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Effectiveness of an online single-session minority stress intervention: No evidence for variation by structural stigma, internalized stigma, or social support

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ABSTRACT

In the United States, the experience of minority stress among LGBTQ+ youth varies across regions with high and low levels of stigma (e.g., laws, policies, and cultural norms that limit the lives of individuals with stigmatized identities). Some evidence suggests that stigma can undermine response to individual-level psychosocial interventions among youth, creating the need to identify factors that may buffer against minority stressors' effects in high-stigma contexts. Social support may be one such factor. Therefore, among LGBTQ+ youth who received a digital, single-session intervention (SSI) focused on minority stress, we investigated whether structural and internalized stigma and social support predicted intervention response, independently or interactively. Specifically, we predicted that LGBTQ+ youth in environments characterized by high stigma would report weaker SSI responses. Further, we predicted that LGBTQ+ youth who perceived higher social support would report stronger SSI responses. We also tested structural stigma and social support as moderators. Using data from a previously-completed randomized evaluation, we analyzed data from 244 LGBTQ+ adolescents, aged 13–16 years, across 181 counties in 46 U.S. states, who engaged with the SSI. We created a factor representing structural stigma using confirmatory factor analysis at the county level. No evidence emerged for structural stigma or social support as a moderator of intervention effects on internalized stigma, identity pride, or mental health-related outcomes, either at post-intervention or at 2-week follow up. Results speak to the potentially broad utility of the SSI tested in this trial for LGBTQ+ youth with limited access to mental health support.

1. Introduction

Adolescents who identify as LGBTQ+ often face multi-level stigma, which encompasses structural, interpersonal, and individual dimensions and can influence their mental health (Hatzenbuehler, 2016; Meyer, 1995). Minority Stress Theory posits that such stigma contributes to disparities in the well-being of stigmatized groups (V. R. Brooks, 1981; Meyer, 2003). Consequently, LGBTQ+ adolescents frequently grapple with heightened depression, anxiety, suicidality, and substance use compared to their cisgender, heterosexual peers (The Trevor Project, 2022). Unfortunately, research suggests that people with minoritized identities living in higher-stigma areas (e.g., areas characterized by anti-LGBTQ+ policies and attitudes) may benefit less from mental health interventions (Pachankis et al., 2023a; Price et al., 2022). Internalized stigma, defined as the internalization of negative societal attitudes about one's LGBTQ+ identity, can also undermine intervention responses among LGBTQ+ youth (Pachankis et al., 2023a). In light of the adverse effects of multi-level stigma on LGBTQ+ youth mental health and intervention response, it is imperative to develop accessible mental health interventions that explicitly address minority stress linked to holding LGBTQ+ identities—especially those that can benefit LGBTQ+ youth wellbeing despite the multi-level stigma they face (Chaudoir et al., 2017).

Social support is one contextual factor that might shape how multi-level stigma influences psychosocial intervention outcomes. Specifically, the presence of social support might protect against structural stigma's adverse effects on stress, mental health, and the individual's response to psychosocial interventions, per the stress-buffering model

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(Cassel, 1974; Cohen, 2004). The stress-buffering model describes how social support reduces the negative effects of stress by connecting individuals to psychological and material resources, coping strategies, and less threatening interpretations of the stressor through their social relationships (e.g., supportive friends and family; Cassel, 1974; Cohen, 2004). Additionally, ample research highlights the positive impact of social support on LGBTQ+ adolescent mental health (McConnell et al., 2016; Pollitt et al., 2017; Trujillo et al., 2017). This study investigated whether LGBTQ+ youth living in more supportive versus more stigmatizing environments exhibited divergent outcomes after participating in a brief, digital intervention designed to target minority stress responses (Shen et al., 2023), and whether the impacts of structural stigma on intervention response differed based on youths' perceived social support.

1.1. Consequences of multilevel stigma for LGBTQ+ youth

Structural stigma, defined as societal-level conditions, cultural norms, and institutional policies that constrain the opportunities, resources, and wellbeing of the stigmatized (McConnell et al., 2016; Pollitt et al., 2017; Trujillo et al., 2017), plays a crucial role in shaping the experience of minority stress for LGBTQ+ youth. High levels of structural stigma—comprised of anti-gay and anti-trans laws, or institutional policies, as well as negative cultural attitudes towards LGBTQ+ individuals—can worsen mental health outcomes for LGBTQ+ individuals, such as hopelessness (B. D. Brooks et al., 2023; Veldhuis et al., 2018) and mood and anxiety disorders (Hatzenbuehler et al., 2010). Moreover, structural stigma may interact with intrapersonal stigma, defined as the internalization of negative societal attitudes about one's LGBTQ+ identity (Corrigan et al., 2013; Williamson, 2000), to further exacerbate health challenges faced by this population (Hatzenbuehler, 2017). As a result, examining the interplay between structural stigma and intrapersonal stigma is crucial for gaining insight into how they impact the effectiveness of mental health interventions for LGBTQ+ youth in stigmatized environments.

There are myriad ways to operationalize structural stigma, including the use of policy and attitudinal indicators at multiple levels (e.g., country-, state-, and city-level) targeting LGBTQ+ populations (Bränström and Pachankis, 2021; Conley and Baum, 2023; Lattanner et al., 2021; Perez-Brumer et al., 2015). One approach to measuring structural stigma and societal attitudes is through the use of data from Project Implicit, a large-scale, web-based study that collects data on implicit and explicit attitudes towards various social groups, including LGBTQ+ individuals, using the Implicit Association Test (IAT) (Hollinsaid et al., 2023; Lattanner et al., 2021). The IAT measures implicit (e.g., unconscious positive and negative attitudes) and explicit (e.g., deliberate and conscious attitudes) biases toward minoritized gender and sexual orientation communities. Prior studies examining structural stigma at a single level (e.g., using the state-level societal attitudes only) fail to capture heterogeneity within U.S. states, where county-level attitudes may contrast with those at the state-level (Lattanner et al., 2021). Understanding whether, and how, structural stigma at this level shapes psychosocial intervention response for LGBTQ+ individuals may require more granular metrics, such as those that leverage county-level attitudes, norms, and contexts. Therefore, in the current study, we aggregated data from Project Implicit by United States counties to explore the impact of county-level structural stigma on LGBTQ+ responses to Project RISE (discussed below).

1.2. Targeting internalized stigma to improve LGBTQ+ youth mental health

Given the adverse effects of stigma on LGBTQ + youth mental health, interventions addressing potentially modifiable minority stressors—such as internalized stigma—may help support LGBTQ+ youth mental health. Several studies have explored the use of psychosocial interventions tailored specifically for LGBTQ+ adolescents (e.g., such as affirmative Cognitive Behavioral Therapy (CBT) interventions adapted to address minority stress faced by LGBTQ+ community (Craig and Austin, 2016; Pachankis et al., 2023). Research has found significant decreases in internalized stigma (Pachankis et al., 2023a), depression (Austin et al., 2018; Craig and Austin, 2016; Lucassen et al., 2015) and suicidal ideation (Diamond et al., 2012) post-intervention. In addition, Project RISE, a digital single-session intervention (SSI) based on principles of affirmative CBT (Pachankis et al., 2023b), specifically designed to focus on minority stress among LGBTQ+ adolescents, successfully improved internalized stigma and hopelessness immediately post-intervention, as well as internalized stigma at 2-week follow up, relative to a psychoeducation control group (Shen et al., 2023).

1.3. Do structural stigma, internalized stigma, and social support interact with one another to predict LGBTQ+ youth intervention response?

