

# Psychosocial Syndemic Risks Surrounding Physical Health Conditions Among Sexual and Gender Minority Individuals

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## Abstract

**Purpose:** The high prevalence of physical health conditions among sexual and gender minority (SGM) individuals could be explained, in part, by SGM individuals' disparate exposure to interconnected psychosocial syndemic risks, including substance use, depression, posttraumatic stress disorder, intimate partner violence, and sexual assault. We utilized a syndemic framework to understand the overlapping and potentially synergistic association between psychosocial syndemic risks and physical health conditions among SGM adults.

**Methods:** A sample of 298 self-identified SGM adults ( $M$  age = 28.03,  $SD$  = 9.86; 47.0% racial/ethnic minority, 41.6% transgender or gender nonconforming) completed an online survey from May 2016 through May 2017.

**Results:** Three (1.0%) participants reported no syndemic risks, 19 (6.4%) reported one, 52 (17.4%) reported two, 85 (28.5%) reported three, 89 (29.9%) reported four, and 50 (16.8%) reported all five syndemic risks. The number of psychosocial syndemic risks was positively associated with the number of physical health conditions and synergistically (i.e., more than additively) increased the overall health burden on SGM individuals.

**Conclusion:** We found evidence for psychosocial syndemic risks as predictors of SGM individuals' physical health. This study is novel in providing evidence for syndemics surrounding a comprehensive set of physical health outcomes among individuals identifying along a full spectrum of SGM identities. The study controlled for HIV to examine syndemic conditions surrounding physical health outcomes beyond this well-established syndemically determined condition. Comprehensive intervention and policy efforts that address co-occurring psychosocial risks for physical health conditions are needed to reduce health disparities affecting SGM populations.

**Keywords:** mental health, physical health, sexual and gender minority, syndemic, violence

## Introduction

SEVERAL STUDIES HAVE DEMONSTRATED that sexual minority individuals disproportionately experience non-HIV-related physical health conditions, such as migraines,<sup>1,2</sup> respiratory problems (e.g., asthma),<sup>2-4</sup> diabetes,<sup>5</sup> cardiovascular disease,<sup>1,6-8</sup> arthritis,<sup>9</sup> and stomach ulcer, enteritis, and colitis,<sup>1</sup> compared with heterosexual individuals. Specific to transgender individuals, scholars have documented higher odds of non-HIV-related physical health conditions, such as arthritis,<sup>10</sup> diabetes,<sup>10</sup> cardiovascular disease,<sup>10</sup> and higher rates of migraines,<sup>11</sup> compared with cisgender individuals. It should be noted that these study findings varied depending on sex and/or sexual or gender minority subgroup. The high prevalence of physical health conditions among sexual and gender minority (SGM) individuals could be explained, in part, by their greater exposure to intercon-

nected and mutually reinforcing psychosocial risks, including substance use,<sup>12-14</sup> sexual assault,<sup>15,16</sup> intimate partner violence,<sup>16-18</sup> depression,<sup>19-21</sup> and posttraumatic stress disorder (PTSD).<sup>22,23</sup>

These types of synergistic psychosocial issues affecting SGM populations are referred to as a syndemic and compound overall risk for physical health conditions.<sup>24-27</sup> Syndemic theory provides a framework for understanding how stigma perpetuates these co-occurring psychosocial risks among SGM populations.<sup>24-27</sup> Syndemic frameworks highlight how the concentrated clustering of and interactions among multiple psychosocial risks adversely affect the health of disadvantaged populations.<sup>25-27</sup> Specifically, in a syndemic, the interaction of diseases or other health problems commonly arises because of adverse social conditions that put socially devalued groups, such as SGM people, at heightened risk.<sup>25</sup>

