JOURNAL OF BEHAVIORAL HEALTH, 2018
VOL 7, NO. 4, PAGE 193–203
10.5455/jbh.20180512020014

ORIGINAL RESEARCH

Open Access

Using latent class analysis to profile risk behaviors among sexual minority students

Yongwen Jiang[1,2], Jan Mermin[3], Tara Cooper[1], Rosemary Reilly-Chammat[3], Samara Viner-Brown[1]

[1]Center for Health Data and Analysis, Rhode Island Department of Health, Providence, RI

[2]Department of Epidemiology, School of Public Health, Brown University, Providence, RI

[3]Office of Student, Community and Academic Supports, Rhode Island Department of Elementary and Secondary Education, Providence, RI

ABSTRACT

Introduction: The purposes of this study were (1) to summarize multiple related health indicators within a health domain using latent class analysis (LCA) to identify the patterns of risky behaviors and health conditions; (2) to profile high-risk behaviors and health conditions among sexual minority students.

Methods: The Rhode Island Youth Risk Behavior Survey is a population-based high school survey conducted in odd years between 2007 and 2015 with a total sample size of 14,718. Thirty-four indicators of five domains were identified: safety and being bullied, depression and suicide, substance use, sexual behavior, and health conditions. LCA was used to categorize students into high- and low-risk classes based on similar patterns of indicators, then these two classes were cross-tabbed with sexual minority categories. The analysis was conducted in 2017.

Results: Bisexual, lesbian and gay, and unsure (of sexual orientation identity) students had higher health-related risks and conditions than their heterosexual peers. Students who reported sexual contact were more likely to have engaged in risky behaviors than those who reported they never had sexual contact. Those who identified as heterosexual, but who had sexual contact with the same sex or both sexes, were more likely to have engaged in risky behaviors than those who identified as heterosexual, but who did not have sexual contact with the same or both sexes.

Conclusions: The LCA method can be applied to identify and define risk behavior patterns among subgroups, which can improve the specification of high-risk populations and allocation of prevention resources.

ARTICLE HISTORY

Received May 12, 2018
Accepted August 26, 2018
Published September 22, 2018

KEYWORDS

Health conditions; high school student; latent class analysis; risk behaviors; sexual minority youth

Introduction

Sexual minority youth refer to gay, lesbian, bisexual, transgender, queer, and questioning adolescents and youth who have had sexual contact with both sexes or same-sex—only in the literature [1,2]. Numerous studies have demonstrated that sexual minority youth experience notable disparities in many risk behaviors and health conditions [3–5]. They exhibit a greater prevalence of violent victimization, dating violence, depression, suicidal behaviors, substance use, homelessness, sexual risk-taking, overweight, physical inactivity, and eating disorder symptoms than heterosexual peers [4,5–15]. Bisexual youth have higher odds of reporting dating violence compared with heterosexuals, and youth who have had sexual contact with both sexes are more vulnerable to physical dating violence than youth having sexual contact with same-sex partners only [2]. Health risks and health conditions tend to co-occur and cluster among sexual minorities [3,14]. For instance, unprotected sexual intercourse or sexual intercourse with multiple partners is related to alcohol and illicit drug use among sexual minority students [14]. However, there is little research on the patterns underlying this co-occurrence, and traditional analytic methods are not sufficient for this purpose.

The Youth Risk Behavior Survey (YRBS), is a statewide population-based health survey, which monitors multiple health domains, including safety and being bullied, depression and suicide, substance use, sexual behavior, and health conditions.

Contact Yongwen Jiang. yongwen_jiang@brown.edu Center for Health Data and Analysis, Rhode Island Department of Health.

Since 2007, Rhode Island's (RI's) YRBS has included sexual identity and sexual contact questions. Each of these health domains included risk behaviors or health conditions, most of which are highly correlated. Traditional analytical methods such as logistic regression can adjust for multiple risk behaviors, but they focus more on individual risk behaviors or health conditions of each domain [16]. If they included multiple highly correlated behaviors, it can cause multi-collinearity, which will distort estimates of the findings. Therefore, conventional analytical methods were not designed to analyze complex relationships involving multiple domains [16].