While each of the trials mentioned above tested interventions designed to address minority stress responses among LGBTQ+ adolescents, none of them examined whether or how *contextual* factors—including baseline levels of structural stigma, internalized stigma, or perceived social support—shape intervention effects. Evaluating how environments inhibit or enhance mental health intervention response may inform clinical decision-making to personalize support for LGBTQ+ adolescents. Structural stigma may moderate the link between baseline internalized stigma and intervention response in LGBTQ+ youth in one of two ways: First, a teen exposed to high levels of structural and internalized stigma might experience larger benefits from a LGBTQ+ affirmative mental health intervention, given their increased need for coping skills and support. Conversely, a teen experiencing high levels of structural and internalized stigma might benefit *less* from intervention, because their environment does not support the application of newly-gleaned coping skills. In this case, a teen experiencing higher *internalized* stigma, but less *structural* stigma, might be best positioned to benefit from affirmative mental health support.

Additionally, perceived social support might moderate the association between baseline exposure to structural or internalized stigma and intervention response in LGBTQ+ youth. Specifically, per the stress-buffering model (Cassel, 1974; Cohen, 2004), it is plausible that perceived social support may serve as a protective factor, mitigating the potentially negative effect of structural and internalized stigma on LGBTQ+ youth intervention response. Due to living in more supportive environments, where they may be supported by family or friends in using skills learned via psychosocial interventions, these youth may be better positioned to benefit from the mental health tools they access. In the present study, we hypothesized that social support would moderate the impacts of structural stigma on the intervention outcomes, such that greater social support would lead to greater improvements in target outcomes (e.g., identity pride, hopelessness) among youth reporting higher levels of structural stigma. We further hypothesized that the interaction between social support and internalized stigma would lead to enhanced intervention response (i.e., greater improvements in levels of identity pride and hopelessness) among LGBTQ+ youth reporting high levels of social support and high levels of internalized stigma. In other words, social support would buffer the negative impacts of structural stigma, and the buffering effect would be greater for youth with higher levels of internalized stigma.

To test these possibilities via secondary data analysis, we sought to identify previously completed trials that tested interventions targeting internalized stigma related to LGBTQ+ youth identity, specifically in the context of LGBTQ+ youth mental health. We identified only one such study: a randomized evaluation of an online single-session intervention targeting minority stress responses in LGBTQ+ youth, called Project RISE (Shen et al., 2023). Although this trial included data relevant to youths' context (e.g., perceived social support; internalized stigma; and zip-code data allowing for computation of structural stigma indicators),

the potential interactive effects of structural stigma, internalized stigma, and social support on Project RISE's effectiveness have not been examined. Given the intervention's overall effectiveness, a key next step toward targeted dissemination involves identifying the contexts and populations for whom it is most effective. Accordingly, the current study examined how structural stigma, internalized stigma, and social support were interactively associated with stigma- and mental health-related outcomes among LGBTQ+ youth who completed Project RISE.

1.4. Hypotheses

We had four primary study hypotheses (H1-H4). H1 aims to replicate prior research identifying associations between structural stigma, internalized stigma, perceived social support, and mental health among LGBTQ+ youth, using baseline data. H2-4 pertain to the potential *moderating* effects of internalized stigma and perceived social support on the association between structural stigma and LGBTQ+ youths' outcomes following Project RISE (see Fig. 1). In this secondary analysis, we examined multiple outcomes, including internalized stigma (primary outcome), identity pride, hopelessness, depression, and anxiety symptoms immediately post-intervention and at the 2-week follow-up, consistent with the original RISE study.

First (Hypothesis 1; H1 - *baseline associations*), we hypothesized a positive correlation between structural stigma and internalized stigma, as well as Project RISE outcomes, at baseline. Specifically, we expected that LGBTQ+ youth living in environments with high levels of structural stigma and who reported higher levels of internalized stigma would exhibit lower levels of identity pride (i.e., defined as positive feelings regarding an individual's part of a minoritized gender or sexual orientation community; Bockting et al., 2013), and higher levels of hopelessness, depression, and anxiety at baseline.

Second (Hypothesis 2; H2), we hypothesized that internalized stigma would moderate the association between structural stigma and Project RISE outcomes at both immediate post-intervention (H2a) and 2-week follow-up (H2b), such that internalized stigma would influence changes in intervention response immediately post-intervention (i.e., levels of identity pride, hopelessness; H2a) and at the 2-week follow-up (i.e., levels of identity pride, hopelessness, depression, and anxiety;

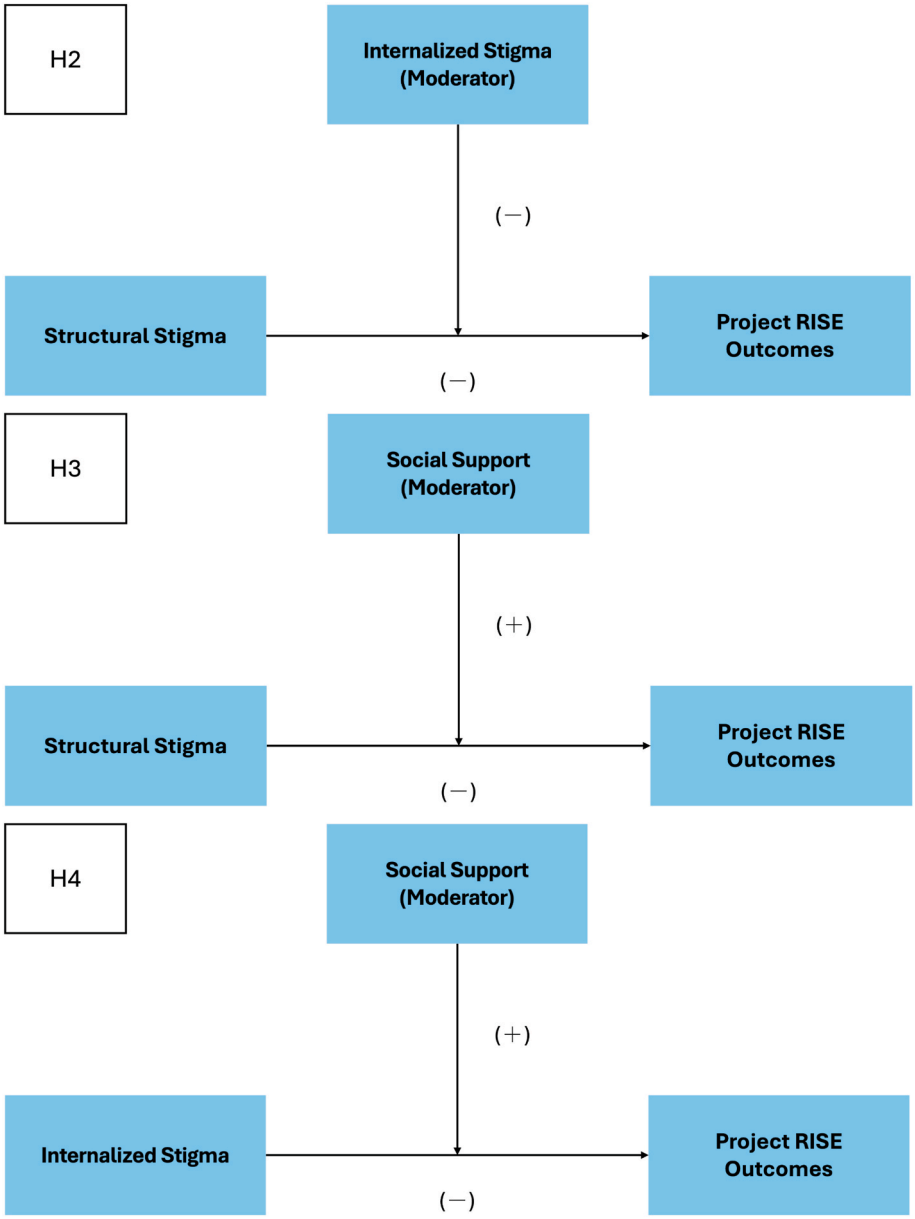

Fig. 1. Moderation conceptual models of project RISE outcomes based on hypothesis 2 (H2), hypothesis 3 (H3), and hypothesis 4 (H4).