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Applications of syndemic theory have most extensively examined the role of violence (e.g., sexual abuse and intimate partner violence) and psychosocial health problems (e.g., PTSD, depression, and substance use) in contributing to HIV risk among men who have sex with men (MSM)<sup>28–30</sup> and transgender women.<sup>31–33</sup> However, little is known about the associations between psychosocial syndemic risks and physical health conditions other than HIV.<sup>5</sup> In addition, despite the pervasiveness of trauma exposure and PTSD among SGM individuals,<sup>22,23</sup> scant research has examined PTSD as a psychosocial risk factor in relation to physical health conditions in this population. The importance of expanding the syndemics research to understand psychosocial determinants of physical health conditions among SGM individuals is underscored by evidence documenting that physical health conditions among SGM individuals are linked to increased rates of each of these psychosocial risks at least separately: violence (e.g., sexual assault and intimate partner violence),<sup>15–18</sup> health-risk behavior (e.g., substance use),<sup>12–14</sup> and psychological distress (e.g., depression and PTSD).<sup>19–23</sup>

Methodologically, most syndemics research into physical health conditions has used an additive (i.e., dose response) approach with a count of syndemic conditions predicting health outcomes, without further assessing the possibility of a synergistic effect of syndemic conditions.<sup>29,34</sup> As such, it remains unclear whether individuals' physical health risk is a function of several co-occurring conditions that is larger than what would be expected from simply adding the number of conditions to predict this risk. To determine a true synergistic effect of co-occurring psychosocial risks in predicting physical health conditions, studies need to test whether the relative risk of physical health conditions from experiencing two or more syndemic conditions is greater than the relative risk that would be predicted from the effects of each syndemic condition separately.<sup>35,36</sup>

The first aim of the present study was to expand existing syndemics research to physical health conditions by assessing the associations between potential psychosocial syndemic risks commonly experienced among SGM individuals and physical health conditions. Psychosocial syndemic risks in this study included substance use, depression, PTSD, intimate partner violence, and sexual assault. We also sought to examine whether each increase in the number of psychosocial syndemic risks would be positively associated with physical health conditions.

The study's final aim was to examine whether the relative risk of physical health conditions as a function of experiencing any combination of syndemic risks (i.e., a syndemic approach) is greater than what would be expected from adding the number of syndemic conditions (i.e., an additive approach) to predict the relative risk of physical health conditions, suggesting the presence of truly synergistic epidemics underlying physical health conditions among SGM individuals.<sup>36</sup> Given the preponderance of evidence of syndemic conditions surrounding HIV among MSM and transgender women,<sup>28–33</sup> evidence that physical health disparities among gay men are attenuated when controlling for HIV status,<sup>1</sup> and our interest in examining syndemics surrounding other physical health conditions besides HIV, we controlled for the presence of HIV in all analyses.

## Methods

### Participants

Participants were 298 self-identified SGM individuals ages 18 to 78 ( $M=28.03$ ,  $SD=9.86$ ). Eligibility criteria included being 18 or older and self-identifying as SGM. Participants were recruited from more than 100 SGM-specific online listservs and social media platforms (e.g., Facebook). Eligible participants completed the survey from May 2016 through May 2017 using a secure online data collection tool (Qualtrics, Provo, Utah and Seattle, Washington). All potential participants received written instructions directing them to a link to access the survey website where they viewed the consent form and chose to participate in a study about SGM health. The survey took ~30–45 minutes to complete. Participants elected to be compensated for survey completion by entering themselves into a raffle to win 1 of 15 \$10, 10 \$20, or 3 \$50 Amazon gift cards. Study procedures were approved by Boston College's Institutional Review Board.

### Measures

**Sociodemographic characteristics.** Participants indicated their age (18–29, 30–44, 45–64, and 65 years and older), gender identity (in accordance with extant research,<sup>37</sup> response options included cisgender woman, cisgender man, transgender woman, transgender man, gender nonconforming, and other), sexual orientation identity (response options included lesbian, gay, bisexual, pansexual, queer, asexual, and other), race or ethnicity (response options included African American/Black, African, Asian/Asian American, Hispanic/Latinx, Native Hawaiian/Pacific Islander, Native American/Alaska Native, Middle Eastern, biracial or multiracial, and other), and ability to pay bills as a proxy of socioeconomic status (response options included: "I do not worry about paying for things I want and need," "I can easily pay my bills, but need to be careful," "I can pay my regular bills, but a bill that was bigger than usual would cause a hardship," "I have trouble paying my regular bills," and "I simply can't pay my bills").

