.
8. Saewyc EM. Contested conclusions: Claims that can (and cannot) be made from the current research on gay, lesbian, and bisexual teen suicide attempts. *Journal of LGBT Health Research*. 2007;3(1):79-87.

- 1  
2  
3 9. Marshal MP, Friedman MS, Stall R, Thompson AL. Individual trajectories of substance  
4 use in lesbian, gay and bisexual youth and heterosexual youth. *Addiction*. 2009;104(6):974-81.  
5  
6
- 7 10. Marshal MP, Burton CM, Chisolm DJ, Sucato GS, Friedman MS. Cross-sectional  
8 evidence for a stress-negative affect pathway to substance use among sexual minority girls.  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
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45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
11. Bridge JA, Goldstein TR, Brent DA. Adolescent suicide and suicidal behavior. *Journal of  
child psychology and psychiatry*. 2006;47(3-4):372-94.
12. Friedman MS, Marshal MP, Guadamuz TE, Wei C, Wong CF, Saewyc EM, et al. A  
meta-analysis of disparities in childhood sexual abuse, parental physical abuse, and peer  
victimization among sexual minority and sexual nonminority individuals. *American journal of  
public health*. 2011;101(8):1481-94.
13. Cohn TJ, Leake VS. Affective distress among adolescents who endorse same-sex sexual  
attraction: Urban versus rural differences and the role of protective factors. *Journal of Gay &  
Lesbian Mental Health*. 2012;16(4):291-305.
14. Goldbach JT, Gibbs J. Strategies employed by sexual minority adolescents to cope with  
minority stress. *Psychology of sexual orientation and gender diversity*. 2015;2(3):297.
15. Cochran BN, Stewart AJ, Ginzler JA, Cauce AM. Challenges faced by homeless sexual  
minorities: Comparison of gay, lesbian, bisexual, and transgender homeless adolescents with  
their heterosexual counterparts. *American Journal of Public Health*. 2002;92(5):773-7.
16. Moradi B, Mohr JJ, Worthington RL, Fassinger RE. Counseling psychology research on  
sexual (orientation) minority issues: conceptual and methodological challenges and  
opportunities. *Journal of Counseling Psychology*. 2009;56(1):5.

17. Szymanski DM, Kashubeck-West S, Meyer J. Internalized heterosexism: A historical and theoretical overview. *The Counseling Psychologist*. 2008;36(4):510-24.
18. Goldbach JT, Tanner-Smith EE, Bagwell M, Dunlap S. Minority stress and substance use in sexual minority adolescents: A meta-analysis. *Prevention Science*. 2014;15(3):350-63.
19. Gates GJ, Newport F. Special report: 3.4% of US adults identify as LGBT. Washington, DC: Gallup. 2012.
20. Hatzenbuehler ML, Nolen-Hoeksema S, Dovidio J. How does stigma “get under the skin”? The mediating role of emotion regulation. *Psychological Science*. 2009;20(10):1282-9.
21. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychological bulletin*. 2003;129(5):674.
22. Rosario M, Schrimshaw EW, Hunter J, Gwadz M. Gay-related stress and emotional distress among gay, lesbian and bisexual youths: A longitudinal examination. *Journal of Consulting and Clinical Psychology*. 2002;70(4):967.
23. Disease CCf, Prevention Ca. Lesbian Gay Bisexual and Transgender Health: Youth 2011 [Available from: <http://www.cdc.gov/lgbthealth/youth.htm>].
24. Medicine NAO. *Annual Report 2015* 2015 [Available from: <https://nam.edu/wp-content/uploads/2016/06/NAM-Annual-Report-2015.pdf>].
25. 2020 HP. *Healthy People 2020* 2011 [Available from: <https://www.healthypeople.gov/>].
26. Kelleher C. Minority stress and health: Implications for lesbian, gay, bisexual, transgender, and questioning (LGBTQ) young people. *Counselling psychology quarterly*. 2009;22(4):373-9.
27. Russell JA. Core affect and the psychological construction of emotion. *Psychological review*. 2003;110(1):145.

- 1  
2  
3 28. Savin-Williams RC. Mom, dad. I'm gay. How families negotiate coming out:  
4  
5 Washington, DC, US: American Psychological Association; 2001.  
6  
7 29. Remafedi G, French S, Story M, Resnick MD, Blum R. The relationship between suicide  
8  
9 risk and sexual orientation: results of a population-based study. *American journal of public*  
10  
11 *health*. 1998;88(1):57-60.  
12  
13 30. Rice E, Barman-Adhikari A. Internet and social media use as a resource among homeless  
14  
15 youth. *Journal of Computer-Mediated Communication*. 2014;19(2):232-47.  
16  
17 31. Russell ST, Ryan C, Toomey RB, Diaz RM, Sanchez J. Lesbian, gay, bisexual, and  
18  
19 transgender adolescent school victimization: Implications for young adult health and adjustment.  
20  
21 *Journal of School Health*. 2011;81(5):223-30.  
22  
23 32. Toomey RB, Ryan C, Diaz RM, Card NA, Russell ST. Gender-nonconforming lesbian,  
24  
25 gay, bisexual, and transgender youth: school victimization and young adult psychosocial  
26  
27 adjustment. *Developmental psychology*. 2010;46(6):1580.  
28  
29 33. D'Augelli A, Grossman, Arnold H. Disclosure of sexual orientation, victimization, and  
30  
31 mental health among lesbian, gay, and bisexual older adults. *Journal of interpersonal violence*.  
32  
33 2001;16(10):1008-27.  
34  
35 34. Kosciw JG, Greytak EA, Bartkiewicz MJ, Boesen MJ, Palmer NA. The 2011 National  
36  
37 School Climate Survey: The Experiences of Lesbian, Gay, Bisexual and Transgender Youth in  
38  
39 Our Nation's Schools: ERIC; 2012.  
40  
41 35. Clatts MC, Goldsamt L, Yi H, Gwadz MV. Homelessness and drug abuse among young  
42  
43 men who have sex with men in New York City: A preliminary epidemiological trajectory.  
44  
45 *Journal of adolescence*. 2005;28(2):201-14.  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 36. Marshal MP, Goldbach JT, McCauley HL, Shultz ML, Dietz LJ, Montano GT, et al. Gay-  
4 related stress and suicide risk: Articulating three mediated pathways that increase risk for  
5  
6 related stress and suicide risk: Articulating three mediated pathways that increase risk for  
7  
8 suicidality among sexual minority youth. *Advancing the Science of Suicidal Behavior:*  
9  
10 *Understanding and Intervention: Nova Science Publishers, Inc.;* 2014. p. 253-68.  
11  
12 37. Morrison TG, Bishop C, Morrison MA, Parker-Taneo K. A psychometric review of  
13  
14 measures assessing discrimination against sexual minorities. *Journal of Homosexuality.*  
15  
16 2016;63(8):1086-126.  
17  
18 38. Birkett M, Newcomb ME, Mustanski B. Does it get better? A longitudinal analysis of  
19  
20 psychological distress and victimization in lesbian, gay, bisexual, transgender, and questioning  
21  
22 youth. *Journal of Adolescent Health.* 2015;56(3):280-5.  
23  
24 39. Mustanski B, Liu RT. A longitudinal study of predictors of suicide attempts among  
25  
26 lesbian, gay, bisexual, and transgender youth. *Archives of sexual behavior.* 2013;42(3):437-48.  
27  
28 40. Burton CM, Marshal MP, Chisolm DJ, Sucato GS, Friedman MS. Sexual minority-  
29  
30 related victimization as a mediator of mental health disparities in sexual minority youth: A  
31  
32 longitudinal analysis. *Journal of youth and adolescence.* 2013;42(3):394-402.  
33  
34 41. Kaplan D. *Structural equation modeling: Foundations and extensions: Sage Publications;*  
35  
36 2008.  
37  
38 42. Diaz RM, Ayala G, Bein E, Henne J, Marin BV. The impact of homophobia, poverty, and  
39  
40 racism on the mental health of gay and bisexual Latino men: findings from 3 US cities.  
41  
42 *American journal of public health.* 2001;91(6):927.  
43  
44 43. Mereish EH, Bradford JB. Intersecting identities and substance use problems: Sexual  
45  
46 orientation, gender, race, and lifetime substance use problems. *Journal of studies on alcohol and*  
47  
48 *drugs.* 2014;75(1):179-88.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 44. Szymanski DM, Sung MR. Minority stress and psychological distress among Asian  
4 American sexual minority persons 1Ψ7. *The Counseling Psychologist*. 2010;38(6):848-72.  
5  
6  
7
- 8 45. Grossman AH, Haney AP, Edwards P, Alessi EJ, Ardon M, Howell TJ. Lesbian, gay,  
9 bisexual and transgender youth talk about experiencing and coping with school violence: A  
10 qualitative study. *Journal of LGBT Youth*. 2009;6(1):24-46.  
11  
12  
13
- 14 46. Scourfield J, Roen K, McDermott L. Lesbian, gay, bisexual and transgender young  
15 people's experiences of distress: resilience, ambivalence and self-destructive behaviour. *Health &*  
16 *social care in the community*. 2008;16(3):329-36.  
17  
18  
19
- 20 47. Hatzenbuehler ML, Keyes KM. Inclusive anti-bullying policies and reduced risk of  
21 suicide attempts in lesbian and gay youth. *Journal of Adolescent Health*. 2013;53(1):S21-S6.  
22  
23  
24
- 25 48. Goldbach JT, Schragger SM, Mamey MR. Criterion and divergent validity of the sexual  
26 minority adolescent stress inventory. *Frontiers in psychology*. 2017;8:2057.  
27  
28  
29
- 30 49. Schragger SM, Goldbach JT, Mamey MR. Development of the Sexual Minority  
31 Adolescent Stress Inventory. *Frontiers in psychology*. 2018;9:319.  
32  
33  
34
- 35 50. Schragger SM, & Goldbach, J. T. *Minority stress measure development: Theoretical*  
36 *concerns and suggested resolutions*. Berlin, Germany: Logos Verlag; 2017.  
37  
38  
39
- 40 51. Elze DE. Research with sexual minority youths: Where do we go from here? *Journal of*  
41 *Gay & Lesbian Social Services*. 2005;18(2):73-99.  
42  
43  
44
- 45 52. Russell ST, Clarke TJ, Clary J. Are teens “post-gay”? Contemporary adolescents’ sexual  
46 identity labels. *Journal of Youth and Adolescence*. 2009;38(7):884-90.  
47  
48  
49
- 50 53. Gates GJ. How many people are lesbian, gay, bisexual and transgender? 2011.  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



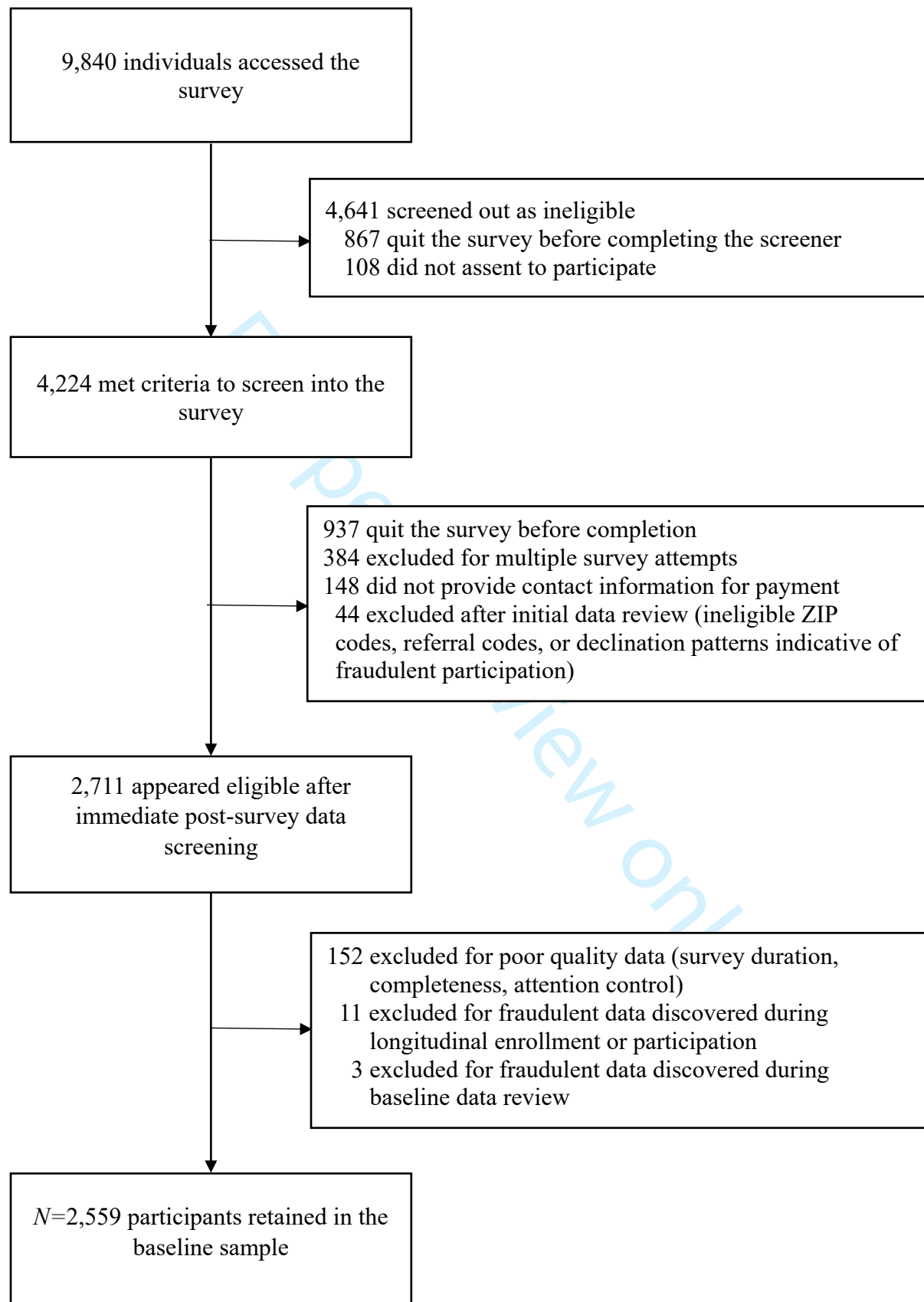
- 1  
2  
3 54. Saewyc EM, Bauer GR, Skay CL, Bearinger LH, Resnick MD, Reis E, et al. Measuring  
4 sexual orientation in adolescent health surveys: Evaluation of eight school-based surveys.  
5  
6 Journal of Adolescent Health. 2004;35(4):345. e1-. e15.  
7  
8  
9  
10 55. Organization WH. Young people's health-a challenge for society: report of a WHO Study  
11 Group on Young People and" Health for All by the Year 2000"[meeting held in Geneva from 4  
12 to 8 June 1984]: World Health Organization; 1986.  
13  
14  
15  
16 56. Mustanski B, Kuper L, Greene GJ. Development of sexual orientation and identity. 2014.  
17  
18  
19 57. Harris, K.M. CTH, E. Whitsel, J. Hussey, J. Tabor, P. Entzel, and J.R. Udry. The  
20 National Longitudinal Study of Adolescent to Adult Health: Research Design 2009 [Available  
21 from: <http://www.cpc.unc.edu/projects/addhealth/design>.  
22  
23  
24  
25  
26 58. Cromartie J. Rural-urban Commuting Area Codes 2020 [Available from:  
27 <https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx>.  
28  
29  
30  
31 59. Heckathorn DD. Respondent-driven sampling: a new approach to the study of hidden  
32 populations. 44. 1997(2):174-99.  
33  
34  
35 60. Aust F, Diedenhofen B, Ullrich S, Musch J. Seriousness checks are useful to improve  
36 data validity in online research. Behavior research methods. 2013;45(2):527-35.  
37  
38  
39  
40 61. Robinson-Cimpian JP. Inaccurate estimation of disparities due to mischievous  
41 responders: Several suggestions to assess conclusions. Educational Researcher. 2014;43(4):171-  
42  
43  
44  
45 85.  
46  
47 62. Bauermeister JA, Pingel E, Zimmerman M, Couper M, Carballo-Diequez A, Strecher VJ.  
48 Data quality in HIV/AIDS web-based surveys: Handling invalid and suspicious data. Field  
49 methods. 2012;24(3):272-91.  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