H2b). That is, internalized stigma could be linked to either larger OR smaller shifts in the outcomes of RISE, because while those with high internalized stigma might have the need for a LGBTQ+ affirmative mental health intervention, low environmental support may limit opportunities for applying the skills gained in this intervention.

Third (Hypothesis 3; H3), we hypothesized that social support would moderate the association between structural stigma and Project RISE outcomes at both immediate post-intervention (H3a) and 2-week follow up (H3b). Specifically, we hypothesized that LGBTQ+ youth who perceived higher levels of social support who also experienced high-levels of structural stigma in their environment would experience greater increases in levels of identity pride and greater decreases in levels of internalized stigma and hopelessness at immediately post-intervention (H3a), and greater increases in levels of identity pride and greater decreases in levels of internalized stigma, hopelessness, depression, and anxiety at the 2-week follow up (H3b).

Fourth (Hypothesis 4; H4), we hypothesized that social support would moderate the association between internalized stigma and Project RISE outcomes at both immediate post-intervention (H4a) and 2-week follow-up (H4b). Specifically, we hypothesized that LGBTQ+ youth with access to high levels of social support who also report high levels of internalized stigma at baseline would experience greater increases in levels of identity pride and greater decreases in levels of hopelessness at immediate post-intervention (H4a), and greater increases in levels of identity pride and greater decreases in levels of hopelessness, depression, and anxiety at the 2-week follow up (H4b).

2. Methods

2.1. Recruitment and study procedure

The current study was a pre-registered, secondary analysis of Project RISE (Shen et al., 2023), which was approved by the University of Denver Institutional Review Board (IRB). The trial protocol of Project RISE was pre-registered on the Open Science Framework (OSF) prior to participant enrollment (https://osf.io/es3zb). Initial recruitment of LGBTQ+ youth via social media advertisements (e.g., Instagram) aimed to recruit a sample of at least 300 participants in May 2022. Instagram ads provided a link to an online survey platform where participants encountered survey questions and the SSI. Recruitment was swift and was cut off after 24 h as recruitment far exceeded expectations. All aspects of this study were completed online. Variables were measured either immediately before the intervention (i.e., demographics, social support, internalized stigma, identity pride, hopelessness, anxiety, and depression), immediately after the intervention (i.e., internalized stigma, identity pride, and hopelessness), and at 2-week follow-up (i.e., internalized stigma, identity pride, hopelessness, anxiety, and depression). Variables not assumed to significantly change due to the nature of the measure were not included in the immediate baseline or follow-up data collection. For example, it was assumed demographics would not significantly change in one 30-min session nor would scores on depression and anxiety as the measure assessed for changes in symptoms over the last two weeks, consistent with previous validation studies of the measure. All participants were screened for inclusion criteria, including LGBTQ+ identity endorsement, age (13–16 years), English fluency, consistent internet access, and self-reported experience of negative impact of LGBTQ+ stigma (i.e., eligible if non-zero response provided). Participants provided assent after screening and given the minimal risks associated with this study, parental permission was waived by the IRB to protect each adolescent's confidentiality and safety. Demographics were completed along with baseline questionnaires. Afterward, participants were randomly assigned by the computerized survey platform (i.e., Qualtrics) to either the SSI (i.e., Project RISE) or the informational-only control condition (see CONSORT diagram in Supplemental Fig. 1). Given our primary focus on differential intervention responses to Project RISE, the current study only examined data from participants assigned to the intervention (see below for more information on the intervention). Data analysis commenced only after all baseline data had been gathered, and follow-up data analysis began after all data collection and recruitment were concluded.

Participants were debriefed on their condition and the study protocol after full completion of the survey. Researchers learned participants' condition after completing data collection and analysis. Participants were compensated $10 for participating in the baseline survey, including pre- and post-SSI measures. Participants were compensated an additional $10 for completing a 2-week follow-up with a subset of baseline measures. All participants were treated per the American Psychological Association's ethical code. For full sample characteristics and more study design information please see Project RISE (https://osf.io/es3zb).

2.2. Intervention

The intervention condition included a minority stress SSI (Project RISE), as well as a resource list that matched the control condition (described below). The minority stress SSI included an introduction to minority stress, privilege, and marginalization, with psychoeducation on how minority stress could impact individuals' emotional well-being and mental health. The SSI also included stories by other youths on how minority stress has impacted them emotionally, cognitively, and behaviorally, and how they used emotion identification skills to identify and act on their needs in the face of minority stress. Additionally, the SSI included self-validation and interactive components allowing participants to reflect and write about their own identities and experiences with minority stress, identify emotions and cognitions related to these experiences, and identify values-based needs based on their emotions and cognitions that they could act on. Lastly, the SSI included an exercise in which youths could identify a coping statement to help them get through minority stress situations and provided them with an action card that comprised their coping statement; their emotions, cognitions, and needs when minority stress arose; and strategies they could implement to act on their needs. The SSI also included an optional exercise where youths could share advice to other youths facing minority stress, based on what they learned from the SSI. Only individuals in the intervention group were examined for the current study. See the original Open Science Framework (OSF) registration for more information and materials: https://osf.io/es3zb.

2.3. Measures

2.3.1. County-level structural stigma

A factor of county-level structural stigma was created using factor analysis of multiple variables measuring implicit and explicit attitudes particularly toward sexual minority (SM) and gender minority (GM) people (i.e., explicit and implicit attitudes towards LGBTQ+ people). Data collected from January 2022 to December 2022 from Project Implicit (Project Implicit, n.d.; https://osf.io/y9hiq/) was used for the purpose of acquiring attitudes by aggregating responses to statements asking individuals about their implicit and explicit attitudes towards LGBTQ+ communities from two separate Implicit Association Test (IAT) datasets (Sexuality IAT and Transgender IAT, Project Implicit, https://osf.io/y9hiq/). Study participants' zip code data was used to link model-generated factor scores reflecting county-level structural stigma.

Sexuality. Four items were used to measure stigma towards sexuality. The first and second county-level structural stigma items included measured explicit attitudes towards gay men and lesbian women. The single-item (e.g., one about attitudes toward gay men and another item about attitudes toward lesbian women) asked participants to rate how warm or cold they felt towards gay men on a scale from 0 (coldest feelings) to 10 (warmest feelings). The third county-level structural stigma item asked participants to rate an explicit attitude about gay people on a 7-point scale. The single-item asked participants to rate how

much they prefer gay/lesbian people to heterosexual people (e.g., rated 1 ″I strongly prefer gay/lesbian people to cisgender people." to 7 ″I strongly prefer heterosexual people to gay/lesbian people.”). The fourth county-level structural stigma item was a measure of implicit attitudes held towards gay/lesbian vs straight people.

Transgender. Three items were used to measure structural stigma towards transgender people. The first county-level structural stigma item was a measure of explicit attitudes towards transgender people. One single-item asked participants to rate how warm or cold they felt towards transgender people on a scale from 0 (coldest feelings) to 10 (warmest feelings). The second county-level structural stigma item asked participants explicit attitudes towards transgender people on a 7-scale. Another single-item asked participants to rate how much they prefer transgender people to cisgender people (e.g., rated one “I strongly prefer transgender people to cisgender people." to seven “I strongly prefer cisgender people to transgender people.”). The third county-level structural stigma item was a measure of implicit attitudes held towards transgender people from the Implicit Association Test.

2.3.2. Lesbian, gay, and Bisexual Identity Scale

The Lesbian, Gay, and Bisexual Identity Scale (LGBIS; Mohr and Kendra, 2011) is a 27-item self-report measure that assesses dimensions of lesbian, gay, and bisexual identity, yielding scores on eight subscales. The LGBIS internalized stigma and identity pride subscales were presented at baseline, immediately post-intervention (regardless of condition), and 2-week follow-up.