Because of small cell sizes and based on prior studies using a similar approach, gender identity groups were collapsed into transgender or gender nonconforming (including transgender women, transgender men, gender nonconforming, and other), cisgender women, and cisgender men.<sup>37,38</sup> Racial/ethnic groups were collapsed into White and people of color (i.e., African American/Black, African, Asian/Asian American, Hispanic/Latinx, Native Hawaiian/Pacific Islander, Native American/Alaska Native, Middle Eastern, Biracial or Multiracial, and other).

**HIV.** HIV was treated as a covariate in all models. Participants indicated whether they were HIV positive. Response options were yes and no, which were coded 1 and 0, respectively.

### Outcome variable

**Physical health conditions.** We assessed physical health conditions affecting participants over the past year. We specifically assessed the following six conditions that affect sexual minority individuals disproportionately compared with

heterosexual individuals: migraines,<sup>1,2</sup> respiratory problems,<sup>2-4</sup> diabetes,<sup>5</sup> cardiovascular disease (e.g., heart attack and hypertension),<sup>1,5-8</sup> arthritis,<sup>9</sup> and stomach or gall bladder trouble (e.g., stomach ulcer, enteritis, and colitis).<sup>1</sup> While research on gender identity-related disparities observed in physical health conditions is limited,<sup>39</sup> some evidence suggests that compared with cisgender individuals, transgender individuals have higher rates of migraines<sup>11</sup> and higher odds of diabetes,<sup>10</sup> cardiovascular disease,<sup>10</sup> and arthritis<sup>10</sup> compared with cisgender individuals. Response options to each condition were yes and no, which were coded 1 and 0, respectively. A count score was computed to indicate the number of physical health conditions that each respondent reported in the past year, resulting in scores ranging from 0 to 6. Higher frequencies represent a greater number of physical health conditions.

#### Predictor variables

**Intimate partner violence.** Participants reported exposure to physical, psychological, or identity-based intimate partner violence within the past year. Physical abuse was assessed with the Conflict Tactics Scale, short form (CTS)<sup>40</sup>; psychological abuse was assessed with the Psychological Maltreatment of Women Inventory (PMWI)<sup>41</sup>; and identity abuse was assessed with the Identity Abuse (IA) Scale.<sup>42</sup> Twenty-eight items from these three scales are answered *yes* (1) or *no* (0). A dichotomous variable was created to indicate reporting any intimate partner violence, consistent with prior syndemic studies.<sup>43</sup> The internal consistency estimate for all scales was strong (i.e., CTS  $\alpha=0.88$ , PMWI  $\alpha=0.95$ , and IA Scale  $\alpha=0.91$ ).

**Sexual assault.** Participants responded to one item in which they indicated whether anyone had ever touched private parts of their body, made them touch someone else's body, or physically forced them to have sex against their wishes during childhood or adulthood.<sup>44</sup> Response options to each were 0 (*no*) and 1 (*yes*). This item is part of a 13-item Stressful Life Events Screening Questionnaire (SLESQ).<sup>44</sup> The SLESQ has good test/retest reliability ( $\kappa=0.73$ ) and convergent validity ( $\kappa=0.64$ ).<sup>44,45</sup>

**Depression.** The 9-item Patient Health Questionnaire (PHQ-9)<sup>46</sup> assessed self-reported depression symptoms over the past 2 weeks. Response options ranged from 0 (*not at all*) to 3 (*nearly every day*). The PHQ-9 has high internal consistency.<sup>46</sup> A cutoff score of 10 or greater was used to indicate the presence of depression, in accordance with previous studies,<sup>47,48</sup> where 1 = *depression* and 0 = *no depression*. The internal consistency estimate for the present study was strong ( $\alpha=0.89$ ).