Latent class analysis (LCA) is a model-based latent class profile method that can categorize students according to their patterns of health risk behaviors and conditions. Therefore, the authors adopted LCA, a more robust method, which enabled a more complete examination of the co-occurrence or clustering of student risk behaviors and health conditions in sexual minority and unsure (of sexual orientation identity) population. One of the goals of Healthy People 2020 is "To improve the health, safety, and well-being of lesbian, gay, bisexual, and transgender individuals [17]." The purposes of this study were to use LCA to identify patterns of risky behaviors and health conditions among RI public high school students, and to profile the influence of high-risk behaviors on sexual minority students.

Methods

Data source

Data are from RI's 2007–2015 High School YRBS. The YRBS is used to monitor health risk behaviors and conditions related to the major causes of mortality, disease, injury, and social problems among youth and adults in the United States and is sponsored by the Centers for Disease Control and Prevention (CDC) [18]. The RI high school YRBS data for the years 2007, 2009, 2011, 2013, and 2015 were combined to increase the sample size of sexual minority youth groups. The overall response rates across these 5 years ranged from 66% to 71%. Respondents with missing data on sex (n = 69), sexual orientation (n = 307), and sexual contact (n = 437) were excluded. The final data set contained a total of 14,718 students. These self-reported, weighted findings are representative of 9th- to 12th-grade public high school students in RI and can be used to make important inferences concerning health-risk behaviors and health conditions [18].

Domains, and health behaviors and conditions

Based on the exploratory data analysis, 34 dichotomous student-level indicators of five health domains were identified: safety and being bullied, depression and suicide, substance use, sexual behavior, and health condition. Then, LCA was utilized to identify latent classes of students with similar profiles in the five domains of 34 student-level indicators. The detailed definitions of health-related risk behaviors and conditions are shown in the Appendix Table A.

Sexual minority students

Sexual orientation identity was based on the state-added question, "Which of the following best describes you?" heterosexual (straight); gay or lesbian; bisexual; or not sure. Sex of sexual contacts was based on "What is your sex?" female; or male, along with the state-added question, "During your life, with whom have you had sexual contact?" I have never had sexual contact; females; males; or females and males. Students were classified as having had opposite-sex contact only, same-sex contact only, both-sex contact, or have never had sexual contact. For this study, sexual minority students were defined as those who identified as gay or lesbian, bisexual or unsure, or who had same-sex contact or both-sex contact.

Analysis

LCA can summarize many discrete indicators into an interpretable number of latent classes [19]. The unit of analysis is the combination of indicators [16]. In the study, the eight indicators of safety and being bullied have a total of 256 (2^8) possible combinations; the four indicators of depression and suicide have a total of 16 (2^4) possible combinations; the 12 indicators of substance use have a total of 4,096 (2^{12}) possible combinations; the five indicators of sexual behavior have a total of 32 (2^5) possible combinations; and the five indicators of health conditions have a total of 32 (2^5) possible combinations [16,20].

To determine the most parsimonious model, a two-class model was fit, followed by sequentially increasing the number of latent classes (up to five classes in our study). Criteria used to select this model included the classification statistics (entropy R^2, standard R^2, and classification errors) to assess

Appendix Table A. Questions for 34 health-risk behaviors, RI High School YRBS, 2007–2015.