Internalized Stigma. The Internalized Homonegativity subscale comprises three items; participants rate their endorsement of these items on a 6-point Likert scale, ranging from 1 (“disagree strongly”) to 6 (“agree strongly”), and a mean score is calculated, ranging from 1 to 6, with higher scores indicating greater internalized stigma. For this study the language of these items was updated to include additional LGBTQ+ identities, as follows: “If it were possible, I would choose to be [cisgender and/or heterosexual].” “I wish I were [cisgender and/or heterosexual].” “I believe it is unfair that I [am attracted to people of my same gender and/or am transgender/gender diverse].” Changes in internalized stigma scores from pre-SSI to post-SSI and to the three-month follow-up will serve as the primary outcome variable in the present study.

Identity Pride. The Identity Affirmation subscale of the LGBIS comprises three items; participants rate their endorsement of these items on a 6-point Likert scale, ranging from 1 (“disagree strongly”) to 6 (“agree strongly”), and a mean score is calculated from 1 to 6, with higher scores indicating greater identity pride. For the purposes of this study the language of these items was updated to include additional LGBTQ+ identities, as follows: “I am glad to be an [LGBTQ+] person.” “I’m proud to be part of the [LGBTQ+] community.” “I am proud to be [LGBTQ+].”

2.3.3. Sexual orientation

Sexual orientation was measured at baseline using the demographic question “How do you identify your sexual orientation? … Please choose which one best fits how you identify.” Response options comprise heterosexual/straight, gay/lesbian/homosexual, bisexual, pansexual, queer, asexual, other, unsure/questioning, and “I do not use a label”. Responses were dummy coded for analysis as Heterosexual = 0 and Minoritized Sexual Identity = 1.

2.3.4. Gender identity

Gender identity was measured at baseline using the demographic question “How do you identify your gender identity? Check all that apply.” Response options comprise man/boy, woman/girl, transgender, female to male transgender/FTM, male to female transgender/MTF, trans male/transmasculine, trans female/trans feminine, genderqueer, gender expansive, androgynous, nonbinary, two-spirited, third gender, agender, not sure, and other. Responses were dummy coded for analysis as Cisgender = 0 and Minoritized Gender Identity = 1. We also coded for Transgender = 0 and all other gender identities = 1.

2.3.5. Sex assigned at birth

Sex assigned at birth was measured at baseline using the demographic question “What sex were you assigned at birth?” Response options comprise female, male, intersex, other, and “prefer not to say.”

2.3.6. Racial/ethnic identity

Racial/ethnic identity was measured at baseline using the demographic question “How do you identify your race/ethnicity? Check all that apply.” Response options were comprised as American Indian or Alaska Native, Asian (including Asian Desi), Black/African American, Hispanic/Latinx, Native Hawaiian or Other Pacific Islander, White/Caucasian (non-Hispanic; includes Middle Eastern), and Other. Participants who indicate more than one response were coded as Multi-racial/Multi-ethnic. Responses were dummy coded for analysis as non-Hispanic White = 0 and Minoritized Racial/Ethnic Identity = 1.

2.3.7. Subjective Social Status

Subjective social status was assessed at baseline using the MacArthur Scale of Subjective Social Status - Youth Version (Goodman et al., 2001). Participants were asked to rate their perceived socioeconomic and social status using the two items from this scale. On these items, participants indicated where they see themselves on a ladder with 10 rungs, the range of which span from 1 to 10, where 1 represented families with the most money, education, and jobs, as well as youth with the highest respect, grades, and social standing; and 10 represents families with the least money, education, and jobs, as well as youth with the lowest respect, grades, and social standing.

2.3.8. Hopelessness

Hopelessness was assessed at baseline, immediately post-intervention, and at follow-up. The four-item version of the Beck Hopelessness Scale (Perczel Forintos et al., 2013) asked participants to rate four statements based on their sense of hopelessness. Participants rate the four statements on a 4-point scale ranging from 0 (Absolutely Disagree) to 3 (Absolutely Agree). The total score ranges from 0 to 12, with a higher score indicating greater levels of hopelessness. The Cronbach’s alpha for the current study was 0.84 at baseline, 0.87 at immediately post-intervention, and 0.88 at 2-week follow-up.

2.3.9. Anxiety symptom severity

Anxiety symptoms were measured using the Generalized Anxiety Disorder 7 (Spitzer et al., 2006). The GAD-7 was assessed pre-SSI and at the 2-week follow-up. The GAD-7 measures the severity of clinical anxiety symptoms, based on diagnostic criteria for generalized anxiety disorder. The GAD-7 included seven items asking respondents how often, during the last two weeks, they were bothered by each of seven anxiety symptoms. Response options were “not at all,” “several days,” “more than half the days,” and “nearly every day,” scored as 0, 1, 2, and 3, respectively; thus total sum scores may range from 0 to 21 and mean scores from 0 to 3. The Cronbach’s alpha for the current study was 0.86 at baseline and 0.89 at 2-week follow-up.

2.3.10. Depressive symptom severity

Depressive symptoms were assessed using the Children’s Depression Inventory, Second Edition: Self-Report Short version (Kovacs, 2015). Depressive symptoms were assessed pre-SSI and at the 2-week follow-up. The CDI-2 is a reliable, valid measure of youth depression severity, normed for youth age and sex and yielding raw and T scores. The Cronbach’s alpha for the current study was 0.83 at baseline and 0.83 at 2-week follow-up.

2.3.11. Social support

Social support was assessed at baseline using the Multidimensional

Scale of Perceived Social Support (Zimet et al., 1988). The MSPSS is a 12-item self-report measure which assessed perceived levels of social support from family, friends, and significant others. Responses to items are on a 7-point Likert scale ranging from 0 ("very strongly disagree") to 6 ("very strongly agree"). Total scores were calculated by a mean score across the 12 items. Mean scores ranged from 0 to 6, and higher scores indicated higher levels of perceived social support. The Cronbach's alpha for the current study was 0.88 at baseline.

2.4. Statistical analyses

A priori power analysis using G*Power with an alpha level of 0.05, 80% power (consistent with the original paper), and up to seven predictors indicated that a total of 395 participants would be required to detect small effects. Based on these results, our study had sufficient statistical power to detect medium or large moderation effects (Faul et al., 2009). To measure county-level structural stigma, we created a factor of county-level structural stigma using Confirmatory Factor Analysis of multiple variables of explicit and implicit attitudes particular to LGBTQ+ individuals. Model fit of the county-level structural stigma factor was assessed with the standardized root-mean-square residual (SRMR) and the comparative fit index (CFI); in combination, SRMR values less than or equal to 0.09 and CFI values greater than or equal to 0.90 indicate good model fit (Hu and Bentler, 1999). If the factor did not fit as predicted, we examined each factor loading to adjust the model as needed to improve fit. Then we linked participants' zip code data with model-generated factor scores of county-level structural stigma. We handled missing data by using the expectation-maximization and bootstrapping algorithm with Amelia II in R (Honaker et al., 2011) to impute participant-level missing data.

To address Hypothesis 1, we used descriptive analyses (e.g., frequency analyses) and Pearson's correlations to examine the associations between baseline variables of county-level structural stigma, internalized stigma, identity pride, depression, and anxiety symptom severity, perceived social support, hopelessness, and potential covariates (i.e., age and race/ethnicity), as well as the outcomes of interest (i.e., internalized stigma, identity pride, hopelessness, depression, and anxiety symptoms post-intervention and at follow up). Given that the intervention was designed for LGBTQ+ youth broadly, and that the structural stigma index includes one GM-related indicator to account for gender minority experiences, we did not control for SM or GM identities in the regression models. This approach aligns with the analysis in the original Project RISE study, which treated LGBTQ+ youth as a collective population.

To address Hypotheses 2–4, we employed multiple linear regression analyses to examine the interactive effects of structural stigma, internalized stigma, and social support at baseline on intervention outcomes immediately post-intervention (i.e., internalized stigma, identity pride, hopelessness) and at the 2-week follow-up (i.e., internalized stigma, identity pride, hopelessness depression, and anxiety), controlling for baseline and post-intervention outcome scores. In these analyses, we included potential covariates (e.g., age and race/ethnicity) if they demonstrated significant correlations with the predictor variables to minimize potential confounding effects. A p-value of less than 0.05 was considered significant.