**Posttraumatic stress disorder.** The 17-item PTSD Checklist-Civilian Version is a self-report measure that corresponds to the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*<sup>49</sup> PTSD symptoms over the prior 30 days (Weathers FW, Litz BT, Herman DS, et al.: The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility. Unpublished work; presented at the Annual Convention of the International Society for Traumatic Stress Studies, San Antonio, TX, 1993.). Response options range from 1

(*not at all*) to 5 (*extremely*). A cutoff score of 50 or greater was used to indicate the presence of PTSD, in accordance with previous studies,<sup>50</sup> where 1 = *PTSD* and 0 = *no PTSD*. The internal consistency estimate was strong ( $\alpha=0.94$ ).

**Substance use.** Participants reported on the use of the following substances in the past 6 months: marijuana, cocaine, stimulants, depressants, heroin, and hallucinogens. Response options range from 0 (*never*) to 6 (*every day*). First, each substance was coded as 0 (*no*) and 1 (*yes*), and then, a dichotomous score was created by assigning a score of "1" to participants who reported using at least one substance and "0" to participants who did not report substance use.

#### Analysis plan

Data analyses were conducted using SPSS, version 24.<sup>51</sup> There were minimal to moderate missing data, ranging from 0.1% to 24.4% across the items. Little et al.'s<sup>52</sup> missing completely at random test was not significant ( $\chi^2=1286.55$ ,  $df=1241$ ,  $p=0.18$ ); therefore, the data were considered to be missing completely at random and expectation-maximization estimation was implemented to handle missing data.<sup>52</sup>

First, the number of psychosocial syndemic risks and physical health conditions was calculated. Three separate analyses of variance (ANOVA) tested for demographic differences across gender identity, sexual orientation identity, and race/ethnicity on physical health conditions. Next, associations between each of the syndemic risks were examined as odds ratios using binary logistic regression.

We then examined the deviance value for our outcome variable—a count of the number of reported physical health conditions. Given that our outcome was a count variable and the deviance value for this variable was not overdispersed, a generalized linear model with a Poisson distribution and robust error variances was used to estimate exponentiated regression coefficients, or risk ratios (RRs), with 95% confidence intervals for experiencing physical health conditions as a function of reporting each of the five syndemic risks, as consistent with previous research.<sup>20</sup> A Poisson regression model has several assumptions, including that (1) the count outcome variable (physical health conditions) has a Poisson distribution, (2) the log-transformed outcomes are linearly related to the predictor variables, and (3) the variance of the counts is smaller than or equal to the mean.<sup>53-55</sup> In addition, the RR represents the relative change in the likelihood of the outcome variable (physical health conditions) for a one-unit change in the predictor variable (syndemic conditions).<sup>55</sup>

To examine the relative risk for experiencing physical health conditions as a function of reporting a syndemic condition surrounding participants' physical health risk, we compared (1) the *actual* association between possessing more than one syndemic risk and physical health condition with (2) the association between possessing more than one syndemic risk and physical health condition that would be *expected* based on the association between *one* syndemic risk and physical health conditions. That is, we calculated the relative risk for possessing one, two, three, four, or five psychosocial syndemic risks versus possessing none (i.e., an additive approach) and examined whether the observed increased relative risk of physical health conditions among participants with two, three, four, or five syndemic risks

exceeded the increased relative risk that would be expected from an additive approach (i.e., a syndemic approach).<sup>35,36</sup> These models were examined with Poisson regression with the number of syndemic risks possessed by each participant specified as a categorical variable used to predict participants' relative risk of physical health conditions. All models controlled for HIV status, age, socioeconomic status, gender identity, sexual orientation identity, and race/ethnicity given that these demographic characteristics are associated with physical health conditions among SGM individuals.<sup>1,30,56,57</sup>