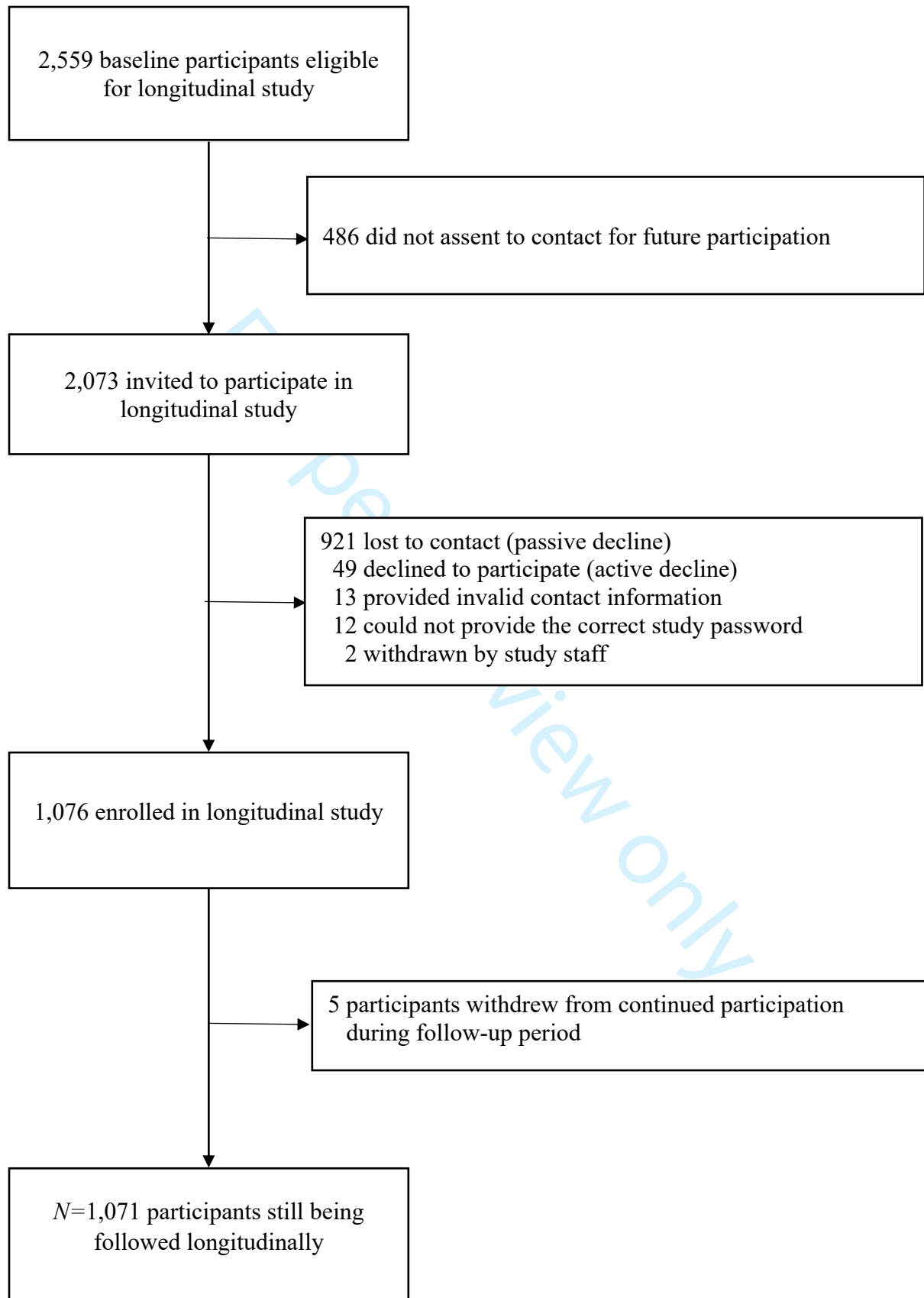
- 1  
2  
3 63. Teitcher JE, Bockting WO, Bauermeister JA, Hoefler CJ, Miner MH, Klitzman RL.  
4  
5 Detecting, preventing, and responding to “fraudsters” in internet research: ethics and tradeoffs.  
6  
7 The Journal of Law, Medicine & Ethics. 2015;43(1):116-33.  
8  
9  
10 64. Grey JA, Konstan J, Iantaffi A, Wilkerson JM, Galos D, Rosser BS. An updated protocol  
11  
12 to detect invalid entries in an online survey of men who have sex with men (MSM): how do valid  
13  
14 and invalid submissions compare? AIDS and Behavior. 2015;19(10):1928-37.  
15  
16  
17 65. Melchior LA, Huba G, Brown VB, Reback CJ. A short depression index for women.  
18  
19 Educational and Psychological Measurement. 1993;53(4):1117-25.  
20  
21  
22 66. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized  
23  
24 anxiety disorder: the GAD-7. Archives of internal medicine. 2006;166(10):1092-7.  
25  
26  
27 67. Lang AJ WK, Roy-Byrne PP, Golinelli D, Chavira D, Sherbourne C, Rose RD,  
28  
29 Bystritsky A, Sullivan G, Craske MG, Stein MB. Abbreviated PTSD Checklist (PCL) as a guide  
30  
31 to clinical response. General hospital psychiatry. 2012;34(4):332-8.  
32  
33  
34 68. (CDC) CfDcAP. Youth Risk Behavior Survey; 2010 2010 [Available from:  
35  
36 <http://www.cdc.gov/yrbs>.  
37  
38 69. Gibbs JJ, Goldbach JT. Religious Identity Dissonance: Understanding How Sexual  
39  
40 Minority Adolescents Manage Antihomosexual Religious Messages. Journal of homosexuality.  
41  
42 2020:1-25.  
43  
44  
45 70. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. Journal of  
46  
47 health and social behavior. 1983:385-96.  
48  
49  
50 71. Cohen S. Perceived stress in a probability sample of the United States. 1988.  
51  
52 72. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived  
53  
54 social support. Journal of personality assessment. 1988;52(1):30-41.  
55  
56  
57  
58  
59  
60

- 1  
2  
3 73. Addison CC, Campbell-Jenkins BW, Sarpong DF, Kibler J, Singh M, Dubbert P, et al.  
4  
5 Psychometric evaluation of a coping strategies inventory short-form (CSI-SF) in the Jackson  
6  
7 heart study cohort. *International journal of environmental research and public health*.  
8  
9 2007;4(4):289-95.  
10  
11  
12 74. Bollen KA, Curran PJ. *Latent curve models: A structural equation perspective*: John  
13  
14 Wiley & Sons; 2006.  
15  
16 75. Curran PJ, Hussong AM. The use of latent trajectory models in psychopathology  
17  
18 research. *Journal of abnormal psychology*. 2003;112(4):526.  
19  
20  
21 76. Curran P, Willoughby M. Reconciling theoretical and statistical models of developmental  
22  
23 processes. *Development and Psychopathology*. 2003;15:581-612.  
24  
25  
26 77. Fox J. *Regression diagnostics: An introduction*: SAGE Publications, Incorporated; 2019.  
27  
28 78. Little RJ, Rubin DB. *Statistical analysis with missing data*: John Wiley & Sons; 2019.  
29  
30 79. Schafer JL. *Analysis of incomplete multivariate data*: Chapman and Hall/CRC; 1997.  
31  
32  
33 80. Borowsky IW, Ireland M, Resnick MD. Adolescent suicide attempts: risks and  
34  
35 protectors. *Pediatrics*. 2001;107(3):485-93.  
36  
37  
38 81. Hu L-T, Bentler PM. *Evaluating model fit*. 1995.  
39  
40 82. Cohen J. *Statistical power analysis for the behavioral sciences*, 2nd edn. Á/L. Erlbaum  
41  
42 Press, Hillsdale, NJ, USA; 1988.  
43  
44  
45 83. Hancock GR, Lawrence FR. Using latent growth models to evaluate longitudinal change.  
46  
47 *Structural equation modeling: A second course*. 2006;2:309-41.  
48  
49 84. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and  
50  
51 comparing indirect effects in multiple mediator models. *Behavior research methods*.  
52  
53 2008;40(3):879-91.  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 85. Mamey MR, Barbosa-Leiker C, McPherson S, Burns GL, Parks C, Roll J. An application  
4 of analyzing the trajectories of two disorders: A parallel piecewise growth model of substance  
5 use and attention-deficit/hyperactivity disorder. *Experimental and clinical psychopharmacology*.  
6 2015;23(6):422.  
7  
8  
9  
10  
11  
12 86. Meredith W, Tisak J. Latent curve analysis. *Psychometrika*. 1990;55(1):107-22.  
13  
14 87. Preacher KJ, Coffman DL. Computing power and minimum sample size for RMSEA.  
15 2006.  
16  
17  
18  
19 88. California UoS. Center for LGBTQ+ Health Equity [Available from:  
20 <https://dworakpeck.usc.edu/research/centers-affiliations/center-for-lgbtq-health-equity-clhe>.  
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3 **Authors' contributions:** S.M. Schrage drafted the initial manuscript and critically revised all  
4 sections. M.R. Mamey drafted the study procedures and measures, developed the analytic plan,  
5 and critically revised the manuscript draft. H. Rhoades developed the study procedures and  
6 critically revised the manuscript draft. J.T. Goldbach developed the introduction, drafted the  
7 patient and public involvement section, and critically revised the manuscript draft. All authors  
8 reviewed and approved the final manuscript.  
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# BMJ Open

## The Adolescent Stress Experiences over Time Study (ASETS) Protocol: Design and Methods of A Prospective Longitudinal Study of Sexual Minority Adolescents in the United States

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3 1 **The Adolescent Stress Experiences over Time Study (ASETS) Protocol:**  
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5 2 **Design and Methods of a Prospective Longitudinal Study of Sexual Minority Adolescents**  
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12 5 Sheree M. Schrager, PhD, MS,<sup>1</sup> Mary Rose Mamey, PhD, MA,<sup>2</sup>

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14 6 Harmony Rhoades, PhD,<sup>2</sup> and Jeremy T. Goldbach, PhD, LMSW<sup>3</sup>  
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19 8 <sup>1</sup>Department of Graduate Studies and Research, California State University, Dominguez Hills,  
20  
21 Carson, California  
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23  
24 10 <sup>2</sup>Suzanne Dworak-Peck School of Social Work, University of Southern California, Los Angeles,  
25  
26 11 California  
27

28 12 <sup>3</sup>Brown School of Social Work, Washington University in St. Louis, St. Louis, Missouri  
29  
30

31 13  
32 14 **Address correspondence to:**

33 15 Sheree M. Schrager, PhD, MS  
34 16 California State University, Dominguez Hills  
35 17 1000 E. Victoria St.  
36 18 Carson, CA 90747  
37 19 Phone: (310) 243-2553  
38 20 Email: sschrager@csudh.edu  
39 21

40  
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## 1 **Abstract**

2 **Introduction:** Sexual minority adolescents (SMA) report higher rates of anxiety, self-harm,  
3 depression and suicide than heterosexual peers. These disparities appear to persist into adulthood  
4 and may worsen for certain subgroups, yet the mechanisms that drive these concerns remain  
5 poorly understood. Minority stress theory, the predominant model for understanding these  
6 disparities, posits that poorer outcomes are due to the stress of living in a violently homophobic  
7 and discriminatory culture. Although numerous studies report associations between minority  
8 stress and behavioral health in adolescence, no study has comprehensively examined how  
9 minority stress may change throughout the course of adolescence, nor how stress trajectories  
10 may predict health outcomes during this critical developmental period.

11 **Methods and analysis:** Between May 15, 2018 and April 1, 2019, we recruited a U.S. national  
12 sample of diverse SMA ( $N = 2,558$ ) age 14-17 through social media and respondent-driven  
13 sampling strategies. A subset of participants ( $N = 1,076$ ) enrolled in the longitudinal component  
14 and will be followed each six months until July 1, 2022. Primary outcomes include symptoms of  
15 depression, anxiety, and PTSD; suicidality and self-harm; and substance use. The key predictor  
16 is minority stress, operationalized as the Sexual Minority Adolescent Stress Inventory. We will  
17 use parallel cohort-sequential latent growth curve models to test study hypotheses within a  
18 developmental framework.

19 **Ethics and dissemination:** All participants provided assent to participate, and longitudinal  
20 participants provided informed consent at the first follow-up survey after reaching age 18. All  
21 study procedures were reviewed and approved by the University of Southern California Social-  
22 Behavioral Institutional Review Board, including a waiver of parental permission given the  
23 potential for harm due to unintentional “outing” to a parent during the consent process. The final

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- 1 anonymous data set will be available upon request, and research findings will be disseminated
- 2 through academic channels and products tailored for the lay community.

For peer review only

## 1 **Strengths and Limitations of This Study**

- 2 • This study leverages a newly developed, valid and psychometrically sound measure of  
3 minority stress in a large, diverse national sample of adolescents.
- 4 • The longitudinal cohort design permits the first examination of change in minority stress  
5 experiences over time among adolescents.
- 6 • The cohort sequential modeling approach also supports the first examination of how  
7 minority stress influences health across adolescence.
- 8 • All outcome measures are self-reported and may be subject to recall and responses  
9 biases; no confirmatory behavioral data will be collected.
- 10 • Generalizability of study findings may be constrained by study eligibility criteria, strict  
11 data quality procedures, and recruitment methods.