For Hypothesis 2, we focused on the interactive effects of structural-level and internalized stigma at baseline on intervention outcomes. In Hypothesis 3, we examined whether social support at baseline moderated the association between structural stigma at baseline (controlling for internalized stigma) and intervention outcomes. Lastly, in Hypothesis 4, we explored whether social support at baseline moderated the association between internalized stigma at baseline (controlling for structural stigma) and intervention outcomes.

3. Results

3.1. Sample characteristics

After randomization, a total of 262 participants were assigned to the intervention group for the minority stress-focused digital SSI. Since 17 participants did not provide valid zip codes that could be linked to the county-level structural stigma index, and 1 participant did not complete the full intervention, our final sample consisted of 244 participants. Of the youth who participated in both the intervention and the initial baseline assessments, approximately 15.6% (n = 38) did not complete all the required measures immediately after the intervention. Additionally, during the period between the baseline assessment and the 2-week follow-up, a dropout rate of approximately 41.8% (n = 102) was observed among participants. To investigate the factors contributing to dropout, a logistic regression model was employed. The results of this analysis revealed that only age demonstrated a statistically significant association with youth dropout. Missing data were imputed using the expectation-maximization and bootstrapping algorithm. This approach ensured the robustness of results and retained high power despite the missing data. Further details on the missing data approach are available in the original study (Shen et al., 2023). Demographic statistics for the sample can be found in Table 1, which provides an overview of the participant's age, gender, race/ethnicity, and other relevant characteristics.

3.2. County-level structural stigma index

A Confirmatory Factor Analysis was performed to quantify the county-level structural stigma index, capturing attitudinal climates specific to LGBTQ+ people. Two indicators — the 7-scale explicit attitudes towards transgender people and the implicit attitudes towards transgender people — were removed due to their small weights (low factor loadings) in the factor analysis. The final county-level structural stigma index comprised five indicators, including four sexuality-specific factors (i.e., explicit attitudes towards gay men, lesbian women, sexuality overall, and implicit attitudes towards gay/lesbian) and one transgender-specific factor (i.e., explicit attitudes towards transgender people). Standardized factor loadings for county-level structural stigma across the U.S. ranged from −2.90 to 6.14, with higher scores indicating higher levels of structural stigma (see Fig. 2 for the U.S. County-Level Structure Stigma Index Map). Similarly, factor loadings from RISE, also represented as standardized scores, ranged from −1.27 to 2.33 (see Supplemental Fig. 2 for the County-Level Structure Stigma Index Map of Project RISE sample). The confirmatory factor analysis model demonstrated a good fit to the data, $\chi 2$ (df) = 374.27 (10), $p < .001$, SRMR = 0.06, CFI = 0.92. These results indicated that our county-level structural stigma index is a reliable and valid measure of the contextual factors affecting individuals with minoritized sexual and gender identities.

3.3. Hypotheses

Hypothesis 1. Correlation between County-level Structural Stigma Index and Baseline Variables

We performed a Pearson's R analysis to investigate the correlations between the county-level structural stigma index and baseline variables, including internalized stigma, identity pride, severity of depression and anxiety symptoms, perceived social support, hopelessness, and our covariates (such as age and race/ethnicity), as well as the outcomes of interest (i.e., internalized stigma, identity pride, hopelessness, depression, and anxiety symptoms post-intervention and at follow up). As shown in Table 2, the county-level structural stigma demonstrated significant correlations with age (r (242) = −0.14, $p = .03$), as well as baseline internalized stigma (r (242) = −0.17, $p = .005$) and immediate post-intervention internalized stigma (r (204) = −0.17, $p = .01$).

Table 1
Sample characteristics.

Demographics	N = 244
	Mean (SD)
Age	15.09 (0.95)
Perceived Social Status	5.39 (1.68)
	n (%)
Sex at Birth	
Female	219 (90%)
Male	25 (10%)
Sexual Minority (Total)	244 (100%)
Asexual	18 (7.4%)
Bisexual	55 (23%)
Gay/Lesbian/Homosexual	58 (24%)
I do not use a label	12 (4.9%)
Other/Not listed	11 (4.5%)
Pansexual	41 (17%)
Queer	30 (12%)
Unsure/Questioning	19 (7.8%)
Gender Minority (Total)[a]	166 (68%)
Transgender	35 (14%)
Female to Male Transgender (FtM)	30 (12%)
Male to Female Transgender (MtF)	5 (2.0%)
Transfeminine	8 (3.3%)
Transmasculine	42 (17%)
Gender Queer	26 (11%)
Gender Expansive	9 (3.7%)
Androgynous	26 (11%)
Nonbinary	74 (30%)
Two Spirit	2 (0.8%)
Third Gender	0 (0%)
Agender	11 (4.5%)
Not Sure	22 (9.0%)
Other Gender	33 (14%)
Racial/Ethnic Minority (Total)	125 (51%)
American Indian or Alaska Native	2 (0.8%)
Asian	17 (7.0%)
Black/African American	26 (11%)
Hispanic/Latinx	26 (11%)
Selected multiple rachial/ethnic minority	50 (20%)
Native Hawaiian or other Pacific Islander	2 (0.8%)
Other Race	1 (0.4%)
Prefer not to answer	1 (0.4%)
White/Caucasian	119 (49%)

Note. Table 1 summarizes the demographic and descriptive characteristics of the sample (N = 244). Data include mean and standard deviation (SD) for continuous variables (e.g., age, perceived social status) and frequencies and percentages for categorical variables (e.g., sex at birth, sexual orientation, gender identity, racial/ethnic identity).

[a] Participants were allowed to select multiple gender identities.

However, we did not observe significant correlations with variables such as identity pride, severity of depression and anxiety symptoms, perceived social support, and hopelessness.

Moreover, internalized stigma is negatively correlated with identity pride (r (242) = −0.51, $p < .001$) and social support (r (242) = −0.14, $p = .03$), and positively correlated with depression symptoms (r (242) = 0.22, $p < .001$). Identity pride is negatively correlated with depression symptoms (r (242) = −0.14, $p = .03$) and positively correlated with social support (r (242) = 0.28, $p < .001$). Depression symptoms show a negative correlation with social support (r (242) = −0.48, $p < .001$) and a positive correlation with anxiety symptoms (r (242) = 0.67, $p < .001$). Finally, anxiety symptoms are negatively correlated with social support (r (242) = −0.35, $p < .001$). Given these significant correlations, baseline scores were used as covariates in the analysis of post-intervention outcomes. Both baseline and post-intervention scores were considered for the 2-week follow-up analysis. See Table 2 for all correlations between study variables.

Hypothesis 2. Internalized stigma as a moderator of structural stigma's effects on Project RISE outcomes

Multiple linear regression analyses revealed no significant moderation effects (all $p > .05$; Table 3) of internalized stigma on the relationship between county-level structural stigma and intervention outcomes at either immediately post-intervention (H2a) or the 2-week follow-up (H2b). Full regression results for all outcomes are provided in Supplemental Table 1.

Hypothesis 3. Social support as a moderator of structural stigma's effects on Project RISE outcomes

Multiple linear regression analyses showed no significant moderation effects (all $p > .05$; Table 3) of social support at baseline on the relationship between country-level structural stigma and intervention outcomes at either immediately post-intervention (H3a) or the 2-week follow-up (H3b). Full regression results for all outcomes are provided in Supplemental Table 1.

Hypothesis 4. Social support as a moderator of internalized stigma's effects on Project RISE outcomes

Multiple linear regression analyses revealed that social support at baseline did not moderate the relationship between internalized stigma and intervention outcomes (all $p > .05$; Table 3), both immediately post-intervention (H4a) and at the 2-week follow-up (H4b). Detailed results for all outcomes are available in Supplemental Table 1.