## Results

Table 1 summarizes the demographic characteristics of the entire sample. Approximately one quarter identified as queer, almost one half as a cisgender woman, and slightly more than one half as White. The ANOVA predicting the number of physical health conditions was not significant for gender identity,  $F(2, 295) = 0.80, p = 0.45, \eta_p^2 = 0.01$ , or sexual orientation identity,  $F(6, 291) = 1.49, p = 0.18, \eta_p^2 = 0.03$ . The ANOVA was significant for race/ethnicity,  $F(1, 296) = 7.25, p < 0.01, \eta_p^2 = 0.02$ , with White SGM participants reporting more physical health conditions ( $n = 158$ ) than SGM people of color ( $n = 140$ ). Three (1.0%) participants reported no syndemic risks, 19 (6.4%) reported one, 52 (17.4%) reported two, 85 (28.5%) reported three, 89 (29.9%) reported four, and 50 (16.8%) reported all five syndemic risks. Of those who reported at least one syndemic risk, 250 (83.9%) reported depression in the past 2 weeks, 246 (82.6%) reported sexual assault in their lifetime, 191 (64.1%) reported intimate partner violence in the past year, 178 (59.7%) reported substance use in the past 6 months, and 119 (39.9%) reported PTSD in the past 30 days.

Table 2 displays the odds of experiencing each of the five psychosocial syndemic risks (i.e., substance use, depression, PTSD, intimate partner violence, and sexual assault) as a function of the presence of each other and the relative risk of experiencing physical health conditions as a function of the presence of each of the five psychosocial syndemic risks. In these bivariate analyses, substance use was marginally associated with intimate partner violence and significantly associated with sexual assault; depression was significantly associated with PTSD, sexual assault, and physical health conditions; PTSD was marginally associated with intimate partner violence and significantly associated with physical health conditions; and sexual assault was significantly associated with physical health conditions. Table 3 highlights the association between the total number of psychosocial syndemic health risks and syndemic conditions.

To examine evidence of an "additive" impact of psychosocial syndemic risks on participants' relative risk of reporting physical health conditions, the relative risk of reporting a physical health condition as a function of reporting the number of psychosocial syndemic risks was calculated (Table 4). The risk of physical health conditions among those with one syndemic risk was 35% higher than the risk of physical health conditions among those without a syndemic risk, although this increase was not significant. In addition, the risk of physical health conditions among those with two syndemic risks was 81% higher than the risk of physical health conditions among those without a syndemic risk, although this increase was not significant. The risk of physical health

TABLE 1. SAMPLE CHARACTERISTICS

Demographics	Total (N = 298), n (%)
Age	
18–29 years	208 (69.8)
30–44 years	72 (24.2)
45–64 years	14 (4.7)
65 years and older	4 (1.3)
Gender identity	
Cisgender woman	139 (46.6)
Cisgender man	35 (11.7)
Transgender woman	18 (6.0)
Transgender man	19 (6.4)
Gender nonconforming	71 (23.8)
Other	16 (5.4)
Sexual orientation identity	
Lesbian	47 (15.8)
Gay	49 (16.4)
Bisexual	71 (23.8)
Pansexual	30 (10.1)
Queer	72 (24.2)
Asexual	17 (5.7)
Other	12 (4.0)
Race/ethnicity	
African American/Black	7 (2.3)
African	0 (0.0)
Asian/Asian American	14 (4.7)
Hispanic/Latinx	15 (5.0)
Native Hawaiian/Pacific Islander	8 (2.7)
Native American/Alaska Native	11 (3.7)
Middle Eastern	17 (5.7)
Biracial or multiracial	59 (19.8)
White	158 (53.0)
Other	9 (3.0)
Socioeconomic status	
I do not worry about paying for things I want and need	23 (7.7)
I can easily pay my bills, but need to be careful	66 (22.1)
I can pay my regular bills, but a bill that was bigger than usual would cause hardship	126 (42.3)
I have trouble paying my regular bills	59 (19.8)
I simply can't pay my bills	24 (8.1)
Physical health conditions	
Migraines	127 (42.6)
Diabetes	17 (5.7)
Cardiovascular disease	47 (15.8)
Arthritis	48 (16.1)
Respiratory problems	82 (27.5)
Stomach or gall bladder trouble	69 (23.2)
Substance use	178 (59.7)
Depression	250 (83.9)
PTSD	119 (39.9)
IPV	191 (64.1)
Sexual assault	246 (82.6)

IPV, intimate partner violence; PTSD, posttraumatic stress disorder.