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3 1 **The Adolescent Stress Experiences over Time Study (ASETS) Protocol:**  
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8 3 **in the United States**  
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10 4 **Introduction**  
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12 5 Sexual minority (e.g., lesbian, gay, bisexual, pansexual) adolescents (SMA) experience  
13 6 significant behavioral health disparities compared to their heterosexual peers. In particular, SMA  
14 7 experience higher rates of internalizing psychopathology including depression, anxiety and self-  
15 8 harm<sup>(1-7)</sup> and externalizing behaviors such as substance use<sup>(8-11)</sup> and suicide attempt and  
16 9 completion.<sup>(12-14)</sup> Longitudinal studies suggest that these disparities persist into young adulthood  
17 10 and may even worsen. For example, data from a national study of adolescents (*Add Health*)  
18 11 showed that average longitudinal trajectories for substance use among SMA are disparate from  
19 12 heterosexual youth beginning in early adolescence and increase as youth transition into young  
20 13 adulthood.<sup>(15)</sup> When examining individual trajectories of suicidality, all sexual minority groups  
21 14 (lesbian, gay, bisexual, mostly heterosexual) reported higher rates of suicidality across all four  
22 15 waves than their heterosexual peers, from mid-adolescence to early adulthood,<sup>(16)</sup> a phenomenon  
23 16 also found in a recent systematic review by Gilbey et al.<sup>(17)</sup>

24 17 There are also behavioral health disparities among SMA by demographic subgroup. For  
25 18 example, sexual minority girls are more likely to report both considering and attempting suicide  
26 19 than sexual minority boys,<sup>(18, 19)</sup> and bisexual youth show larger substance use disparities than  
27 20 other sexual minority groups.<sup>(15)</sup> SMA living in rural areas also experience different behavioral  
28 21 health outcomes than their urban counterparts due to confidentiality concerns, values, and limited  
29 22 access to cities with more extensive peer networks<sup>(20)</sup> and a more comprehensive social support  
30 23 system.<sup>(21)</sup> As there are likely to be subgroup differences among racial and ethnic lines as well,

1 scholars have called for attention to racial and ethnic diversity in sexual minority research  
2 generally.<sup>(22-24)</sup> Even in large meta-analytic studies that include adolescents and/or young adults,  
3 the lack of racial and ethnic diversity in sampling is noted as a significant limitation that often  
4 precludes subgroup comparisons.<sup>(19, 25)</sup> Recent studies of Black<sup>(26)</sup> and Latinx<sup>(27)</sup> adolescents do  
5 suggest that intersectional differences may exist, and understanding their experience is  
6 increasingly relevant: although population estimates specific to adolescents are lacking, national  
7 survey data suggest that racial and ethnic minority youth are more likely than white segments of  
8 the U.S. population to identify as SMA.<sup>(28)</sup>

9       The primary theoretical framework for understanding the disparities found among sexual  
10 minorities is the minority stress theory (MST),<sup>(29-31)</sup> which has been endorsed by the Centers for  
11 Disease Control and Prevention,<sup>(32)</sup> the National Academy of Medicine,<sup>(33)</sup> and Healthy People  
12 2030.<sup>(34)</sup> MST suggests that discrimination, violence, and victimization due to a pervasive  
13 homophobic culture are the primary sources of stress and most probable driving mechanisms of  
14 mental health disparities among sexual minorities, including SMA.<sup>(30, 35-38)</sup> Numerous cross-  
15 sectional studies have attributed poor behavioral health outcomes among adolescents to minority  
16 stressors, such as negative disclosure experiences with family and peers,<sup>(1, 36, 37, 39)</sup> becoming  
17 homeless upon disclosure,<sup>(40)</sup> in-school victimization (bullying) by students and faculty  
18 members,<sup>(41-43)</sup> and experiences of violence.<sup>(19, 44-46)</sup> However, no study has ever comprehensively  
19 examined the relationship between minority stress and health outcomes longitudinally among  
20 adolescents. Despite recognition that stigmatizing experiences can disrupt adolescent  
21 development and contribute to negative outcomes,<sup>(47)</sup> the gap between theoretically predicted  
22 relationships and empirical evidence to support them is largely due to four key concerns:

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3 1 (1) Studies of minority stress during adolescence have been fraught with *poor psychometric*  
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5 2 *measurement*.<sup>(20, 48)</sup> A review of psychometric measurements assessing discrimination  
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7 3 against sexual minorities found that across 162 articles, nearly all had suboptimal  
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9 4 psychometric properties.<sup>(49)</sup> Few studies have used empirically validated measures, and most  
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11 5 measures had been developed using small investigator-led samples or adapted from  
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13 6 measures with adults in other minority populations.<sup>(25)</sup> Previously available general stress  
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15 7 measures, even those validated for use with adolescents, do not allow us to differentiate  
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17 8 between common developmental stressors and those associated with minority stress.  
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21 9 (2) There is an absence of studies examining minority stress and behavioral health in  
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23 10 adolescents *over time*. Only six studies (with four unique samples) have examined the  
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25 11 relationship between minority stress and subsequent behavioral health outcomes, and each  
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27 12 has several major limitations: (a) lack of a well-constructed comprehensive measure of  
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29 13 minority stress for adolescents; (b) reliance on small regional samples; and (c) lack of  
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31 14 repeated-measures analyses and trajectory modeling to assess patterns of change in minority  
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33 15 stress during this critical developmental time period.<sup>(31, 50-52)</sup> Although the field has generally  
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35 16 assumed minority stress is the most probable cause of persisting behavioral health concerns  
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37 17 among SMA, no study has examined this directly. As a related concern, no studies have  
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39 18 provided evidence that SMA can be effectively retained over time outside of general  
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41 19 population studies. Although not a primary outcome of the current study, establishing the  
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43 20 feasibility of population retention is a critical step for future prospective research.  
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49 21 (3) Although some *subgroup differences* in behavioral health outcomes have been documented  
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51 22 among adolescents, their determinants are not well understood. As previously described,  
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53 23 differential outcomes are noted in sexual minority samples by race, ethnicity, gender, and  
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1 geography, and authors have called for increased attention to subgroup analyses in future  
2 research.<sup>(16, 19, 25, 53)</sup> These experiences have been explored in primarily young adult and  
3 adult samples.<sup>(54-56)</sup> Although some evidence is emerging to support the assumption is that  
4 minority stress also drives these disparities,<sup>(43, 57-61)</sup> few studies have systematically explored  
5 subgroup differences in minority stress over time, particularly among youth. A large study  
6 that is well-powered to examine differences among multiple demographic groups – that is,  
7 able to model more than simple binary comparisons – remains needed.

8 (4) The presence or absence of *protective factors* may add to the confusion. Some studies  
9 suggest avoidance strategies<sup>(62)</sup> or emotionally focused cognitive restructuring<sup>(63)</sup> may be  
10 helpful; others have recommended finding accepting friends, having supportive parents or  
11 family members, identifying supportive adults at school, and relying on SMA community  
12 resources (e.g., gay–straight alliances, SMA community centers) as methods for coping with  
13 minority stress.<sup>(21)</sup> However, not all subgroups of SMA may have these opportunities. For  
14 example, youth who live in rural areas may have less access to affirming resources<sup>(20)</sup> and be  
15 more likely to live in areas with less protective school policies.<sup>(64)</sup> Thus, the relationships  
16 between minority stress, demographics, protective factors and outcomes remain poorly  
17 understood.

18 The current study is the first to address these four major gaps in the extant literature. We  
19 can now measure minority stress in adolescents with a psychometrically sound instrument, the  
20 Sexual Minority Adolescent Stress Inventory (SMASI), which was developed and validated by  
21 the research team in prior work funded by the National Institutes of Health (NIH).<sup>(65-67)</sup> Using  
22 this measure, we will conduct a systematic investigation of minority stressors and behavioral  
23 health over time in a large, diverse national sample. With repeated measures of minority stress



1 and a modeling approach (cohort sequential latent growth curve modeling – see *Data Analysis*)  
2 that considers change across age rather than time, we can answer questions not previously  
3 addressed, such as whether minority stress increases over time as young teenagers develop  
4 throughout adolescence; when do minority stressors peak; whether there are demographic  
5 differences in the frequency, severity and pattern of minority stressors; and whether changes in  
6 minority stressors over time predict corresponding changes in health outcomes over time.  
7 Furthermore, we can test whether trajectories of minority stress are inversely associated with  
8 protective factors over time and if they too differ by demographic subgroup.

9 Thus, the present study will serve as one of the first longitudinal studies conducted with  
10 this vulnerable population. We address critical methodological design factors necessary to  
11 conduct high-quality longitudinal research with SMA, including: (a) a safe and effective  
12 recruitment approach, with built-in mechanisms to protect SMA from being “outed” via study  
13 participation, which could increase risk of victimization (e.g., kicked out of home); (b) repeated  
14 measures over time of important psychosocial predictors and outcomes; (c) recruitment of  
15 participants at ages 14–17, because they are a particularly neglected subpopulation in SMA  
16 studies;<sup>(68)</sup> and (d) respondent-driven sampling methods to recruit youth who may have not  
17 disclosed their sexual orientation to others, including their parents, resulting in a lack of both  
18 scientific and clinical understanding about them. Upon completion, the study will provide critical  
19 information needed to inform the nature and timing of intervention efforts for this high-need,  
20 underserved, and difficult-to-reach population of youth.

## 21 **Methods and Analysis**

### 22 **Sample Selection**

1           *Population Definition.* Recent studies suggest that upwards of 15% of youth do not  
2 identify as exclusively heterosexual.<sup>(69, 70)</sup> Throughout this protocol, we use the term *sexual*  
3 *minority adolescents*, or SMA, to refer to adolescent individuals who endorse same-sex attraction  
4 or identity. Attraction includes romantic or sexual feelings, whereas identity describes how youth  
5 label themselves (e.g., lesbian, gay, bisexual).<sup>(71)</sup> These are consistent with constructs commonly  
6 used to operationalize sexual orientation.<sup>(72, 73)</sup> We recognize *adolescents* generally as youth aged  
7 13 to 20, a common international convention.<sup>(74)</sup> However, we restricted recruitment in this study  
8 to youth aged 14 to 17, as we have in our preliminary work, given literature suggesting youth  
9 commonly begin to define their sexual identity during these years.<sup>(75)</sup> We also required  
10 participants to be cisgender, i.e., to express a gender identity congruent with their sex assigned at  
11 birth, at the time of recruitment. At the time this study was open to enrollment, the SMASI had  
12 only been validated with cisgender adolescents. As the primary purpose of this study was the  
13 longitudinal validation of the SMASI instrument, we chose to mirror the inclusion criteria on  
14 which the SMASI was initially developed and validated in order to reduce error variance when  
15 assessing minority stress attributable to sexual identity, given the present inability to differentiate  
16 between sexual and gender minority stress among adolescents who are both sexual and gender  
17 minorities. Although transgender and nonbinary youth were excluded from enrolling in the  
18 baseline sample, maintaining a cisgender identity over time was not a requirement for  
19 continuation in the longitudinal portion of the study; indeed, we expect changes in gender  
20 identity over time, and will assess those in later waves (see *Measures*).<sup>(76)</sup> A separate NIH-  
21 funded study (R21HD082813-01A1) is now underway to examine gender minority stress among  
22 transgender and nonbinary youth and parse out sexual versus gender minority stress experiences.

1            *Study Eligibility.* Youth were eligible to participate in the study if they were at least 14  
 2 and no more than 17 years old; were cisgender male or female (i.e., reported a current gender  
 3 identity consistent with their sex assigned at birth); resided in the United States, as determined by  
 4 ZIP code; identified as not 100% heterosexual using *Add Health* guidelines (i.e., identified as  
 5 mostly heterosexual, bisexual, gay, lesbian, or unsure);<sup>(77)</sup> and were willing and able to provide  
 6 assent to participate.

7            *Stratification Variables.* To ensure geographic diversity, ZIP code was recoded into two  
 8 additional variables: region and urbanicity. Region (West, Southwest, Midwest, Northeast, and  
 9 Southeast; Table 1) was based on the state associated with the participant's reported ZIP code.

10            Table 1. Assignment of U.S. states to regions.

U.S. Region	U.S. States		
West	Alaska	Idaho	Utah
	California	Montana	Washington
	Colorado	Nevada	Wyoming
	Hawaii	Oregon	
Southwest	Arizona	Oklahoma	Texas
	New Mexico		
Midwest	Illinois	Michigan	North Dakota
	Indiana	Minnesota	Ohio
	Iowa	Missouri	South Dakota
	Kansas	Nebraska	Wisconsin
Northeast	Connecticut	Massachusetts	Pennsylvania
	Delaware	New Hampshire	Rhode Island
	Maine	New Jersey	Vermont
	Maryland	New York	
Southeast	Alabama	Kentucky	South Carolina
	Arkansas	Louisiana	Tennessee
	Florida	Mississippi	Virginia
	Georgia	North Carolina	West Virginia

11  
 12            Urbanicity (rural or urban) was determined based on the Rural Urban Commuting Area  
 13 (RUCA)<sup>(78)</sup> codes. Specifically, “urban” was defined as a ZIP code corresponding to RUCA

1 codes of 1.0, 1.1, 2.0, 2.1, 4.1, 5.1, 7.1, 8.1, and 10.1. “Rural” was defined as all other valid  
2 RUCA codes. When a ZIP code was associated with a RUCA 3.1 score, that score was used; for  
3 ZIPs that were not assigned a RUCA 3.1 score due to changes in the classification system  
4 between RUCA versions 2 and 3, the RUCA 2.0 score was used.

## 5 **Participant Recruitment**

6 *Targeted Advertising.* Initial participants were recruited through advertising on  
7 Facebook/Instagram (which now share a single advertising platform) and YouTube.  
8 Advertisements varied slightly by platform, but all included language asking youth to “Share  
9 Your Voice” and described basic details of the research study and incentives that participants  
10 could earn. Advertising was stratified by gender, geographic region, and urbanicity. This resulted  
11 in 20 target cohorts, as each of the five regions encompassed four unique groups: rural males,  
12 rural females, urban males, and urban females. We used two different sets of advertising images:  
13 one featuring females (for the female groups) and one featuring males (for the male groups). To  
14 reach each of these groups, general specifications included age (14-17 years), gender (women or  
15 men), and location. Facebook/Instagram allows bulk uploading of up to 2,500 ZIP codes per ad.  
16 A total of 44 targeted ads were required to reach all possible combinations of region, urbanicity,  
17 and gender, as some combinations included nearly 10,000 eligible ZIP codes.  
18 Facebook/Instagram also allows advertisers to target audiences based on interests. Using  
19 keywords enumerated by members of the research team, we identified specific interest terms by  
20 gender. Male-targeted interests included Gay-friendly; Gay, Lesbian, Bisexual, Transgender,  
21 Straight Alliance; Homosexuality; LGBT community; LGBT symbols; and Pansexuality.  
22 Female-targeted interests included all of the male-targeted interest keywords plus Lesbian  
23 Connection and Lesbian Romance.

1 Simultaneously, the research team identified YouTube channels for review using  
2 keywords including LGBTQ, gay, coming out, transition, and trans. Channels were reviewed for  
3 visibility, reach, and engagement of each channel, operationalized as the number of subscribers  
4 per channel and number of video views for each channel's three most-viewed videos. We  
5 initially identified 47 possible YouTube channels that had high visibility and engagement among  
6 LGBTQ+ adolescents, using a combination of keyword searches (e.g., LGBTQ, gay, coming out,  
7 transition) and subscriber and video view counts; after reviewing this list, we advertised to 23  
8 channels that were verified YouTube accounts, able to accept advertisements, and agreed up on  
9 by the study team as being relevant to sexual minority adolescents. Using the Google advertising  
10 system, we placed advertisements for the ASETS study directly on the pages of those channels.