Given the results of H2-H4, we initially planned to apply the false discovery rate (FDR) correction to account for multiple comparisons. However, this was not implemented as no significant results were observed. Applying the FDR correction in this context would not have changed the interpretation of the findings, as all results remained insignificant.

4. Discussion

This study explored the associations between county-level structural stigma, internalized stigma, social support, and mental health outcomes among LGBTQ+ adolescents who completed a minority stress-focused digital single-session intervention (SSI), Project RISE. County-level structural stigma and internalized stigma were positively correlated with one another at baseline. However, contrary to hypotheses, county-level structural stigma did not significantly moderate the link between baseline internalized stigma and SSI response. Similarly, social support at baseline did not moderate links between structural stigma and SSI outcomes, nor between internalized stigma and SSI outcomes.

Present results are contextualized by the results of the primary Project RISE effectiveness trial (Shen et al., 2023). Specifically, the original study's findings suggested that youth who completed Project RISE experiencing significant improvements in internalized stigma (d = −0.71; 95% CI: 0.90, −0.51), identity pride (d = 0.43; 95% CI: 0.24, 0.62), and hopelessness (d = −0.77; 95% CI: 0.96, −0.57) from pre-to post-intervention, along with improvements in internalized stigma (d = −0.71; 95% CI: 0.90, −0.51), identity pride (d = 0.24; 95% CI: 0.01, 0.46), depression (d = −0.68; 95% CI: 0.92, −0.44), and anxiety (d = −0.38; 95% CI: 0.61, −0.15) at the 2-week follow-up. Paired with these results, the present study suggests that Project RISE may benefit mental health in LGBTQ+ youth *regardless* of their experiences of social support or stigma.

Hypothesis 1. Correlation between County-level Structural Stigma Index and Baseline Variables

Contrary to our hypothesis and previous literature, the correlations between the county-level structural stigma index and the baseline variables yielded mixed results. While significant associations were found between structural stigma and variables such as age, baseline internalized stigma, and immediate post-intervention internalized stigma, we did not observe significant correlations with variables such as identity pride, severity of depression and anxiety symptoms, perceived social support, and hopelessness. One potential explanation for these unexpected results is that our sample consisted of youth participants who

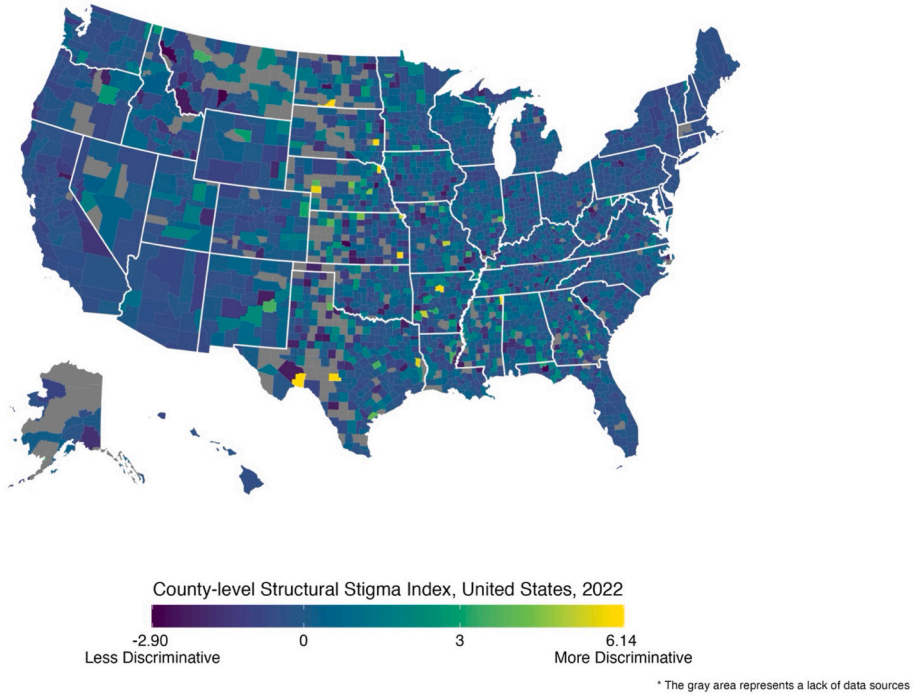

Fig. 2. U.S. County-Level structural stigma index map: Highlighting LGBTQ+ discrimination.

may possess greater resilience or coping strategies, which could have played a role in buffering the effects of structural stigma on these variables (Vigna et al., 2018). While the majority of Project RISE participants endorsed clinically-elevated symptoms of anxiety, depression, or both, most participants in the current study also resided in counties with relatively low levels of structural stigma, which may provide them with support and access to care that may not be readily available in higher stigma locations of the country. Additionally, it is possible that social attitudes, as captured by the county-level structural stigma index, may carry less weight in influencing these variables among youth due to the more proximal social contexts that impact their lives. For instance, the presence of support in their immediate environment, such as the presence of supportive initiatives like Gay-Straight Alliances (GSAs) in schools, might create a safer and less stigmatizing environment for youth, even in areas with higher levels of structural stigma (Hatzenbuehler et al., 2015). GSAs have been shown to provide crucial support and resources for LGBTQ+ youth, potentially mitigating the negative effects of structural stigma (Walls et al., 2008). Future research could explore the role of proximal, daily experiences of affirmation on the well-being of LGBTQ+ youth living in areas with varying levels of structural stigma.

Hypothesis 2. Project RISE Was Effective Regardless of the Levels of Structural Stigma and Internalized Stigma, Immediately Post-Intervention and at the 2-Week Follow Up

Contrary to our expectations, county-level structural stigma did not moderate the association between baseline internalized stigma and intervention outcomes. Thus, the effectiveness of Project RISE was not influenced by the overall attitudinal climate specific to LGBTQ+ individuals in participants' respective counties. These results are somewhat surprising, as previous research has shown that structural stigma can contribute to negative mental health outcomes in LGBTQ+ individuals (Hatzenbuehler, 2017). However, it is possible that the intervention itself played a crucial role in mitigating the impact of structural stigma. Project RISE was specifically designed to address the unique challenges and experiences of LGBTQ+ youth who face minority stress, including various levels of stigma (Shen et al., 2023). Through an adaptation process that incorporated principles and techniques tailored to the stigma-based mechanisms (Pachankis et al., 2023b) affecting the mental and behavioral health of stigmatized groups, the intervention remained effective in improving mental health outcomes. Targeted interventions such as Project RISE, an intervention specifically developed and adapted to the needs of marginalized populations, can effectively address the detrimental effects of stigma on mental health. These findings align with broader research suggesting that tailored, stigma-focused interventions can foster resilience among marginalized populations, even in challenging structural environments (Schleider et al., 2025).

Hypothesis 3 and 4. Project RISE Was Effective Regardless of the Levels of Structural Stigma and Social Support, Immediately Post-Intervention and at the 2-Week Follow Up

Similarly, social support at baseline did not moderate the association between county-level structural stigma, internalized stigma, and intervention outcomes. The presence or absence of social support did not significantly alter the effects of structural stigma and internalized stigma on the outcomes of the intervention, indicating minimal influence on the intervention's outcomes. Our findings highlight the robustness and effectiveness of Project RISE in improving mental health outcomes, regardless of the level of social support available to participants at baseline. While social support has been identified as a protective factor for mental health among LGBTQ+ youth (Snapp et al., 2015), it may not have played a significant role in mitigating the effects of stigma in the context of this adapted intervention. It is worth noting that social support is a multifaceted construct, encompassing various sources such as family support, peer support, and community support (Fiore et al., 1986). Each aspect of support may have differential effects on intervention outcomes, and future research could explore these nuances to gain a deeper understanding of the specific role of different forms of social support in the context of minority stress interventions (Pachankis et al., 2020). Nonetheless, the present study highlights that the effectiveness of Project RISE extends beyond the presence of baseline social support, emphasizing the potential impact of the intervention in improving mental health outcomes among LGBTQ+ adolescents even in the absence of robust social support networks.