conditions among those with three syndemic risks was 115% higher than the risk of physical health conditions among those without a syndemic risk. The risk of physical health conditions among those with four syndemic risks was 156% higher than the risk of physical health conditions

TABLE 2. BIVARIATE ASSOCIATIONS BETWEEN PSYCHOSOCIAL SYNDemic RISKS AND PHYSICAL HEALTH CONDITIONS

	Substance use, adj. OR (95% CI)	Depression, adj. OR (95% CI)	PTSD, adj. OR (95% CI)	IPV, adj. OR (95% CI)	Sexual assault, adj. OR (95% CI)	Physical health conditions, adj. RR (95% CI)
1. Substance use	---	0.95 (0.49-1.85)	1.24 (0.75-2.06)	1.59 <sup>†</sup> (0.95-2.67)	2.75** (1.42-5.34)	1.02 (0.82-1.25)
2. Depression	---	---	12.45*** (3.73-41.53)	1.18 (0.61-2.28)	2.88** (1.33-6.21)	1.73*** (1.26-2.37)
3. PTSD	---	---	---	1.63 <sup>†</sup> (0.97-2.73)	1.29 (0.65-2.52)	1.40*** (1.15-1.77)
4. IPV	---	---	---	---	0.97 (0.50-1.90)	1.07 (0.86-1.32)
5. Sexual assault	---	---	---	---	---	1.53* (1.07-2.18)
6. Physical health conditions	---	---	---	---	---	---

ORs and RRs with 95% CIs adjusted for HIV, age, race/ethnicity, sexual orientation, gender identity, and socioeconomic status. Associations between the five psychosocial syndemic risks were tested using bivariate logistic regression. The association between psychosocial syndemic risks and physical health conditions was tested using Poisson regression.

<sup>†</sup>  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Adj. OR, adjusted odds ratio; Adj. RR, adjusted risk ratio; CI, confidence interval.

among those without a syndemic risk. Finally, the risk of physical health conditions among those with five syndemic risks was 176% higher than the risk of physical health conditions among those without a syndemic risk.

To test whether the association between physical health conditions and having two syndemic risks was greater than additive (i.e., syndemic), we calculated the relative risk of experiencing physical health conditions as a function of possessing two syndemic conditions and the relative risk of physical health conditions that would be *expected* based on the association between one syndemic risk and physical health conditions (i.e., 35% + 35% = 70%) compared with the *actual* association between two syndemic risks and physical health conditions (i.e., 81%). To test whether the association between physical health conditions and having three syndemic risks was greater than additive (i.e., syndemic), we calculated the relative risk of experiencing physical health conditions as a function of possessing three syndemic risks and the relative risk of physical health conditions that would be *expected* based on the association between one syndemic risk and physical health conditions (i.e., 35% + 35% + 35% = 105%) compared with the *actual* association between three syndemic risks and physical health conditions (i.e., 115%).

Similarly, to test whether the association between physical health conditions and having four syndemic risks was greater than additive (i.e., syndemic), we calculated the relative risk of experiencing physical health conditions as a function of possessing four syndemic risks and the relative risk of physical health conditions that would be *expected* based on the association between one syndemic risk and physical health conditions (i.e., 35% + 35% + 35% + 35% = 140%) compared with the *actual* association between four syndemic risks and physical health conditions (i.e., 156%). Finally, to test whether the association of having five syndemic risks was greater than additive (i.e., syndemic), we calculated the relative risk of experiencing physical health conditions as a function of possessing five syndemic risks and the relative risk of physical health conditions that would be *expected* based on the association between one syndemic risk and physical health conditions (i.e., 35% + 35% + 35% + 35% + 35% = 175%) compared with the *actual* association between five syndemic risks and physical health conditions (i.e., 176%). That the presence of multiple psychosocial syndemic factors predicted the relative risk of physical health conditions more than additively suggests that these psychosocial factors might form a syndemic surrounding SGM individuals.