11 *Respondent-Driven Sampling.* Respondent-Driven Sampling (RDS) is a type of chain-  
12 referral sampling that allows for identified members of a hidden group, called "seeds," to recruit  
13 other group members from their personal networks.<sup>(79)</sup> Participants who completed their survey  
14 and were initially deemed eligible for retention were asked if they might be interested in  
15 referring friends who they thought might be eligible to participate. Participants who confirmed  
16 their interest in referring friends to the study were provided with an email that contained three  
17 unique survey links as well as two different language prompts to encourage peers to participate.  
18 In return for successfully recruiting an eligible participant who completed the survey, the  
19 recruiter participant (seed) was paid \$10 per referral for up to three eligible participants.

## 20 **Baseline Study Procedures**

21 *Initial Eligibility Screening.* Advertisement clicks and referral links all directed youth to a  
22 screening page in Qualtrics that asked a series of demographic questions to determine their  
23 eligibility based on age in years, gender, ZIP code, and sexual attraction. Ineligible participants

1 were thanked for their interest in the study and then re-routed to a separate Qualtrics survey  
2 where they could optionally provide contact information (email and/or phone number) to be  
3 included in outreach for future studies. Eligible participants were shown the Institutional Review  
4 Board (IRB)-approved study assent text and asked to confirm assent in order to proceed with the  
5 main survey, implemented in Qualtrics (see *Measures*).

6 *Post-Survey Data Collection.* After completing the survey, the participant was re-routed  
7 to a separate Qualtrics survey for payment in order to keep their personally identifiable  
8 information separate from their main study data. This payment survey asked the participant for  
9 their private email address at which to receive an electronic gift card. Participants were also  
10 asked if they knew other sexual minority youth, and if so, whether they would consider referring  
11 any of those youth into the study, to aid RDS recruitment. Finally, participants were asked  
12 whether they would be interested in participating in the longitudinal study and given fields to  
13 provide up to five different contact methods if so. Contact options included email, phone  
14 numbers for call/text, and usernames for Facebook, Twitter, Snapchat, and any other social  
15 media accounts that allow for personal messaging. Participants were able to rank their provided  
16 methods of contact in order of preference. This step in the process was critical to establishing  
17 retention for the longitudinal study.

18 *Final Eligibility Determination.* Each business day a study team member downloaded any  
19 new surveys from Qualtrics. Variables were created to represent region, urbanicity, response  
20 declinations (total number of “Decline to answer” responses across the entire survey); survey  
21 duration, and attention validation (number of attention-control questions the respondent  
22 answered correctly).<sup>(80)</sup> Participants who failed to complete the entirety of the survey—that is,  
23 they exited the survey prior to completing and being routed to the payment survey—were

1 excluded and could not be paid due to lack of contact information. Participants determined to  
2 have engaged in any type of fraudulent activity were also immediately excluded from both study  
3 eligibility and pay. “Fraudulent activity” included providing information or response patterns,  
4 either within the main survey data or on the payment and contact information survey, that  
5 confirmed duplicate response by a previous participant, or screening out of a first survey attempt  
6 (i.e., determined to be ineligible) and immediately re-accessing the survey with false responses in  
7 an attempt to access the full survey.<sup>(81-84)</sup> Fraudulent participants were identified by duplicate IP  
8 address, duplicate email and/or contact information, similar patterned responses throughout  
9 survey (including open-ended responses with identical or unique wording), and/or survey time  
10 stamps. Fraudulent participation was not compensated even if sufficient contact information was  
11 provided.

12 Participants who completed the survey but provided very low quality data, defined as  
13 either an unrealistically short survey completion time ( $\leq 10$  minutes), a low attention-control  
14 score ( $\leq 1$  out of 4 correct responses), or very high ( $\geq 35$ ) “Decline to answer” response count,  
15 were compensated for their participation but were excluded from the baseline dataset and not  
16 invited to participate in the longitudinal study or refer peers via RDS. Participants who had  
17 survey duration times of 10 – 15 minutes, attention-control scores of 2, and moderately high  
18 ( $\geq 25$ ) responses of “Decline to answer” were compensated for participation and further evaluated  
19 for inclusion on a case-by-case basis. By applying all of the above-described procedures prior to  
20 longitudinal recruitment, we ensured that only participants who provided valid and trustworthy  
21 data would be enrolled in the longitudinal study.

22 *Incentive Compensation.* All baseline participants who were eligible for compensation,  
23 whether or not their data were retained for analysis, were sent a \$15 Amazon gift card to the

1 private email address they provided in the payment survey. Participants whose data were retained  
2 for analyses were assigned a unique four-digit participant identifier at this time.

3 All participants were recruited into the study and completed their baseline surveys ( $N =$   
4 2,558) between May 15, 2018 and April 1, 2019. Figure 1 illustrates the number of individuals  
5 retained and excluded at each step of the baseline recruitment and data collection process.

## 6 **Longitudinal Study Procedures**

7 *Longitudinal Enrollment.* Approximately one week from the date of a participant's  
8 baseline survey completion, participants who expressed interest in longitudinal participation  
9 were entered into a master tracking log file. This artificial delay helped ensure that we could  
10 detect participants willing to engage in fraudulent behavior, including participants who were  
11 trying to take the baseline survey multiple times in an attempt to receive multiple payments, prior  
12 to inviting them to be part of the longitudinal study. Participants who reached this longitudinal  
13 recruitment stage were contacted by a research assistant in real-time via the participant's  
14 preferred contact method, using a study-specific username or account shared by the research  
15 team. Participants were first reminded that they recently completed an online survey.

16 In an effort to protect their privacy and ensure that we were speaking with the right  
17 individual, we asked them to please tell us what that survey was about. Participants who  
18 provided the correct information (e.g., "LGBT youth") were asked if they were interested in  
19 learning more about the longitudinal study. Participants who expressed interest were given  
20 information about the study outlining their involvement, including a written information sheet.  
21 Those who agreed to participate were then asked to confirm or update their contact information,  
22 and the research assistant verified the participant could receive emails from the study team that  
23 did not end up in their spam/junk folders. Participants were reminded that the study team's next



1 contact with them would be through an automated monthly check-in survey every month (see  
2 *Monthly Check-In Surveys*) and that they would receive an email in approximately six months for  
3 their next full survey. Finally, they were provided with all methods of contact to reach the study  
4 team and were encouraged to reach out in the event they had questions, concerns, or comments.

5 *RDS Referrals.* Longitudinally enrolled participants were given the option to refer peers  
6 into the baseline survey for an additional incentive, i.e., RDS referrals. Participants who stated  
7 they may know others who might be interested were provided three custom Qualtrics referral  
8 links, which contained an embedded RDS code that both identified the new participant as an  
9 RDS referral and allowed the study team to link the new survey to the referring participant for a  
10 referral payment. All referred participants went through the same validation, eligibility, and  
11 payment process as those who entered the study through direct outreach methods. Additionally,  
12 the participant who referred them was provided with a \$10 Amazon gift card as a referral  
13 incentive. Referrers were not paid referral incentives for distribution of survey links to youth  
14 who were ineligible for participation or those whose surveys were excluded from retention due to  
15 low data quality. Participants who attempted to refer themselves were easily identified by the  
16 quality assurance protocol previously described; in the case of self-referrals, the participant was  
17 immediately excluded from both the baseline and longitudinal study due to their demonstrated  
18 willingness to defraud the study team.

19 *Monthly Check-In Surveys.* Because the study was conducted entirely online, having up-  
20 to-date contact information for all participants was of critical importance. Additionally, with six  
21 months in between full surveys, it was important to have more regular contact with participants  
22 in order to maintain rapport and interest in the study. Thus, a brief check-in survey, consisting of  
23 one item asking whether any of the participant's contact information had changed within the last

1 30 days, was automatically emailed to each longitudinal participant near the first day of every  
2  
3 month. If a participant indicated that their contact information had changed, they were then  
4  
5 prompted to provide any new or updated contact information. If a participant failed to respond  
6  
7  
8 to the automated check-in survey by the 15th of each month, a research assistant would manually  
9  
10 reach out to them once through each of the participant's preferred contact methods. Each check-  
11  
12 in survey was accompanied by a raffle where all respondents to the check-in survey within the  
13  
14 calendar month were entered into a random drawing to receive a \$100 Amazon gift card,  
15  
16  
17 regardless of whether their contact information had changed.  
18  
19  
20  
21

22 *Longitudinal Follow-Up Surveys.* A unique link to each Qualtrics follow-up survey was  
23  
24 created by the study team for each participant. This link, provided to the participant once they  
25  
26 became eligible to complete the survey, contained embedded information about the date on  
27  
28 which they completed their previous survey along with their assigned unique participant  
29  
30 identifier. This allowed information about prior participation dates to be pre-populated in survey  
31  
32 items requesting retrospective information in an effort to aid in recall.  
33  
34

35 At the start of every week, all participants whose follow-up survey date fell within that  
36  
37 week (i.e., a multiple of 6 months after their baseline survey date) were sent an automated survey  
38  
39 link in an email from the Qualtrics platform. Automated messages were sent on Monday,  
40  
41 Wednesday, and Sunday of the first week of eligibility. Participants who failed to complete their  
42  
43 follow-up survey by the third automated attempt would begin to receive manual messages from  
44  
45 research assistants containing their unique embedded survey link. Manual attempts to contact the  
46  
47 participant were first sent via the participant's most recently indicated preferred contact method.  
48  
49  
50 After three months, their survey window would close and participants would not be able to  
51  
52 complete that wave of data collection to ensure any two consecutive waves of data collection  
53  
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1 would reflect a minimum time difference of three months apart. Follow-up data collection began  
2 on August 15, 2018, and will conclude on July 1, 2022 when the three-month window of the 36-  
3 month survey closes.

4 *Longitudinal Eligibility and Payment Determination.* When a participant completed a  
5 follow-up survey, the participant was re-routed to the separate Qualtrics survey page for payment  
6 using the same procedures as at baseline. Each business day a study team member would access  
7 the main survey through Qualtrics and download the previous day's surveys. Variables were  
8 again created in each follow-up dataset including survey duration, attention control score, and  
9 count of "decline to answer" responses. Participants who failed to complete the entire survey or  
10 who had very low quality data (as defined above), were encouraged to retake the survey with an  
11 explanation provided as to why they were asked to retake the survey. This outreach process  
12 continued for five total manual attempts alternating every other day. This process was replicated  
13 at all subsequent survey waves. The longitudinal enrollment and retention diagram is shown in  
14 Figure 2; to date, six participants have withdrawn from continued follow-up, bringing the  
15 longitudinal sample to  $N=1,070$ .

## 16 **Measures**

17 Beginning with baseline data collection, the following measures were collected:

18 *Outcomes.* We focus analysis on understanding behavioral health, consistent with  
19 terminology from the Substance Abuse and Mental Health Services Administration,<sup>(49)</sup> to  
20 describe an integrated approach focused on the promotion of emotional health and prevention of  
21 mental illness, alcohol and other drug use, and associated outcomes (e.g., suicide). Behavioral  
22 health outcomes included: *depressive symptoms*, measured with the CESD-4;<sup>(85)</sup> *anxiety*,  
23 assessed with the Generalized Anxiety Disorder 7-item measure (GAD-7);<sup>(86)</sup> symptoms of *Post-*

1  
2  
3 1 *Traumatic Stress Disorder* (PTSD),<sup>(87)</sup> using the Abbreviated PTSD Checklist-Civilian (PCL-C);  
4  
5 2 and five questions from the Youth Risk Behavior Survey (YRBS) to assess *suicidality and self-*  
6  
7 3 *injury*.<sup>(88)</sup> All responses were recoded to binary indicators of suicidal ideation, plan, attempt,  
8  
9 4 attempt resulting in injury, and self-injurious behavior. Finally, YRBS items were also used to  
10  
11 5 assess lifetime and past-30-day *substance use*,<sup>(88)</sup> including binary indicators of whether a  
12  
13 6 participant had used alcohol, tobacco, marijuana, prescription pain relievers, prescription  
14  
15 7 tranquilizers, and prescription stimulants.

16  
17  
18  
19 8 *Key Predictor: Minority Stress.* The focal measure in this study is the Sexual Minority  
20  
21 9 Adolescent Stress Inventory<sup>(65-67)</sup> (SMASI; whole-scale omega ( $\omega$ )=.97), which relies on 54 main  
22  
23 10 items to measure 10 domains of minority stress: social marginalization (8 items,  $\omega$ =.93), family  
24  
25 11 rejection (11 items,  $\omega$ =.94), internalized homonegativity (7 items,  $\omega$ =.94), identity management  
26  
27 12 (3 items,  $\omega$ =.77), homonegative climate (4 items,  $\omega$ =.88), intersectionality (3 items,  $\omega$ =.82),  
28  
29 13 negative disclosure experiences (5 items,  $\omega$ =.77), religion (5 items,  $\omega$ =.93), negative  
30  
31 14 expectancies (3 items,  $\omega$ =.81), and homonegative communication (5 items,  $\omega$ =.77). An optional  
32  
33 15 subscale assessed stress experiences at work among youth with any work history (10 items,  
34  
35 16  $\omega$ =.96). At baseline, youth were asked if they have had each experience “ever” and “in the past  
36  
37 17 30 days;” the stem language changes to “since [they] last took the survey” and “in the past 30  
38  
39 18 days” at subsequent time points.

40  
41  
42  
43  
44 19 *Demographic Covariates.* Variables used for eligibility screening included *age* (in years).  
45  
46 20 *Sex assigned at birth* (male or female) was used in concert with *gender identity* (response options  
47  
48 21 included: male; female; trans male/trans man; trans female/trans woman; genderqueer; gender  
49  
50 22 nonconforming; nonbinary; gender identity not listed here) to determine cisgender status. For  
51  
52 23 eligibility screening that depended on survey programming logic, *sexual minority identity* was  
53  
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56  
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60

1 determined with the recommended item from Add Health guidelines:<sup>(77)</sup> “If you had to pick one  
2 of the following options, please choose the description that best fits how you think about  
3 yourself,” with all response options other than “100% heterosexual (straight)” qualifying for  
4 eligibility. ZIP code was assessed to verify *U.S. residence* and subsequently recoded for  
5 stratification into *urbanicity* and *region* as previously described.