Table 2
Pearson's R correlation analysis between covariates, baseline scores, and outcomes of interest.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Age	–	0.51	0.17	0.03	0.80	0.79	0.56	0.74	0.78	0.61	0.6	0.92	0.07	0.61	0.61	0.70	0.68	0.96
2. Social Subjective Status	0.04	–	*	0.71	0.46	0.17	0.00	0.02	0.23	*	0.36	0.33	*	0.75	0.86	0.06	0.64	0.03
3. Discrimination	−0.09	0.24	–	0.50	0.03	0.15	*	*	*	*	*	0.02	*	0.02	0.07	0.00	0.01	0.02
4. Structural Stigma	−0.14	−0.02	0.04	–	0.00	0.28	0.85	0.18	0.99	0.84	0.01	0.46	0.18	0.09	0.14	0.1	0.93	0.21
5. BL Internalized Stigma	−0.02	−0.05	0.14	−0.18	–	*	*	0.07	0.03	*	*	*	0.07	*	*	0.00	0.13	0.03
6. BL Identity Pride	0.02	0.09	−0.09	0.07	−0.51	–	0.03	0.31	*	*	*	*	0.12	*	*	0.13	0.13	0.37
7. BL Depression Symptoms	−0.04	0.18	0.48	−0.01	0.22	−0.14	–	*	*	*	*	0.01	*	0.00	0.05	*	*	*
8. BL Anxiety Symptoms	−0.02	0.15	0.38	0.09	0.12	−0.07	0.67	–	*	*	*	0.41	*	0.52	0.99	*	*	0.00
9. BL Social Support	−0.02	−0.07	−0.28	0.00	−0.14	0.28	−0.48	−0.35	–	*	*	*	*	0.00	*	*	*	*
10. BL Hopelessness	−0.03	0.25	0.40	−0.01	0.28	−0.17	0.68	0.41	−0.38	–	*	*	*	*	0.01	*	*	*
11. PI Internalized Stigma	0.03	0.06	0.23	−0.17	0.82	−0.50	0.27	0.16	−0.28	0.32	–	*	*	*	*	*	0.03	0.01
12. PI Identity Pride	−0.01	0.07	−0.16	0.05	−0.43	0.83	−0.18	−0.06	0.31	−0.18	−0.55	–	*	*	*	0.01	0.04	0.02
13. PI Hopelessness	−0.12	0.14	0.29	0.01	0.13	−0.11	0.61	0.34	−0.37	0.69	0.31	−0.27	–	*	*	*	*	*
14. F/U Internalized Stigma	0.04	−0.03	0.19	−0.14	0.86	−0.54	0.26	0.05	−0.25	0.35	0.84	−0.53	0.25	–	*	*	0.07	*
15. F/U Identity Pride	−0.04	−0.01	−0.15	0.12	−0.56	0.83	−0.16	0.00	0.3	−0.22	−0.61	0.81	−0.18	−0.55	–	0.00	0.02	0.03
16. F/U Depression Symptoms	0.03	0.16	0.27	−0.14	0.26	−0.13	0.72	0.48	−0.35	0.52	0.30	−0.22	0.54	0.32	−0.27	–	*	*
17. F/U Anxiety Symptoms	0.03	0.04	0.23	0.01	0.13	−0.13	0.56	0.65	−0.29	0.38	0.18	−0.17	0.43	0.15	−0.2	0.7	–	*
18. F/U Hopelessness	0.00	0.18	0.19	−0.10	0.18	−0.08	0.59	0.26	−0.35	0.64	0.23	−0.20	0.71	0.29	−0.18	0.68	0.49	–

Note. Table 2 displays the Pearson correlation coefficients (r) below the diagonal and p-values above the diagonal among covariates, baseline variables, and outcomes of interest (e.g., internalized stigma, identity pride, depression, and anxiety symptoms) at baseline, post-intervention, and follow-up. Abbreviations: "BL" indicates baseline, "PI" indicates post-intervention, and "F/U" indicates follow-up. Significant correlations ($p < .001$) are marked with an asterisk (*).

Table 3
Results of multiple linear regression analyses for internalized stigma (primary outcome).

Outcome Variables	b	Standard Error	*p*-value	95% CI
(H2a) Post-intervention internalized stigma				
Structural stigma	0.07	0.40	0.861	[-0.71, 0.85]
Baseline internalized stigma	0.78	0.07	<0.001	[0.64, 0.91]
Structural stigma*baseline internalized stigma	−0.06	0.17	0.723	[-0.40, 0.28]
Age (covariate)	0.06	0.06	0.318	[-0.05, 0.16]
(H2b) 2-week follow-up internalized stigma				
Structural stigma	0.11	0.41	0.791	[-0.71, 0.93]
Baseline internalized stigma	0.49	0.09	<0.001	[0.31, 0.68]
Structural stigma*baseline internalized stigma	−0.02	0.18	0.918	[-0.37, 0.33]
Post-intervention internalized stigma (covariate)	0.38	0.07	<0.001	[0.23, 0.52]
Age (covariate)	0.12	0.06	0.069	[-0.01, 0.24]
(H3a) Post-intervention internalized stigma				
Structural stigma	−0.20	0.56	0.713	[-1.30, 0.89]
Baseline social support	−0.19	0.06	<0.001	[-0.30, −0.08]
Structural stigma*baseline social support	0.03	0.13	0.801	[-0.22, 0.28]
Baseline internalized stigma (covariate)	0.77	0.04	<0.001	[0.70, 0.85]
Age (covariate)	0.06	0.05	0.231	[-0.04, 0.17]
(H3b) 2-week follow-up internalized stigma				
Structural stigma	0.07	0.74	0.923	[-1.39, 1.54]
Baseline social support	−0.03	0.07	0.656	[-0.17, 0.11]
Structural stigma*baseline social support	0.00	0.16	0.995	[-0.31, 0.31]
Baseline internalized stigma (covariate)	0.50	0.07	<0.001	[0.36, 0.64]
Post-intervention internalized stigma (covariate)	0.37	0.07	<0.001	[0.22, 0.51]
Age (covariate)	0.12	0.06	0.066	[-0.01, 0.24]
(H4a) Post-intervention internalized stigma				
Baseline internalized stigma	0.85	0.15	<0.001	[0.55, 1.16]
Baseline social support	−0.10	0.11	0.356	[-0.32, 0.11]
Baseline internalized stigma*baseline social support	−0.02	0.03	0.516	[-0.09, 0.05]
Discrimination (covariate)	0.00	0.01	0.489	[-0.01, 0.01]
Structural stigma (covariate)	−0.12	0.16	0.470	[-0.44, 0.20]
Baseline hopelessness (covariate)	0.10	0.08	0.207	[-0.06, 0.25]
(H4b) 2-week follow-up internalized stigma				
Baseline internalized stigma	0.78	0.17	<0.001	[0.44, 1.12]
Baseline social support	0.21	0.12	0.092	[-0.03, 0.46]
Baseline internalized stigma*baseline social support	−0.07	0.04	0.054	[-0.14, 0.00]

(*continued on next page*)

Table 3 (*continued*)

Outcome Variables	b	Standard Error	*p*-value	95% CI
Post-intervention internalized stigma (covariate)	0.38	0.07	<0.001	[0.24, 0.52]
Discrimination (covariate)	−0.01	0.01	0.245	[-0.02, 0.00]
Structural stigma (covariate)	0.00	0.17	0.977	[-0.33, 0.34]
Baseline hopelessness (covariate)	0.16	0.08	0.049	[0.00, 0.31]

Note. Table 3 presents the results of multiple linear regression analyses examining the primary outcome, internalized stigma, across Hypotheses 2–4. For each hypothesis, unstandardized regression coefficients (b), standard errors (SE), p-values, and 95% confidence intervals (CI) are reported. Non-significant p-values (>0.05) for the interaction term indicate no evidence of moderation effects. Full regression results for additional outcomes are provided in Supplemental Table 1.