### Discussion

This study examined the possibility that five psychosocial syndemic risks (i.e., substance use, depression, PTSD, intimate partner violence, and sexual assault) that affect SGM individuals disproportionately might operate as a syndemic surrounding the physical health of this population. The relative risk of experiencing physical health conditions was positively associated with the number of psychosocial syndemic risks among SGM participants, consistent with literature on syndemic conditions predicting HIV among MSM and transgender women.<sup>58-60</sup> Specifically, those with one syndemic condition have 1.35 times the risk of physical health conditions compared with those with none and those with two

TABLE 3. ASSOCIATION BETWEEN THE TOTAL NUMBER OF PSYCHOSOCIAL SYNDEMIC HEALTH RISKS AND SYNDEMIC CONDITIONS

<i>Syndemic condition</i>	<i>One syndemic risk, N (%)</i>	<i>Two co-occurring syndemic risks, N (%)</i>	<i>Three co-occurring syndemic risks, N (%)</i>	<i>Four co-occurring syndemic risks, N (%)</i>	<i>Five co-occurring syndemic risks, N (%)</i>
Substance use	3 (1.00)	11 (3.69)	46 (15.43)	68 (22.82)	50 (16.78)
Depression	5 (1.68)	39 (13.09)	67 (22.48)	89 (29.87)	50 (16.78)
PTSD	0 (0)	5 (1.68)	19 (6.38)	45 (15.10)	50 (16.78)
IPV	4 (1.34)	20 (6.71)	46 (15.43)	71 (23.83)	50 (16.78)
Sexual assault	7 (2.34)	29 (9.73)	77 (25.84)	83 (27.85)	50 (16.78)

syndemic conditions have 1.81 times the risk of physical health conditions compared with those with none, although these associations were not significant. Those with three syndemic conditions have 2.15 times the risk of physical health conditions compared with those with none. Those with four syndemic conditions have 2.56 times the risk of physical health conditions compared with those with none. Those with five syndemic conditions have 2.76 times the risk of physical health conditions compared with those with none.

Taken together, these findings provide novel evidence highlighting the importance of considering co-occurring psychosocial syndemic risks in relation to physical health conditions, such as migraines, respiratory problems, diabetes, cardiovascular disease (e.g., heart attack and hypertension), arthritis, and stomach or gall bladder trouble (e.g., stomach ulcer, enteritis, and colitis), above and beyond the effect of HIV, among SGM individuals. Moreover, results from this study justify the need for physical health conditions to be included as an outcome of future syndemic studies with SGM individuals. This study is novel in that it is the first to examine evidence for syndemics surrounding a comprehensive set of physical health outcomes among individuals identifying along a full spectrum of SGM identities. Whereas previous studies into the possibility of syndemic conditions affecting SGM people's health have been primarily concerned with predicting HIV among MSM and transgender women,<sup>28-34,58-60</sup> this study controlled for HIV to examine syndemic conditions surrounding physical health outcomes beyond this well-established syndemically determined condition.

These findings support the need for novel intervention strategies to target multiple co-occurring psychosocial syndemic risks in improving physical health conditions among SGM populations. The results suggest that interventions tar-

geting SGM individuals' co-occurring mental, behavioral, and relational health could potentially improve SGM individuals' physical health as well. For instance, interventions that focus on modifiable psychosocial mechanisms shown to underlie syndemic risks (e.g., shame) might reduce the burden of physical health conditions among SGM individuals.<sup>61-63</sup> Mechanisms such as shame might not only give rise to psychosocial syndemic risks but might also compromise physical health by reducing personal motivations to seek health care services or adhere to medication.<sup>64</sup> Because syndemics ultimately arise from marginalizing social structures (e.g., discriminatory institutions),<sup>24-27</sup> reducing the structural conditions that permit adverse psychosocial experiences in the first place can improve conditions of social inequality and ultimately the physical health of SGM populations.