6 Additional demographic variables included open-ended *sexual identity*, assessed by  
7 asking “What would you say is your sexual orientation or identity?” and a text box for an open-  
8 ended responses that could be recoded for later analyses. *Race and ethnicity* was a forced-choice  
9 item with response options of Native American/American Indian/Alaska Native; Asian/Pacific  
10 Islander; Black or African American; White/Caucasian; Latino/Hispanic; Multi-racial (with a  
11 text box to specify); and Race/ethnicity not listed here (with a text box to specify). Gender  
12 expression was captured with one item asking, “A person's appearance, style, dress, or the way  
13 they walk or talk may affect how people describe them. How do you think other people would  
14 describe you?” Response options were on a 7-point Likert-type scale from “Very feminine” to  
15 “Very masculine.” *School enrollment* was captured with a binary indicator of whether  
16 participants are currently enrolled in school, and *educational attainment* measured the highest  
17 grade already completed (less than 7th grade; 7th grade; 8th grade; 9th grade; 10th grade; 11th  
18 grade; High school graduate or GED; Some college; Trade school certification or Associate's  
19 (AA) degree; Bachelor's (BA/BS) degree or higher). Additionally, participants were asked  
20 whether they were eligible for free or reduced-price lunch at the school they most recently  
21 attended as a proxy for *socioeconomic status* (response options: “Yes,” “No,” “I don't know”).  
22 *Work status* was assessed with one item asking whether participants are currently working, with  
23 response options of “Yes, full-time”; “Yes, part-time”; “No, but I have previously had a job”; or

1 “No, and I have not previously had a job”. In follow-up surveys, participants were asked  
2 whether they had worked since the last time they took the survey (“Yes” or “No”). *Living*  
3 *situation* was assessed by asking participants with whom do they currently live. Response  
4 options included: two parents; mother only; father only; grandparents or other relatives; foster  
5 parents; group home; alone or with roommates in own apartment or home;  
6 boyfriend/girlfriend/romantic partner/spouse; with friends or couch-surfing; homeless or on the  
7 street; and other (with a text box to specify). Participants were asked whether they had become  
8 involved in the *foster care system* (“Yes”, “No”, or “Unsure”). Participants were asked about  
9 their *primary language* spoken a) at home and b) with their friends; response options included  
10 English; Spanish; or another language (with text box to specify). Participants were asked to  
11 indicate their personal and family religion from a comprehensive list.<sup>(89)</sup> Although not used in the  
12 eligibility process, sexual attraction to men, women, and gender nonconforming people was also  
13 assessed with Likert-type response options ranging from “Not at all” to “Extremely.”

14 *Theoretical Covariates and Protective Factors.* Participants completed the Perceived  
15 Stress Scale (PSS), a measure of *general stress*,<sup>(90, 91)</sup> to ensure we can control for other common  
16 adolescent stress experiences unrelated to minority stress. *Social support*<sup>(92)</sup> from friends, family,  
17 and a significant other was measured with the Multidimensional Scale of Perceived Social  
18 Support. *Disclosure* questions were asked to understand categories of individuals who may know  
19 the participant is LGBTQ (baseline) or to whom, if anyone, the participant has disclosed their  
20 sexual orientation to for the first time since the last survey (follow-up surveys). Options  
21 included: mother; father; siblings; other adult relatives; peers/supervisor(s) at work; members of  
22 the participant’s religious community; teacher(s); peers at school, childhood friends;  
23 heterosexual friends; LGBTQ friends; and girlfriend/boyfriend/partner. Response options were

1 “Yes” (selected if they had disclosed to one or more of the people in the stated category), “No”  
2 (selected if they had not disclosed to anyone in that category), or “Not Applicable” (if they did  
3 not have the listed person in their life).

4 A series of binary items assessed the presence of supportive resources such as *gay-*  
5 *straight alliances (GSA)* and *mentorship*, as follows: Three items captured whether the person  
6 currently had regular access to a GSA; whether their current (or most recently attended) school  
7 has a group or club specific to the LGBTQ+ community; and whether they participated in  
8 meetings or activities sponsored by an LGBTQ+ club at their school (or most recently attended  
9 school). Participants were also asked whether there is an adult 25 years or older, currently in  
10 their life, who they consider to be a mentor. Those who responded “yes” were asked whether this  
11 person is part of their immediate family; if they responded yes, they received an additional  
12 question asking, “Other than an immediate family member (or the person who raised you), is  
13 there an adult 25 years or older who you consider to be your mentor?” These items were recoded  
14 into a binary item reflecting the presence or absence of a non-family mentor age 25 or older.

15 Finally, adolescent *coping strategies* were captured with the Coping Strategies Inventory-  
16 Short Form,<sup>(93)</sup> which includes 16 items on four subscales (problem-focused engagement;  
17 problem-focused disengagement; emotion-focused engagement; and emotion-focused  
18 disengagement). An additional 20 items assessed *LGBT-specific coping strategies*. The first ten  
19 questions asked about potentially recurring events, such as “I spent time with the LGBTQ  
20 community” and “I tried to gain new knowledge about the LGBTQ community.” Response  
21 options for these statements included “Never,” “Sometimes,” “Often,” and “Regularly.” The  
22 second ten questions asked participants for a binary response indicating if they had ever had the

1 positive experience, such as “I went to an LGBTQ pride event” and “I’ve been in a romantic  
2 relationship.”

3 With the exception of sex assigned at birth and race/ethnicity, which were only captured  
4 at baseline, all of the above measures were also collected at each follow-up time point. This  
5 includes explicitly inquiring about sexual identity and gender identity at each wave, given the  
6 fluidity of these identities during adolescence.

7 *Additional Measures.* Although not the primary focus of the study, additional measures  
8 were added at later waves of data collection to probe emerging findings in the literature on SMA  
9 behavioral health. These included a more thorough investigation into the experiences of  
10 homeless and precariously housed youth; intersectionality of SGM status with cultural identity;  
11 experiences with body dysmorphia; sexual behavior, intimate partner violence, and  
12 nonconsensual distribution of explicit images (“revenge porn”); healthcare access and utilization;  
13 specific forms of marijuana or nicotine used in the past 30 days; and lifetime and past 30-day use  
14 of cocaine and methamphetamine.

### 15 **Data Analysis Plan**

16 We propose using cohort sequential latent growth curve modeling (LGCM)<sup>(94)</sup> to describe  
17 how minority stress and its associated behavioral health outcomes change over time among  
18 SMA. Compared with traditional longitudinal analysis methods such as comparing pre- and post-  
19 test scores or change by data collection wave, the cohort sequential LGCM approach examines  
20 individual change over age and is more appropriate for modeling developmental processes,  
21 coinciding with theoretical paradigms that are often person-centered longitudinal pathways.<sup>(95, 96)</sup>

22 Several preliminary steps and decisions will be made prior to longitudinal model  
23 estimation and will vary depending on the type of analysis (e.g., ordinary least squares vs.



1 logistic regression). Multicollinearity and influential cases will be assessed.<sup>(97)</sup> Distributional  
2 properties of all continuous and categorical variables will be evaluated, and we will apply  
3 appropriate transformation or robust estimation procedures to correct for non-normally  
4 distributed variables (e.g., specifying the WLSMV estimator for binary indicators).<sup>(98, 99)</sup>  
5 Attrition analyses will be conducted to understand missingness. Missing data will be handled in  
6 all growth models using full information maximum likelihood estimators in Mplus assuming data  
7 are missing completely at random or missing at random.<sup>(100)</sup> Multiple imputation<sup>(101)</sup> methods  
8 will also be used when appropriate. Depending on the analysis and the hypothesis being tested,  
9 demographic and some substantive variables will be included as covariates to increase the  
10 specificity of the effects; e.g., geographic region, race/ethnicity, or general stress. Prior to  
11 estimating full unconditional LGCMs, we will identify the best-fitting functional forms of  
12 trajectories (i.e., linear, quadratic, cubic, and/or piecewise) for each variable.<sup>(102)</sup> Structural  
13 equation models will be evaluated using commonly accepted fit indices (e.g., chi-square, CFI,  
14 IFI, TLI, and RMSEA) and modification indices (e.g., LaGrange multipliers).<sup>(103)</sup> Standard  
15 guidelines for small (.2), medium (.5), and large (.8) effect sizes<sup>(104)</sup> will be adopted.  
16 Confirmatory factor analysis will be used to assess measurement invariance of the SMASI and  
17 all outcome measures over time.

18 *General approach to hypothesis testing.* LGCMs will be estimated for the SMASI total  
19 score, the SMASI subscales, and each of the behavioral health outcomes. The use of a cohort  
20 sequential LGCM will allow for the modeling of change in each outcome trajectory as  
21 adolescents age during the course of our study by plotting latent means across age to understand  
22 developmental trends among participants. These are useful in examining within-person change  
23 across time and between-person variability.<sup>(102)</sup> Furthermore, LGCMs provide group-level

1 statistics, including the average amount of change over time (i.e., slope), the average starting  
2 point (i.e., intercept), and the relationship between the two.<sup>(105, 106)</sup> One important advantage of  
3 LGCM is the implementation and comparison of appropriate functions to best fit the trend of the  
4 data. It is likely that several patterns of growth during the course of adolescence may emerge –  
5 that is, two or more separate slopes may be modeled within the same trajectory to demonstrate  
6 divergence in trends.<sup>(105, 107)</sup> These separate but related pieces incorporate the piecewise function,  
7 which allows for several linear slopes to be modeled within the same construct (e.g., minority  
8 stress) and can provide information about differences in construct level (i.e., intercept) and  
9 growth velocity (i.e., slope) at various points throughout adolescence.

10 Due to the hypothesized relationships between minority stress and the behavioral health  
11 outcomes (depressive symptoms, anxiety, PTSD symptoms, suicidality, and substance use), we  
12 propose to analyze these trajectories simultaneously via the use of parallel cohort sequential  
13 LGCM models.<sup>(107)</sup> By modeling two growth processes (e.g., minority stress and depressive  
14 symptoms) at once, we can evaluate the relationship of slopes and intercepts both within and  
15 across measures to understand their interrelated effects over time. This approach will allow us to  
16 test the following working hypotheses (WH):

17 *WH1. There will be differences in minority stress across adolescent development. A*  
18 cohort sequential LGCM<sup>(108)</sup> for the total SMASI score and each of its 11 subscales will be  
19 estimated to describe individual and group-level trajectories of minority stress among all SMA  
20 during the course of the study period. This will establish the best-fitting LGCM and allow the  
21 selection and implementation of the most appropriate piecewise function. We will test piecewise  
22 models with one (i.e., linear across development) to four growth trajectories to determine which  
23 function best represents the data. This will also allow us to understand how and when changes

1 may occur throughout adolescence. The best-fitting model for each of the outcomes will be  
2 evaluated according to fit statistics (e.g., AIC, BIC, RMSEA, CFI/TLI) and by examining  
3 differences in chi-square statistics of nested models.

4       Once the functional form is chosen, the intercepts and slopes can be evaluated for each  
5 LGCM. Each model will capture the hypothesized differences in growth by estimating intercept  
6 means (defined as the starting point of the growth period) and slope means (change over time)  
7 for each of the growth processes and the correlations among and between them. We hypothesize  
8 that the intercepts of all growth functions will show statistically significant residual variance,  
9 indicating that adolescents vary significantly in their minority stress levels at the initial point of  
10 each growth process. We further hypothesize that the slopes of all of the growth trajectories will  
11 show significant residual variance, indicating that youth experience varied rates of increase or  
12 decrease of minority stress over time. Such findings would demonstrate that trajectories of  
13 minority stress across adolescence differ among individual youth.

14       *WH2.1. Trajectories of minority stress and behavioral health outcomes will be associated*  
15 *over time (i.e., considered parallel processes).* We will estimate cohort sequential LGCMs for  
16 each of the behavioral health outcomes to measure growth over time. Separate models describing  
17 depressive symptoms, anxiety, PTSD symptoms, suicidal ideation and attempt, self-injury, and  
18 four substance use outcomes (alcohol, tobacco, marijuana, and prescription drugs) will be  
19 estimated. A similar process to the analysis for WH1 will be applied to building these models.  
20 Subsequently, the LGCMs of the SMASI total score with each behavioral health outcome will be  
21 combined in a parallel LGCM to evaluate the relationship between the two variables over time.  
22 Regression coefficients reflecting influence of minority stress on each outcome (i.e., regression  
23 of health outcome slopes and intercepts onto SMASI slopes and intercepts) will be estimated.

1 Significant coefficients corresponding to the regression paths from the SMASI to health  
2 outcomes would provide strong evidence that minority stress affects behavioral health outcomes  
3 over time.

4 *WH2.2. Reporting higher levels of minority stress in early adolescence will be associated*  
5 *with poorer behavioral health outcomes in later adolescence.* Within the parallel LGCM  
6 framework, we will regress the intercepts and slopes of all behavioral health outcomes onto the  
7 intercept(s) of the SMASI to determine whether and how levels of minority stress predict later  
8 health outcomes during adolescence. Specifically, we hypothesize that: (a) The intercept of the  
9 SMASI latent variable (or in the case of a multiple trajectory piecewise model, the intercept of  
10 the first trajectory) will be positively and significantly associated with the intercept(s) of the  
11 behavioral health outcome, indicating that higher levels of minority stress in early adolescence  
12 result in worse health at each unique phase of development; (b) The first intercept of the SMASI  
13 will be significantly, positively associated with all outcome slopes, such that high levels of  
14 minority stress in early adolescence will result in a steeper increase in behavioral health  
15 problems in all growth periods; and (c) the slope(s) of the SMASI will differentially predict the  
16 rate of change in later health outcome growth periods, such that a steeper increase or decrease in  
17 minority stress throughout adolescence will predict corresponding increases or decreases in  
18 behavioral health.

19 *WH3.1. There will be significant differences in outcome trajectories by demographic*  
20 *subgroup.* Building on the previous analyses, we will use four demographic stratification  
21 variables (race and ethnicity, gender, sexual identity, and urbanicity) to explore whether there are  
22 subgroup differences (e.g., male vs. female; gay vs. lesbian vs. bisexual/pansexual vs. queer) in  
23 trajectories of minority stress and behavioral health outcomes across adolescence. For example,

1 prior literature suggests that girls are more likely to experience suicidality in adolescence than  
2 boys<sup>(18,19)</sup> and bisexual youth are more likely to engage in substance use than other sexual  
3 minority groups of the same age.<sup>(15)</sup> We hypothesize that we will see significant group  
4 differences in our data that confirm these findings. In a series of analyses using the multiple  
5 group function in Mplus, with up to four identity groups modeled within a single analysis, we  
6 will evaluate the structural invariance of each of our final parallel LGCMs across the subgroups  
7 comprising each of our stratification variables. The intercept and slope coefficients for each  
8 growth process will first be estimated freely across groups; the loadings will then be constrained  
9 to be equal across groups. If there is no decrement in fit (i.e., CFI  $\Delta < .01$  or nonsignificant chi-  
10 square difference test), we will conclude the model has structural invariance and thus there are  
11 no differences in either the minority stress or the behavioral health outcome process across  
12 demographic subgroups. If significant decrements in fit emerge (e.g., when constraining across  
13 gender in the suicidality models), we will systematically free parameters to determine which  
14 intercept(s) or slope(s) differ by group and in which direction. Because no longitudinal study of  
15 this nature has been conducted, there is no evidence to support *a priori* hypotheses about  
16 minority stress differences by subgroup. Commensurate with the extant literature, however, we  
17 expect to find subgroup differences for each of our behavioral health outcomes. Therefore, we  
18 hypothesize that the parallel LGCMs will not demonstrate structural invariance.