4.1. Limitations and strengths

It is important to acknowledge the limitations of this study. First, the sample consisted of youth participants recruited solely through social media in the U.S., which may limit the generalizability of the findings to individuals in other cultural, geographic, or socioeconomic contexts, or to those without consistent internet access. For example, the underrepresentation of transfeminine individuals, Male-to-Female transgender individuals, and those assigned male at birth may limit the generalizability of our findings to these populations and calls for further research with more balanced representation. Furthermore, while the study had sufficient statistical power to detect medium or large moderation effects, a larger sample would be required to detect potentially smaller, more nuanced differences in the impact of structural stigma between high- and low-level stigma areas (Faul et al., 2009). This secondary study was also not powered to examine additional moderator effects involving the control group or to detect small, nuanced effects. As such, our analyses focused exclusively on participants in the intervention group and examined the role of structural stigma, internalized stigma, and social support in predicting intervention outcomes. Future research with larger sample sizes should investigate intervention effects across both intervention and control groups to provide a more comprehensive understanding of these dynamics. Relatedly, the small sample size further limited the study from deciphering within-group differences, such as how structural stigma may have differentially impacted intervention outcomes for SM versus GM youth. While our sample is geographically distributed across the U.S., the majority of participants came from regions with relatively lower levels of structural stigma (see Supplemental Fig. 2). This limitation may impact the generalizability of our findings, particularly regarding the effectiveness of interventions targeting structural stigma. Future research should explore the impact of structural stigma with samples drawn from more diverse and discriminatory regions across the U.S. Additionally, our factor analysis revealed that most gender-related items fell out of the factor and produced a factor loading of less than 0.4; these items were subsequently removed. Because of the small sample size, and because all participants in this study identified as a SM, we focused on LGBTQ+ youth broadly; nevertheless, future research should intentionally recruit gender diverse youth to enhance understanding of how structural stigma impacts GM youth, and how this is similar or different from impacts on SM youth. Another limitation was that participants' zip code information was self-reported, and there is a possibility that some participants may have entered incorrect or inaccurate zip codes, which could impact the accuracy of the county-level structural stigma index. Furthermore, reliance on self-report measures leaves room for response biases, including social desirability bias or recall bias. Future research should employ diverse recruitment strategies and consider incorporating objective measures to enhance sample representativeness and data validity. Exploring the effects of multilevel structural stigma, including county-level, state-level, and country-level factors, would provide a more comprehensive understanding of how different levels of structural stigma contribute to the experiences and well-being of LGBTQ+ individuals. Future research could explore the interplay of multilevel structural stigma, incorporating both state- and county-level factors, to gain a more comprehensive understanding of how different levels of structural stigma influence the psychosocial variables of LGBTQ+ individuals. Moreover, while the county-level structural stigma index captured attitudes specific to LGBTQ+ individuals, it did not encompass comprehensive structural indicators. Future studies should consider incorporating additional measures, such as policies and laws directly impacting LGBTQ+ rights, to provide a more holistic understanding of the influence of structural stigma on intervention outcomes. Addressing these limitations would deepen our knowledge of LGBTQ+ mental health interventions and support the development of more effective and tailored approaches.

Notably, although we had significant attrition at the 2-week follow-up, we had a rigorous approach to imputing follow-up data (Shen et al., 2023) to ensure that the original trial's effects were robust enough to account for the missing data. There were no significant post-SSI moderation effects and virtually no drop-outs immediately post-intervention. This lends credence to the interpretation that the level of structural stigma did not affect intervention outcomes at follow-up. The overall effectiveness of Project RISE highlights the potential of targeted interventions to improve mental health outcomes in LGBTQ+ adolescents. SSIs have been shown to be effective in improving mental health outcomes and increasing service access in the majority of studies, with 20 out of 24 reviews demonstrating positive impacts (Schleider et al., 2025). This highlights their potential as a valuable tool for addressing mental health challenges, though further research should continue to explore factors influencing their efficacy. The positive changes observed in internalized stigma, identity pride, hopelessness, depression, and anxiety levels demonstrate the intervention's potential success in addressing the challenges associated with minority stress. In the current study, we utilized the latest available data from 2022 (Project Implicit, n.d.; https://osf.io/y9hiq/) to assess county-level structural stigma, providing a comprehensive understanding of the most recent environment in which LGBTQ+ adolescents navigate. By incorporating data collected in 2022, we were able to capture the contemporary attitudinal climates specific to minoritized sexual and transgender populations. By using the most up-to-date data, our findings offer valuable insights into the current landscape of structural stigma in the United States, allowing for a more accurate representation of the experiences faced by LGBTQ+ adolescents. This innovative use of recent data highlights the importance of staying abreast of societal attitudes and provides a nuanced perspective on the challenges and opportunities for intervention efforts.

By examining interventions across a range of social contexts with varying levels of structural stigma, our study increases the variation necessary to detect associations between structural stigma and intervention effectiveness. Examining interventions across social contexts provides a nuanced understanding of how contextual factors may influence the outcomes of interventions for marginalized populations. Moreover, our findings contribute to the growing body of literature on the efficacy of digital interventions in supporting LGBTQ+ youth, advancing evidence-based practices in mental health care.

LGBTQ+ individuals face unique stressors related to their sexual orientation and gender identity, including discrimination and social exclusion. These stressors can have detrimental effects on their mental health and well-being. By directly targeting these stressors and addressing the underlying mechanisms of minority stress, interventions like Project RISE provide tailored support and promote resilience among LGBTQ+ youth. The positive outcomes observed in this study highlight the effectiveness of addressing minority stress as a crucial component of interventions aimed at improving the mental health of this population.

Our findings support ongoing efforts to develop and implement targeted interventions that address the unique needs and experiences of LGBTQ+ individuals, ultimately enhancing their overall well-being and fostering a more inclusive and affirming society.

4.2. Implications and conclusions

In conclusion, this study demonstrates that the effectiveness of Project RISE, a minority stress-focused digital single-session intervention, exists even in the context of various levels of stigma or social support. The findings underscore the resilience and potential of LGBTQ+ youth to benefit from targeted interventions that address their unique challenges in light of their continued exposure to the negative effects of structural stigma. Importantly, this study is the first to investigate how county-level structural stigma influences the efficacy of a minority stress-focused intervention (Project RISE), providing valuable insights for future interventions and policies. Some literature suggests that interventions may be less effective in higher structural stigma environments compared to low-structural stigma environments (Price et al., 2022; Reid et al., 2014). However, our study highlights the potential of an adapted, brief, and accessible intervention, such as a minority stress-focused digital single-session intervention, to mitigate the influence of structural stigma among marginalized populations. The positive outcomes observed support the use of digital platforms to deliver effective mental health interventions for marginalized populations, including LGBTQ+ youth. Moving forward, it is essential to continue advancing our understanding of LGBTQ+ youth mental health interventions by exploring long-term effects, mechanisms of change, and comparative effectiveness. By refining and expanding the evidence base, we can strive towards more inclusive, equitable, and effective care for this vulnerable population.

CRediT authorship contribution statement

Ya-Wen Chang: Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Data curation, Conceptualization. **Ian Sotomayor:** Writing – review & editing, Writing – original draft, Conceptualization. **Erica Szkody:** Writing – review & editing, Writing – original draft, Conceptualization. **Kathryn R. Fox:** Writing – review & editing, Methodology, Investigation. **Jessica L. Schleider:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization.

Data availability statement

All study pre-registration, data, and R code are available via the Open Science Framework (https://osf.io/es3zb).

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Declaration of competing interest

Please disclose as none and proceed further.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmmh.2025.100409.

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