#### *Limitations and future directions*

Although this study examines physical health conditions among a fuller spectrum of SGM individuals than heretofore examined and utilizes an innovative approach to examining synergistic psychosocial risks predicting the relative risk of experiencing physical health conditions besides HIV, the results must be interpreted in light of several limitations. This study's cross-sectional design precludes causal inference and the inconsistent time frame of its variables further limits understanding about the temporal ordering of syndemic risks and the relative risk of physical health outcomes. Future longitudinal research can confirm prospective associations between psychosocial risks and the relative risk of physical health among SGM populations. Future studies utilizing a larger sample of SGM individuals could stratify analyses according to sexual orientation identity, gender identity,

TABLE 4. ASSOCIATION BETWEEN THE TOTAL NUMBER OF PSYCHOSOCIAL SYNDEMIC HEALTH RISKS AND PHYSICAL HEALTH CONDITIONS

<i>No. of psychosocial syndemic risks</i>	<i>N (%)</i>	<i>Adj. RR</i>	<i>95% CI</i>
No syndemic risks	3 (1.0)	1	
One syndemic risk	19 (6.4)	1.35	0.51-3.55
Two co-occurring syndemic risks	52 (17.4)	1.81	0.73-4.48
Three co-occurring syndemic risks	85 (28.5)	2.15 <sup>†</sup>	0.88-5.24
Four co-occurring syndemic risks	89 (29.9)	2.56*	1.06-6.19
Five co-occurring syndemic risks	50 (16.8)	2.76*	1.13-6.75

RRs with 95% CIs adjusted for HIV, age, race/ethnicity, sexual orientation, gender identity, and socioeconomic status. The associations between the number of syndemic risks and physical health conditions were tested using Poisson regression.

<sup>†</sup> $p < 0.10$ , \* $p < 0.05$ .

race/ethnicity, and age to determine which subgroups of the SGM population might be most affected by syndemic conditions. In addition, this study utilized self-report measures of syndemic risks and physical health conditions, which could have resulted in self-report or same-source bias, through which self-reported physical health outcomes are confounded by the psychosocial predictors.<sup>65</sup>

Although gender identity and sex assigned at birth represent key social and biological processes, this study did not assess gender minority status using the commonly recommended two-step approach, potentially resulting in misclassification of gender identity.<sup>66</sup> Future studies should aim to measure the most recent understanding of primary study constructs, such as PTSD. Whereas we assessed *DSM-IV* symptoms of PTSD, newer measures assess the *DSM-V* conceptualization of PTSD with strong validity.<sup>67</sup> Utilizing registry-based physician-assessed physical health outcomes would also strengthen the validity of our outcomes.<sup>35</sup> In addition, this study's recruitment strategy relied upon SGM-specific online social media platforms and listservs, potentially contributing to an overrepresentation of young and open SGM individuals in our sample.

Future studies can extend the findings from the present study by investigating the causes and consequences of psychological distress, violence, and risk behaviors that synergistically affect SGM population health. Although the present study extends previous research on the overlapping and potentially synergistic association between syndemic conditions and the relative risk of physical health conditions among SGM individuals, future research should consider using a person-centered approach to uncover the nuances in the association between co-occurring psychosocial syndemic conditions and the relative risk of physical health conditions in this population.<sup>36</sup> For example, instead of using a count of the number of syndemic conditions, latent class analysis can be utilized to identify unique patterns of syndemic conditions among any given sample of SGM individuals and examine the relative risk of physical health conditions according to a person's membership in any of these emergent latent syndemic classes.

## Conclusion

Existing studies suggest that SGM individuals are affected disproportionately by physical health conditions compared with the general population.<sup>1–11</sup> The present study elucidates not only the co-occurrence of psychosocial syndemic risks but also their relationship to the relative risk of physical health conditions among SGM individuals. The study also addressed limitations of existing syndemics research on SGM populations<sup>28,29,32,68</sup> by testing whether the joint association of having one, two, three, four, or five syndemic risks was greater than additive, as increasingly encouraged.<sup>36</sup> Specifically, this study found preliminary evidence that the number of syndemic risks not only additively but also synergistically increased the relative risk of physical health conditions among SGM individuals. As such, comprehensive interventions targeting the mechanisms underlying co-occurring substance use, depression, PTSD, intimate partner violence, and sexual assault have the potential to improve physical health conditions among the most at-risk members of this population.

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The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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