19 *WH3.2: Trajectories of minority stress will be inversely associated with protective factors*  
20 *over time and will differ by demographic subgroup.* Using the approach described under WH2.1,  
21 we will first estimate the LGCM for protective factors (either simultaneously, i.e. with a latent  
22 “protective factors” variable, or as separate manifest measures depending on results of  
23 preliminary analyses). Next, we will model the trajectories of the protective factor(s) and the

1 SMASI total score simultaneously to estimate a parallel LGCM; minority stress growth  
2 parameters will be regressed on protective factors. Finally, as in WH3.1, we will examine the  
3 protective factor/minority stress parallel process model for differences by demographic subgroup  
4 using the multiple group function in Mplus and examining constrained and unconstrained  
5 models. We hypothesize that protective factors will show an overall inverse trajectory to  
6 minority stress; that is, greater intercepts and slopes of protective factors will be associated with  
7 lower intercepts and slopes of minority stress, and vice-versa. We further hypothesize that the  
8 parallel LGCMs of protective factors and minority stress will not demonstrate structural  
9 invariance – that is, there will be subgroup differences in the growth processes, owing to  
10 hypothesized sociodemographic differences in protective factors (e.g., greater accessibility of  
11 social support systems in urban compared to rural environments).

## 12 **Sample Size Calculation**

13 For LGCM analyses, statistical power depends on sample size, degrees of freedom (the  
14 number of known minus free parameters), variable distributions, amount of missing data,  
15 measure reliabilities, and strength of the relationships among variables. Based on the code  
16 provided by Preacher and Coffman (2006),<sup>(109)</sup> we used the hypothesis-testing framework for  
17 Root-Mean-Square Error of Approximation (RMSEA) as a vehicle to estimate the power for  
18 LGCM in our study. For the first, simplest models to be implemented (i.e., one intercept, one  
19 linear slope), we expect 34 degrees of freedom; this value will decrease with each additional  
20 trajectory estimated in the piecewise models (e.g., a 4-slope trajectory will have 7 degrees of  
21 freedom). With  $\alpha=0.05$ , null hypothesis RMSEA of 0.05 and alternative hypothesis RMSEA of  
22 0.08, degrees of freedom ranging from 7 to 56, and nominal statistical power of 0.80, a  
23 longitudinal sample size of up to 1,075 may be needed to achieve adequate power for all

1 analyses depending on the exact size of the model. For WH3.1 and WH3.2, which examine  
2 differences in minority stress and outcome trajectories by subgroups, statistical power depends  
3 on both group size and total sample size, as we cannot assume identical fit of the initial model in  
4 all groups.<sup>110</sup> Using the trajectory forms developed for the previous hypotheses, we can support  
5 simultaneous trajectory comparisons with at least 190 participants per group; with a planned  
6 sample of N=1,075, we would potentially be adequately powered to examine up to five  
7 demographic subgroups simultaneously. However, given the low likelihood of perfectly even  
8 recruitment across all demographic strata, it may be more feasible to limit models to four groups  
9 to ensure adequate group size without overly condensing across meaningful categories. With  
10 these approaches in mind, the range of statistical power for all proposed models provided by a  
11 sample of this size is between .80 to .99, depending on the closeness of the null and alternative  
12 hypotheses.

### 13 **Patient and Public Involvement**

14 Youth advisors were first involved in 2013 during an initial qualitative study funded by  
15 the Zumberge Foundation. That study provided the original basis for closed-ended items that  
16 eventually evolved into the SMASI measure. The current study design is a direct result of  
17 interviews conducted with SMA between 2013-2015, a small study of minority stress conducted  
18 between 2014-2016, and a set of focus groups conducted in 2016-2017 to understand stress and  
19 health patterns among the population. Youth were not directly involved in the choice of outcome  
20 measures; however, youth at several LGBTQ+ drop-in centers were involved in the development  
21 of study protocols (e.g., advertisements used) and helped provide guidance on recruitment and  
22 retention methods. Some study participants were also directly involved in recruitment via their  
23 choice to refer other youth through RDS procedures. We are in the process of forming a youth

1 advisory board that will assist with choosing the methods and developing plans for dissemination  
2 of study results to participants and linked communities.

### 3 **Ethics and Dissemination**

4 A comprehensive informed assent document was provided to eligible youth immediately  
5 upon screening into the study, and indeed, assent to participate was required in order to begin  
6 survey data collection. All study participants were willing and able to provide assent at the  
7 baseline survey. Because SMA constitute a vulnerable group whose parents may not be aware of  
8 their sexual minority status, we were granted a waiver of parental consent. At the beginning of  
9 each follow-up survey, participants who had reached age 18 since completing the previous  
10 survey were consented using adult protocols for informed consent. All study procedures for both  
11 baseline and longitudinal follow-up activities were reviewed and approved by the Social-  
12 Behavioral IRB at the University of Southern California. Because the study is purely  
13 observational with no researcher-controlled intervention, there is no external data safety  
14 monitoring board for the study. However, a member of the research team reviews study data  
15 immediately upon downloading the new data files each business day, and any open-ended  
16 statements or data that could potentially suggest participant safety concerns are immediately  
17 brought to the attention of the study investigators, who are considered mandated reporters in the  
18 State of California. Statements are reviewed and assessed for information concerning abuse or  
19 neglect of a child; abuse or neglect of an elder; or threat that the participant will harm themselves  
20 or someone else. An IRB-approved standard operating procedure is in place in the event of a  
21 positive disclosure; however, to date, no participant has disclosed any imminent safety concerns,  
22 and no other adverse events have been reported. The protocol included providing referrals to  
23 support resources for all participants, and following up with specific additional resources for



1 those who screened at risk for suicidality (e.g., both general and LGBTQ-specific crisis  
2 services).

3 To enhance protection for study data, we obtained an NIH Certificate of Confidentiality  
4 The final dataset will include self-reported demographic and behavioral health data, as described  
5 above, from surveys completed by the research participants. All identifying data will be  
6 destroyed at the end of the study after analysis. The final anonymous data set will be made  
7 available to other qualified members of the scientific community upon request per policies of the  
8 NIH and the University of Southern California IRB. We are committed to participating in the  
9 sharing and building of research knowledge, and will adhere to the NIH Policy on Sharing of  
10 Unique Research Resources including the Guidelines for Recipients of NIH Grants and  
11 Contracts. Requests for research resources that are generated as part of this project (e.g.,  
12 qualitative outcomes, the stress measurement instrument) will be distributed in a timely manner.

13 Finally, the purpose of the current research is to examine pathways that may predict  
14 differing behavioral health outcomes in sexual minority adolescents. To that end, the overarching  
15 purpose is to share our developed resources with the community. As the research team completes  
16 analyses and arrives at empirical results, we have contracted with a creative graphics firm to  
17 develop infographics that cleanly summarize research findings with terminology suitable for the  
18 lay public. In addition to presenting our work in peer-reviewed manuscripts and scientific  
19 meetings, we are pursuing opportunities to share our findings with the broader community,  
20 including hosting the infographics and other study materials and derivatives on the website of the  
21 University of Southern California Center for LGBTQ+ Health Equity.<sup>(111)</sup>

## 1     **References**

- 2     1.     Haas AP EM, Mays VM, Mathy RM, Cochran SD, D'Augelli AR, Silverman MM, Fisher  
3     PW, Hughes T, Rosario M, Russell ST. Suicide and suicide risk in lesbian, gay, bisexual, and  
4     transgender populations: Review and recommendations. *Journal of Homosexuality*.  
5     2011;58(1):10-51.
- 6     2.     Hendricks M, Testa R. Model for understanding risk and resiliency in transgender and  
7     gender-nonconforming individuals. *Professional Psychology: Research and Practice*.  
8     2012;43(5):460-7.
- 9     3.     Anhalt K MT. Developmental and adjustment issues of gay, lesbian, and bisexual  
10    adolescents: a review of the empirical literature. *Clin Child Fam Psychol Rev*. 1998;1(4):215-30.
- 11   4.     Stettler NM, Katz LF. Minority stress, emotion regulation, and the parenting of sexual-  
12   minority youth. *Journal of GLBT Family Studies* 2017, 13(4):380-400.
- 13   5.     Lucassen MF, Stasiak K, Samra R, Frampton CM, Merry SN. Sexual minority youth and  
14   depressive symptoms or depressive disorder: A systematic review and meta-analysis of  
15   population-based studies. *Australian & New Zealand Journal of Psychiatry* 2017, 51(8):774-787.
- 16   6.     Jones A, Robinson E, Oginni O, Rahman Q, Rimes KA. Anxiety disorders, gender  
17   nonconformity, bullying and self-esteem in sexual minority adolescents: Prospective birth cohort  
18   study. *Journal of Child Psychology and Psychiatry* 2017, 58(11):1201-1209.
- 19   7.     Taliaferro LA, Muehlenkamp JJ. Nonsuicidal self-injury and suicidality among sexual  
20   minority youth: Risk factors and protective connectedness factors. *Academic Pediatrics* 2017,  
21   17(7):715-722.

- 1 8. Marshal MP, Friedman MS, Stall R, King KM, Miles J, Gold MA, et al. Sexual  
2 orientation and adolescent substance use: a meta-analysis and methodological review. *Addiction*.  
3 2008;103(4):546-56.
- 4 9. Moon MW, Fornili K, O'Briant AL. Risk comparison among youth who report sex with  
5 same-sex versus both-sex partners. *Youth & Society*. 2007;38(3):267-84.
- 6 10. Goldbach JT, Mereish EH, Burgess C. Sexual orientation disparities in the use of  
7 emerging drugs. *Substance Use & Misuse*. 2017;52(2):265-71.
- 8 11. Watson RJ, Goodenow C, Porta C, Adjei J, & Saewyc, E. Substance use among sexual  
9 minorities: Has it actually gotten better? *Substance Use & Misuse* 2018, 53(7):1221-1228.
- 10 12. Coker TR AS, Schuster MA. The health and health care of lesbian, gay, and bisexual  
11 adolescents. *Annual review of public health*. 2010;31:457-77.
- 12 13. Saewyc EM. Contested conclusions: Claims that can (and cannot) be made from the  
13 current research on gay, lesbian, and bisexual teen suicide attempts. *Journal of LGBT Health*  
14 *Research*. 2007;3(1):79-87.
- 15 14. Smith BC, Armelie AP, Boarts JM, Brazil M, Delahanty DL. PTSD, depression, and  
16 substance use in relation to suicidality risk among traumatized minority lesbian, gay, and  
17 bisexual youth. *Archives of Suicide Research* 2016, 20(1):80-93.
- 18 15. Marshal MP, Friedman MS, Stall R, Thompson AL. Individual trajectories of substance  
19 use in lesbian, gay and bisexual youth and heterosexual youth. *Addiction*. 2009;104(6):974-81.
- 20 16. Marshal MP, Burton CM, Chisolm DJ, Sucato GS, Friedman MS. Cross-sectional  
21 evidence for a stress-negative affect pathway to substance use among sexual minority girls.  
22 *Clinical and Translational Science*. 2013;6(4):321-2.

- 1 17. Gilbey D, Mahfouda S, Ohan J et al. Trajectories of mental health difficulties in young  
2 people who are attracted to the same gender: A systematic review. *Adolescent Res Rev.*  
3 2020;5:281–293. <https://doi.org/10.1007/s40894-019-00128-8>.
- 4 18. Bridge JA, Goldstein TR, Brent DA. Adolescent suicide and suicidal behavior. *Journal of*  
5 *child psychology and psychiatry.* 2006;47(3-4):372-94.
- 6 19. Friedman MS, Marshal MP, Guadamuz TE, Wei C, Wong CF, Saewyc EM, et al. A  
7 meta-analysis of disparities in childhood sexual abuse, parental physical abuse, and peer  
8 victimization among sexual minority and sexual nonminority individuals. *American Journal of*  
9 *Public Health.* 2011;101(8):1481-94.
- 10 20. Cohn TJ, Leake VS. Affective distress among adolescents who endorse same-sex sexual  
11 attraction: Urban versus rural differences and the role of protective factors. *Journal of Gay &*  
12 *Lesbian Mental Health.* 2012;16(4):291-305.
- 13 21. Goldbach JT, Gibbs J. Strategies employed by sexual minority adolescents to cope with  
14 minority stress. *Psychology of Sexual Orientation and Gender Diversity.* 2015;2(3):297.
- 15 22. Cochran BN, Stewart AJ, Ginzler JA, Cauce AM. Challenges faced by homeless sexual  
16 minorities: Comparison of gay, lesbian, bisexual, and transgender homeless adolescents with  
17 their heterosexual counterparts. *American Journal of Public Health.* 2002;92(5):773-7.
- 18 23. Moradi B, Mohr JJ, Worthington RL, Fassinger RE. Counseling psychology research on  
19 sexual (orientation) minority issues: Conceptual and methodological challenges and  
20 opportunities. *Journal of Counseling Psychology.* 2009;56(1):5.
- 21 24. Szymanski DM, Kashubeck-West S, Meyer J. Internalized heterosexism: A historical and  
22 theoretical overview. *The Counseling Psychologist.* 2008;36(4):510-24.

- 1  
2  
3 1 25. Goldbach JT, Tanner-Smith EE, Bagwell M, Dunlap S. Minority stress and substance use  
4  
5 2 in sexual minority adolescents: A meta-analysis. *Prevention Science*. 2014;15(3):350-63.  
6  
7  
8 3 26. Mereish EH, \*Sheskier M, \*Hawthorne D, Goldbach JT. Sexual orientation disparities in  
9  
10 4 mental health and substance use among Black American young people in the U.S.A.: Effects of  
11  
12 5 cyber and bias-based victimization. *Culture, Health and Sexuality*. 2019;21(9):985-998.  
13  
14  
15 6 27. Anhalt K, Toomey RB, Shramko M. Latinx sexual minority youth adjustment in the  
16  
17 7 context of discrimination and internalized homonegativity: The moderating role of cultural  
18  
19 8 orientation processes. *Journal of Latinx Psychology*. 202;8(1):41-57.  
20  
21 9 <https://doi.org/10.1037/lat0000134>.  
22  
23  
24 10 28. Gates GJ, Newport F. Special report: 3.4% of US adults identify as LGBT. Washington,  
25  
26 11 DC: Gallup. 2012.  
27  
28  
29 12 29. Hatzenbuehler ML, Nolen-Hoeksema S, Dovidio J. How does stigma “get under the  
30  
31 13 skin”? The mediating role of emotion regulation. *Psychological Science*. 2009;20(10):1282-9.  
32  
33  
34 14 30. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual  
35  
36 15 populations: Conceptual issues and research evidence. *Psychological Bulletin*. 2003;129(5):674.  
37  
38 16 31. Rosario M, Schrimshaw EW, Hunter J, Gwadz M. Gay-related stress and emotional  
39  
40 17 distress among gay, lesbian and bisexual youths: A longitudinal examination. *Journal of*  
41  
42 18 *Consulting and Clinical Psychology*. 2002;70(4):967.  
43  
44  
45 19 32. Disease CCf, Prevention Ca. Lesbian Gay Bisexual and Transgender Health:  
46  
47 20 Youth 2011 [Available from: <http://www.cdc.gov/lgbthealth/youth.htm>.  
48  
49 21 33. Medicine NAO. *Annual Report 2015* 2015 [Available from: [https://nam.edu/wp-](https://nam.edu/wp-content/uploads/2016/06/NAM-Annual-Report-2015.pdf)  
50  
51 22 [content/uploads/2016/06/NAM-Annual-Report-2015.pdf](https://nam.edu/wp-content/uploads/2016/06/NAM-Annual-Report-2015.pdf).  
52  
53  
54 23 34. 2020 HP. *Healthy People 2020* 2011 [Available from: <https://www.healthypeople.gov/>.  
55  
56  
57  
58  
59  
60

- 1  
2  
3 1 35. Kelleher C. Minority stress and health: Implications for lesbian, gay, bisexual,  
4 transgender, and questioning (LGBTQ) young people. *Counselling Psychology Quarterly*.  
5  
6 2 2009;22(4):373-9.  
7  
8 3  
9  
10 4 36. Russell JA. Core affect and the psychological construction of emotion. *Psychological*  
11  
12 5 *Review*. 2003;110(1):145.  
13  
14 6 37. Savin-Williams RC. *Mom, dad, I'm gay. How families negotiate coming out:*  
15  
16 Washington, DC, US: American Psychological Association; 2001.  
17  
18 7  
19 8 38. Myers W, Turanovic JJ, Lloyd KM, Pratt TC. The victimization of LGBTQ students at  
20  
21 9 school: A meta-analysis. *Journal of School Violence* 2020:1-12.  
22  
23 10 39. Remafedi G, French S, Story M, Resnick MD, Blum R. The relationship between suicide  
24  
25 11 risk and sexual orientation: Results of a population-based study. *American Journal of Public*  
26  
27 12 *Health*. 1998;88(1):57-60.  
28  
29 13 40. Rice E, Barman-Adhikari A. Internet and social media use as a resource among homeless  
30  
31 14 youth. *Journal of Computer-Mediated Communication*. 2014;19(2):232-47.  
32  
33 15 41. Russell ST, Ryan C, Toomey RB, Diaz RM, Sanchez J. Lesbian, gay, bisexual, and  
34  
35 16 transgender adolescent school victimization: Implications for young adult health and adjustment.  
36  
37 17 *Journal of School Health*. 2011;81(5):223-30.  
38  
39 18 42. Toomey RB, Ryan C, Diaz RM, Card NA, Russell ST. Gender-nonconforming lesbian,  
40  
41 19 gay, bisexual, and transgender youth: School victimization and young adult psychosocial  
42  
43 20 adjustment. *Developmental Psychology*. 2010;46(6):1580.  
44  
45 46 43. Pollitt AM, Mallory AB, Fish JN. Homophobic bullying and sexual minority youth  
47  
48 21 alcohol use: Do sex and race/ethnicity matter? *LGBT Health* 2018, 5(7):412-420.  
49  
50 22  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 1 44. D'Augelli A, Grossman, Arnold H. Disclosure of sexual orientation, victimization, and  
4  
5 2 mental health among lesbian, gay, and bisexual older adults. *Journal of Interpersonal Violence*.  
6  
7 3 2001;16(10):1008-27.  
8  
9  
10 4 45. Kosciw JG, Greytak EA, Bartkiewicz MJ, Boesen MJ, Palmer NA. The 2011 National  
11  
12 5 School Climate Survey: The Experiences of Lesbian, Gay, Bisexual and Transgender Youth in  
13  
14 6 Our Nation's Schools: ERIC; 2012.  
15  
16  
17 7 46. Bouris A, Everett BG, Heath RD, Elsaesser CE, Neilands TB. Effects of victimization  
18  
19 8 and violence on suicidal ideation and behaviors among sexual minority and heterosexual  
20  
21 9 adolescents. *LGBT Health* 2016, 3(2):153-161.  
22  
23  
24 10 47. Clatts MC, Goldsamt L, Yi H, Gwadz MV. Homelessness and drug abuse among young  
25  
26 11 men who have sex with men in New York City: A preliminary epidemiological trajectory.  
27  
28 12 *Journal of Adolescence*. 2005;28(2):201-14.  
29  
30  
31 13 48. Marshal MP, Goldbach JT, McCauley HL, Shultz ML, Dietz LJ, Montano GT, et al. Gay-  
32  
33 14 related stress and suicide risk: Articulating three mediated pathways that increase risk for  
34  
35 15 suicidality among sexual minority youth. *Advancing the Science of Suicidal Behavior:*  
36  
37 16 *Understanding and Intervention*: Nova Science Publishers, Inc.; 2014. p. 253-68.  
38  
39  
40 17 49. Morrison TG, Bishop C, Morrison MA, Parker-Taneo K. A psychometric review of  
41  
42 18 measures assessing discrimination against sexual minorities. *Journal of Homosexuality*.  
43  
44 19 2016;63(8):1086-126.  
45  
46  
47 20 50. Birkett M, Newcomb ME, Mustanski B. Does it get better? A longitudinal analysis of  
48  
49 21 psychological distress and victimization in lesbian, gay, bisexual, transgender, and questioning  
50  
51 22 youth. *Journal of Adolescent Health*. 2015;56(3):280-5.  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 1 51. Mustanski B, Liu RT. A longitudinal study of predictors of suicide attempts among  
4  
5 2 lesbian, gay, bisexual, and transgender youth. *Archives of Sexual Behavior*. 2013;42(3):437-48.  
6  
7  
8 3 52. Burton CM, Marshal MP, Chisolm DJ, Sucato GS, Friedman MS. Sexual minority-  
9  
10 4 related victimization as a mediator of mental health disparities in sexual minority youth: A  
11  
12 5 longitudinal analysis. *Journal of Youth and Adolescence*. 2013;42(3):394-402.  
13  
14  
15 6 53. Kaplan D. *Structural equation modeling: Foundations and extensions*: Sage Publications;  
16  
17 7 2008.  
18  
19 8 54. Diaz RM, Ayala G, Bein E, Henne J, Marin BV. The impact of homophobia, poverty, and  
20  
21 9 racism on the mental health of gay and bisexual Latino men: Findings from 3 US cities.  
22  
23 10 *American Journal of Public Health*. 2001;91(6):927.  
24  
25  
26 11 55. Mereish EH, Bradford JB. Intersecting identities and substance use problems: Sexual  
27  
28 12 orientation, gender, race, and lifetime substance use problems. *Journal of Studies on Alcohol and*  
29  
30 13 *Drugs*. 2014;75(1):179-88.  
31  
32  
33 14 56. Szymanski DM, Sung MR. Minority stress and psychological distress among Asian  
34  
35 15 American sexual minority persons 1977. *The Counseling Psychologist*. 2010;38(6):848-72.  
36  
37  
38 16 57. Toomey RB, Huynh VW, Jones SK, Lee S, Revels-Macalinao M. Sexual minority youth  
39  
40 17 of color: A content analysis and critical review of the literature. *Journal of Gay & Lesbian*  
41  
42 18 *Mental Health*. 2017;21(1), 3–31.  
43  
44  
45 19 58. Layland EK, Exten C, Mallory AB, Williams ND, Fish JN. Suicide attempt rates and  
46  
47 20 associations with discrimination are greatest in early adulthood for sexual minority adults Across  
48  
49 21 diverse racial and ethnic groups. *LGBT Health*. 2020;7(8), 439–447.  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



- 1  
2  
3 1 59. Mallory AB, Russell ST. Intersections of racial discrimination and LGB victimization for  
4  
5 2 mental health: A prospective study of sexual minority youth of color. *Journal of Youth and*  
6  
7 3 *Adolescence*. 2021;50(7), 1353–1368.  
8  
9  
10 4 60. Bostwick WB, Meyer I, Aranda F, Russell S, Hughes T, Birkett M, Mustanski B. Mental  
11  
12 5 health and suicidality among racially/ethnically diverse sexual minority youths. *American*  
13  
14 6 *Journal of Public Health*. 2014;104(6), 1129–1136.  
15  
16  
17 7 61. Thoma BC, Huebner DM. Health consequences of racist and antigay discrimination for  
18  
19 8 multiple minority adolescents. *Cultural Diversity and Ethnic Minority Psychology*. 2013;19(4),  
20  
21 9 404–413.  
22  
23  
24 10 62. Grossman AH, Haney AP, Edwards P, Alessi EJ, Ardon M, Howell TJ. Lesbian, gay,  
25  
26 11 bisexual and transgender youth talk about experiencing and coping with school violence: A  
27  
28 12 qualitative study. *Journal of LGBT Youth*. 2009;6(1):24-46.  
29  
30  
31 13 63. Scourfield J, Roen K, McDermott L. Lesbian, gay, bisexual and transgender young  
32  
33 14 people's experiences of distress: Resilience, ambivalence and self-destructive behaviour. *Health*  
34  
35 15 *& Social Care in the Community*. 2008;16(3):329-36.  
36  
37  
38 16 64. Hatzenbuehler ML, Keyes KM. Inclusive anti-bullying policies and reduced risk of  
39  
40 17 suicide attempts in lesbian and gay youth. *Journal of Adolescent Health*. 2013;53(1):S21-S6.  
41  
42  
43 18 65. Goldbach JT, Schragar SM, Mamey MR. Criterion and divergent validity of the sexual  
44  
45 19 minority adolescent stress inventory. *Frontiers in Psychology*. 2017;8:2057.  
46  
47  
48 20 66. Schragar SM, Goldbach JT, Mamey MR. Development of the sexual minority adolescent  
49  
50 21 stress inventory. *Frontiers in Psychology*. 2018;9:319.  
51  
52  
53 22 67. Schragar SM, Goldbach JT. *Minority stress measure development: Theoretical*  
54  
55 23 *concerns and suggested resolutions*. Berlin, Germany: Logos Verlag; 2017.  
56  
57  
58  
59  
60

- 1  
2  
3 1 68. Elze DE. Research with sexual minority youths: Where do we go from here? *Journal of*  
4  
5  
6 2 *Gay & Lesbian Social Services*. 2005;18(2):73-99.  
7  
8 3 69. Jones JM. Special report: LGBT Identification Rises to 5.6% in Latest US Estimate.  
9  
10 4 Washington, DC: Gallup. 2021  
11  
12 5 70. Raifman J, Charlton BM, Arrington-Sanders R, Chan PA, Rusley J, Mayer KH, Stein  
13  
14 6 MD, Austin SB, McConnell, M. Sexual orientation and suicide attempt disparities among US  
15  
16 7 adolescents: 2009–2017. *Pediatrics*. 2020;145(3)  
18  
19 8 71. Russell ST, Clarke TJ, Clary J. Are teens “post-gay”? Contemporary adolescents’ sexual  
20  
21 9 identity labels. *Journal of Youth and Adolescence*. 2009;38(7):884-90.  
22  
23  
24 10 72. Gates GJ. How many people are lesbian, gay, bisexual and transgender? 2011.  
25  
26 11 73. Saewyc EM, Bauer GR, Skay CL, Bearinger LH, Resnick MD, Reis E, et al. Measuring  
27  
28 12 sexual orientation in adolescent health surveys: Evaluation of eight school-based surveys.  
29  
30 13 *Journal of Adolescent Health*. 2004;35(4):345. e1-. e15.  
31  
32  
33 14 74. Organization WH. Young people's health-a challenge for society: Report of a WHO  
34  
35 15 Study Group on Young People and "Health for All by the Year 2000"[meeting held in Geneva  
36  
37 16 from 4 to 8 June 1984]: World Health Organization; 1986.  
38  
39  
40 17 75. Mustanski B, Kuper L, Greene GJ. Development of sexual orientation and identity. 2014.  
41  
42 18 76. Chew D, Tollit MA, Poulakis Z, Zwickl S, Cheung AS, Pang, KC. Youths with a non-  
43  
44 19 binary gender identity: A review of their sociodemographic and clinical profile. *The Lancet*  
45  
46 20 *Child & Adolescent Health*. 2020;4(4), 322–330.  
47  
48  
49 21 77. Harris KM CTH, Whitsel E, Hussey J, Tabor J, Entzel P, Udry JR. The National  
50  
51 22 Longitudinal Study of Adolescent to Adult Health: Research Design 2009 [Available from:  
52  
53 23 <http://www.cpc.unc.edu/projects/addhealth/design>.  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 1 78. Cromartie J. Rural-urban Commuting Area Codes 2020 [Available from:  
4  
5 2 <https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx>.  
6  
7  
8 3 79. Heckathorn DD. Respondent-driven sampling: A new approach to the study of hidden  
9  
10 4 populations. 44. 1997(2):174-99.  
11  
12 5 80. Aust F, Diedenhofen B, Ullrich S, Musch J. Seriousness checks are useful to improve  
13  
14 6 data validity in online research. Behavior Research Methods. 2013;45(2):527-35.  
15  
16  
17 7 81. Robinson-Cimpian JP. Inaccurate estimation of disparities due to mischievous  
18  
19 8 responders: Several suggestions to assess conclusions. Educational Researcher. 2014;43(4):171-  
20  
21 9 85.  
22  
23  
24 10 82. Bauermeister JA, Pingel E, Zimmerman M, Couper M, Carballo-Diequez A, Strecher VJ.  
25  
26 11 Data quality in HIV/AIDS web-based surveys: Handling invalid and suspicious data. Field  
27  
28 12 Methods. 2012;24(3):272-91.  
29  
30  
31 13 83. Teitcher JE, Bockting WO, Bauermeister JA, Hoefler CJ, Miner MH, Klitzman RL.  
32  
33 14 Detecting, preventing, and responding to “fraudsters” in internet research: ethics and tradeoffs.  
34  
35 15 The Journal of Law, Medicine & Ethics. 2015;43(1):116-33.  
36  
37  
38 16 84. Grey JA, Konstan J, Iantaffi A, Wilkerson JM, Galos D, Rosser BS. An updated protocol  
39  
40 17 to detect invalid entries in an online survey of men who have sex with men (MSM): How do  
41  
42 18 valid and invalid submissions compare? AIDS and Behavior. 2015;19(10):1928-37.  
43  
44  
45 19 85. Melchior LA, Huba G, Brown VB, Reback CJ. A short depression index for women.  
46  
47 20 Educational and Psychological Measurement. 1993;53(4):1117-25.  
48  
49 21 86. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized  
50  
51 22 anxiety disorder: The GAD-7. Archives of Internal Medicine. 2006;166(10):1092-7.  
52  
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2  
3 1 87. Lang AJ WK, Roy-Byrne PP, Golinelli D, Chavira D, Sherbourne C, Rose RD,  
4  
5 2 Bystritsky A, Sullivan G, Craske MG, Stein MB. Abbreviated PTSD checklist (PCL) as a guide  
6  
7 3 to clinical response. *General Hospital Psychiatry*. 2012;34(4):332-8.  
8  
9  
10 4 88. (CDC) CfDcAP. Youth Risk Behavior Survey; 2010 2010 [Available from:  
11  
12 5 <http://www.cdc.gov/yrbs>.  
13  
14  
15 6 89. Gibbs JJ, Goldbach JT. Religious identity dissonance: Understanding how sexual  
16  
17 7 minority adolescents manage antihomosexual religious messages. *Journal of Homosexuality*.  
18  
19 8 2020:1-25.  
20  
21  
22 9 90. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *Journal of*  
23  
24 10 *Health and Social Behavior*. 1983:385-96.  
25  
26  
27 11 91. Cohen S. Perceived stress in a probability sample of the United States. 1988.  
28  
29 12 92. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived  
30  
31 13 social support. *Journal of Personality Assessment*. 1988;52(1):30-41.  
32  
33  
34 14 93. Addison CC, Campbell-Jenkins BW, Sarpong DF, Kibler J, Singh M, Dubbert P, et al.  
35  
36 15 Psychometric evaluation of a coping strategies inventory short-form (CSI-SF) in the Jackson  
37  
38 16 heart study cohort. *International Journal of Environmental Research and Public Health*.  
39  
40 17 2007;4(4):289-95.  
41  
42  
43 18 94. Bollen KA, Curran PJ. *Latent curve models: A structural equation perspective*: John  
44  
45 19 Wiley & Sons; 2006.  
46  
47 20 95. Curran PJ, Hussong AM. The use of latent trajectory models in psychopathology  
48  
49 21 research. *Journal of Abnormal Psychology*. 2003;112(4):526.  
50  
51  
52 22 96. Curran P, Willoughby M. Reconciling theoretical and statistical models of developmental  
53  
54 23 processes. *Development and Psychopathology*. 2003;15:581-612.  
55  
56  
57  
58  
59  
60

- 1  
2  
3 1 97. Fox J. Regression diagnostics: An introduction: SAGE Publications, Incorporated; 2019.  
4  
5 2 98. Mamey MR, Burns GL, Barbosa-Leiker C, Smith CL, McPherson S. Parallel growth  
6  
7 modeling to better understand smoking with stimulant use outcomes during an integrated  
8  
9 treatment trial. *Experimental and Clinical Psychopharmacology*; 2021.  
10  
11 5 99. Muthén B. Second-generation structural equation modeling with a combination of  
12  
13 categorical and continuous latent variables: New opportunities for latent class–latent growth  
14  
15 modeling; 2001.  
16  
17 8 100. Little RJ, Rubin DB. Statistical analysis with missing data: John Wiley & Sons; 2019.  
18  
19 9 101. Schafer JL. Analysis of incomplete multivariate data: Chapman and Hall/CRC; 1997.  
20  
21 10 102. Borowsky IW, Ireland M, Resnick MD. Adolescent suicide attempts: Risks and  
22  
23 protectors. *Pediatrics*. 2001;107(3):485-93.  
24  
25 11 103. Hu L-T, Bentler PM. Evaluating model fit. 1995.  
26  
27 12 104. Cohen J. Statistical power analysis for the behavioral sciences, 2nd edn. Á/L. Erlbaum  
28  
29 Press, Hillsdale, NJ, USA; 1988.  
30  
31 13 105. Hancock GR, Lawrence FR. Using latent growth models to evaluate longitudinal change.  
32  
33 Structural equation modeling: A second course. 2006;2:309-41.  
34  
35 14 106. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and  
36  
37 comparing indirect effects in multiple mediator models. *Behavior Research Methods*.  
38  
39 2008;40(3):879-91.  
40  
41 15 107. Mamey MR, Barbosa-Leiker C, McPherson S, Burns GL, Parks C, Roll J. An application  
42  
43 of analyzing the trajectories of two disorders: A parallel piecewise growth model of substance  
44  
45 use and attention-deficit/hyperactivity disorder. *Experimental and clinical psychopharmacology*.  
46  
47 2015;23(6):422.  
48  
49  
50  
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52  
53  
54  
55  
56  
57  
58  
59  
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- 1  
2  
3 1 108. Meredith W, Tisak J. Latent curve analysis. *Psychometrika*. 1990;55(1):107-22.  
4  
5 2 109. Preacher KJ, Coffman DL. Computing power and minimum sample size for RMSEA.  
6  
7 3 2006.  
8  
9 4 110. Preacher KJ, Cai L, MacCallum RC. Alternatives to traditional model comparison  
10 strategies for covariance structure models. In: Little TD, Bovaird JA, Card NA, eds. *Modeling*  
11 contextual effects in longitudinal studies. Mahwah, NJ: Lawrence Erlbaum Associates; 2007:33–  
12 62.  
13  
14 5 111. California UoS. Center for LGBTQ+ Health Equity [Available from:  
15  
16  
17  
18  
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21  
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- <https://dworakpeck.usc.edu/research/centers-affiliations/center-for-lgbtq-health-equity-clhe>.

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3 1 **Authors' contributions:** S.M. Schrage drafted the initial manuscript and critically revised all  
4  
5 2 sections. M.R. Mamey drafted the study procedures and measures, developed the analytic plan,  
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8 3 and critically revised the manuscript draft. H. Rhoades developed the study procedures and  
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10 4 critically revised the manuscript draft. J.T. Goldbach developed the introduction, drafted the  
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12 5 patient and public involvement section, and critically revised the manuscript draft. All authors  
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14 6 reviewed and approved the final manuscript.  
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3 1 Figure 1. CONSORT flow diagram for enrollment into baseline study phase (final N=2,558).  
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- 1 Figure 2. CONSORT flow diagram for enrollment and retention in longitudinal study phase
- 2 (current N=1,070).

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Figure 1. CONSORT flow diagram for enrollment into baseline study phase (final  $N=2,558$ ).

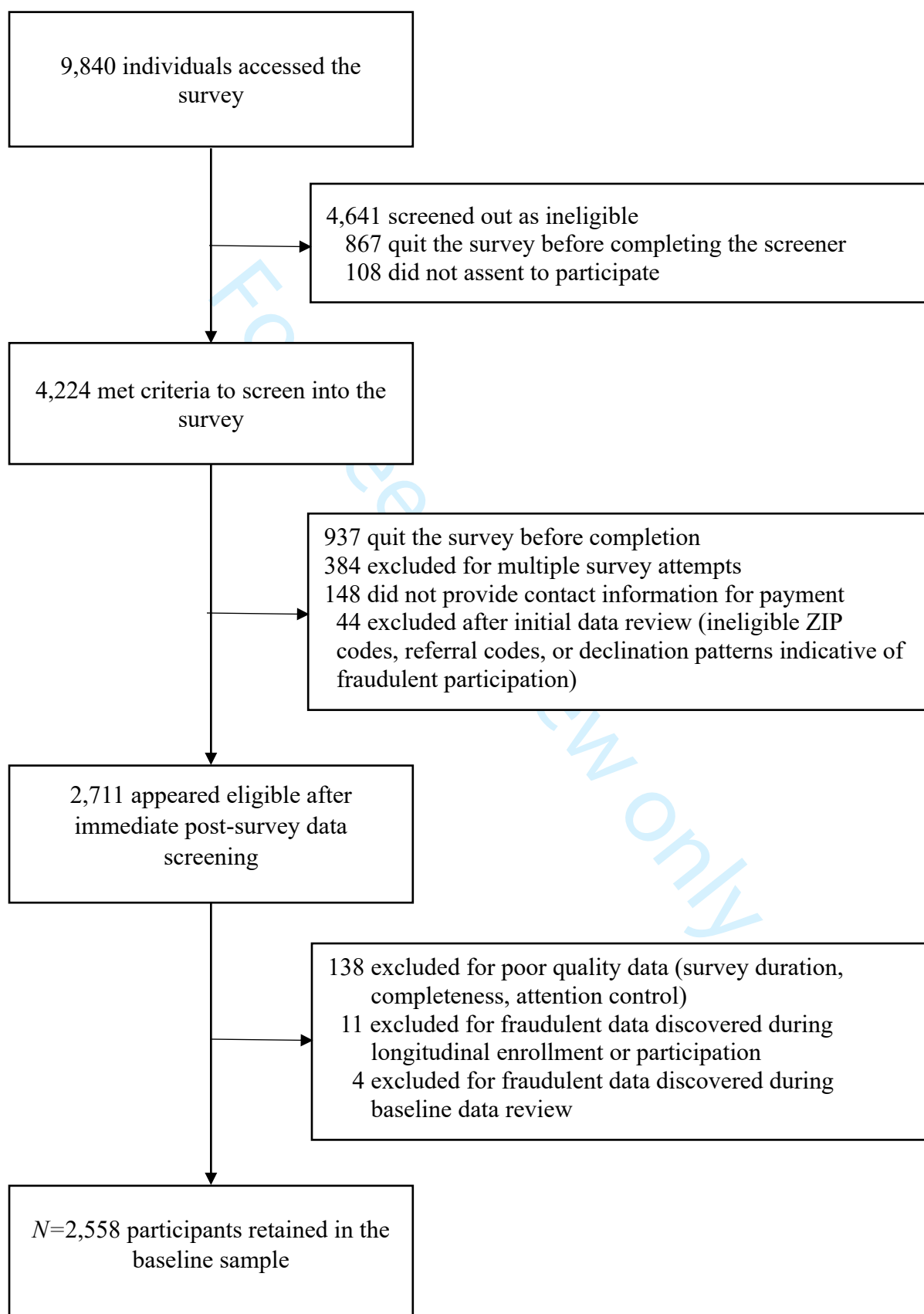
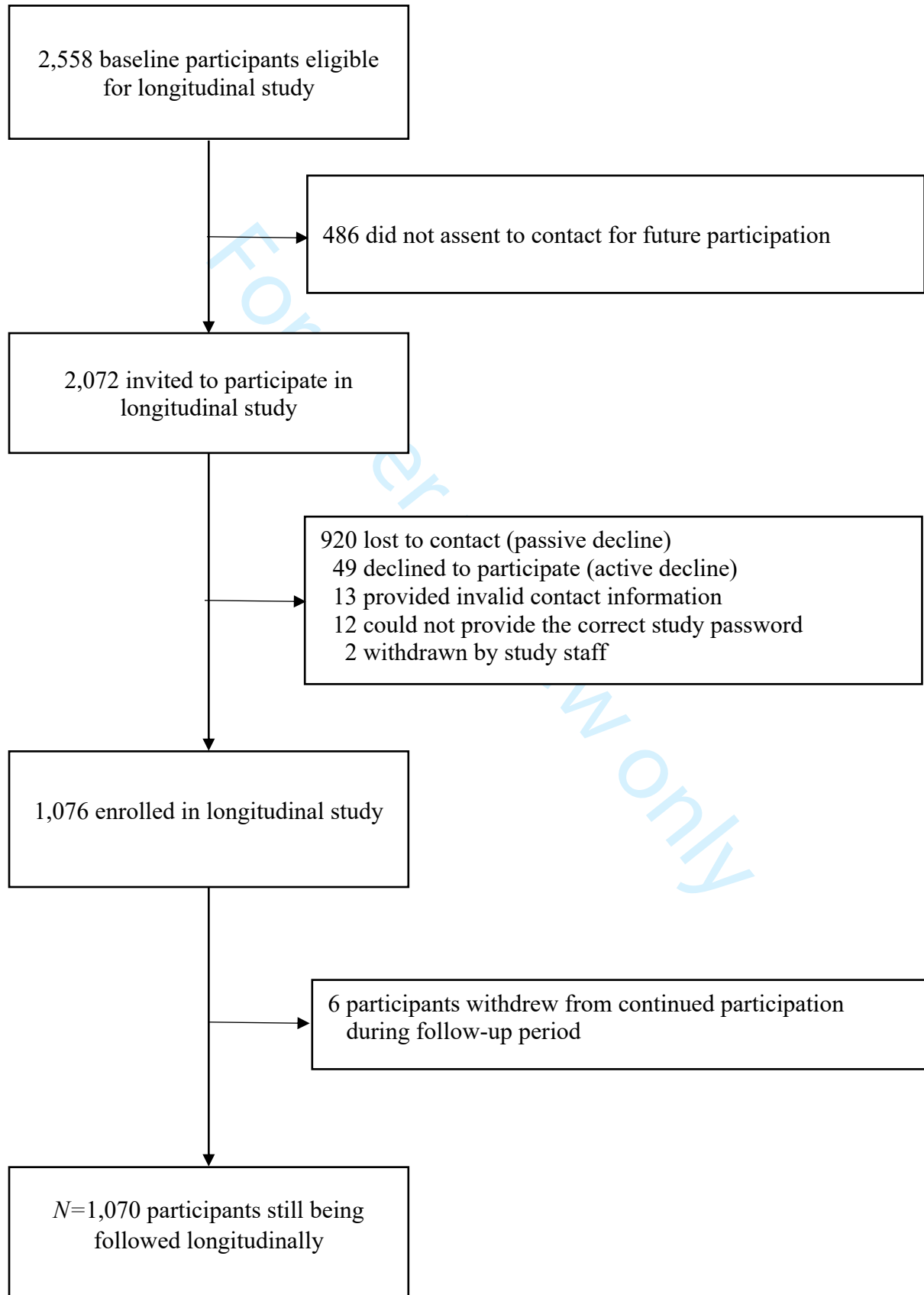


Figure 2. CONSORT flow diagram for enrollment and retention in longitudinal study phase (current  $N=1,070$ ).



STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	Manuscript Location
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	page 1 lines 1-2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	page 2 lines 11-18
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	pages 5-9
Objectives	3	State specific objectives, including any prespecified hypotheses	page 9 lines 3-8; specific hypotheses on page 26 line 17, page 27 lines 14-15, page 28 lines 4-5 and 19-20, page 29 lines 19-20
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	page 9 lines 10-17
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	page 11 lines 7-11; page 16 lines 3-5; page 19 lines 1-3
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Eligibility: page 11 lines 1-6 Sources: pages 12-13 and page 17 lines 5-18 Follow-up: page 14 lines 3-17; page 16 line 7-page 17 line 4
		(b) For matched studies, give matching criteria and number of exposed and unexposed	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	pages 19-24
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	pages 19-24
Bias	9	Describe any efforts to address potential sources of bias	page 10 lines 17-22; page 11 lines 7-11; page 13 lines 11-13
Study size	10	Explain how the study size was arrived at	page 30 line 13 - page 31 line 12
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	page 24 line 16 – page 26 line 15 Groupings: page 28 lines 20-23
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	pages 24-30

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		(b) Describe any methods used to examine subgroups and interactions	page 28 line 20 – page 30 line 11
		(c) Explain how missing data were addressed	page 25 lines 5-8
		(d) If applicable, explain how loss to follow-up was addressed	page 25 lines 5, 7-8 (loss to follow-up not yet established as data collection is still ongoing)
		(e) Describe any sensitivity analyses	N/A

<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	page 16 lines 3-4; page 19 lines 14-15; Figures 1 and 2
		(b) Give reasons for non-participation at each stage	Figures 1 and 2
		(c) Consider use of a flow diagram	Included (Figures 1 and 2)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	N/A
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	Report numbers of outcome events or summary measures over time	N/A
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(b) Report category boundaries when continuous variables were categorized	N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	N/A
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	N/A
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	N/A
Generalisability	21	Discuss the generalisability (external validity) of the study results	N/A
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original	Page 1 lines 22-25

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study on which the present article is based

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\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

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