Health risk behaviors	Questions
Safety and Being Bullied	
Rarely/Never wore a seatbelt	How often do you wear a seat belt when riding in a car driven by someone else? 1: Never/Rarely; 2: Sometimes/Most of the time/Always
Rode with a drinking driver	During the past 30 days, how many times did you ride in a car or other vehicle driven by someone who had been drinking alcohol? 1: 0 times; 2: 1+ time**s**
Carried a gun on school property	During the past 30 days, on how many days did you carry a weapon such as a gun, knife, or club on school property? 1: 0 days; 2: 1+ day
Did not go to school due to feeling unsafe	During the past 30 days, on how many days did you not go to school because you felt you would be unsafe at school or on your way to or from school? 1: 0 days; 2: 1+ day
Fought at school	During the past 12 months, how many times were you in a physical fight on school property? 1: 0 times; 2: 1+ time
Hit by boyfriend/girlfriend on purpose	During the past 12 months, did your boyfriend or girlfriend ever hit, slap, or physically hurt you on purpose? 1: Yes; 2: No
Forced to have sexual intercourse	Have you ever been physically forced to have sexual intercourse when you did not want to? 1: Yes; 2: No
Bullied on school property	During the past 12 months, have you ever been bullied on school property? 1: Yes; 2: No
Depression and Suicide	
Felt sad/hopeless	During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities? 1: Yes; 2: No
Considered suicide	During the past 12 months, did you ever seriously consider attempting suicide? 1: Yes; 2: No
Planned suicide	During the past 12 months, did you make a plan about how you would attempt suicide? 1: Yes; 2: No
Attempted suicide	During the past 12 months, how many times did you actually attempt suicide? 1: 0 times; 2: 1+ time
Substance Use	
Current cigarette use	During the past 30 days, on how many days did you smoke cigarettes? 1: 0 days; 2: 1+ days
Current smokeless tobacco use	Did you use chewing tobacco, snuff, or dip on one or more of the past 30 days? 1**:** Yes; 2**:** No
Current cigar use	During the past 30 days, on how many days did you smoke cigars, cigarillos, or little cigars? 1: 0 days; 2: 1+ days
Current alcohol use	During the past 30 days, on how many days did you have at least one drink of alcohol? 1 0 days; 2 1+ days
Consumed five+ drinks in a row	During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row, that is, within a couple of hours? 1: 0 days; 2: 1+ days
Current marijuana use	During the past 30 days, how many times did you use marijuana? 1: 0 times; 2: 1+ times
Ever tried cigarette smoking	Have you ever tried cigarette smoking, even one or two puffs? 1: Yes; 2: No
Ever used marijuana	During your life, how many times have you used marijuana? 1: 0 times; 2: 1+ times
Ever used cocaine	During your life, how many times have you used any form of cocaine, including powder, crack, or freebase? 1: 0 times; 2: 1+ times
Smoked a cigarette before the age of 13 years	Do you smoke a whole cigarette for the first time before the age of 13 years? 1: Yes; 2: No
Drank alcohol before the age of 13 years	Did you have your first drink of alcohol other than a few sips before the age of 13 years? 1: Yes; 2: No
Tried marijuana before the age of 13 years	Did you try marijuana for the first time before the age of 13 years? 1: Yes; 2: No
Sexual Behavior	
Currently sexually active	Did you have sexual intercourse with one or more people during the past three months? 1: Yes; 2: No
Ever had sexual intercourse	Have you ever had sexual intercourse? 1 Yes; 2 No
Ever had sex with 4+ persons during their life	Did you have sexual intercourse with four or more people during their life? 1: Yes; 2: No
Had sexual intercourse before the age of 13 years	Did you have sexual intercourse for the first time before the age of 13 years? 1: Yes; 2: No
Not taught in school about AIDS/HIV	Have you ever been taught about AIDS or HIV infection in school? 1**:** Yes; 2**:** No
Health Condition	
Actual overweight (BMI percentile)	Percentage of students who were overweight or obese (>= 85th percentile for BMI, based on sex- and age-specific reference data from the 2000 CDC growth chart)

Continued

Health risk behaviors	Questions
Described themselves as overweight	Do you describe yourselves as slightly or very overweight? 1: Yes; 2: No
Not active 60 minutes on 5+ past 7 days	During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? 1: 0–4 days; 2: 5+ days
Have long-term health problems	Do you have any physical disabilities or long-term health problems? 1: Yes; 2: No
Have learning disabilities	Do you have any long-term emotional problems or learning disabilities? 1: Yes; 2: No

the goodness of fit of the model (Table 1) [20,21]. Entropy R-squared and standard R-squared indicate how well one can predict class memberships based on the indicators, and the closer these values are to 1, the better the predictions [20,21]. It is common to select the model with a classification error closest to 0 [20,21]. The interpretability of the classes was also considered.

Latent GOLD 4.5 [21] was used to perform the LCA because this software can accommodate the complex sampling design of YRBS and can also handle missing data [21]. LCA was used to group students into two distinct latent classes distinguished by five health domains: low risk (class 1) and high risk (class 2). The software identified the indicators as structurally missing and treated them as missing at random and totally dependent on the covariates [21,22]. Weighted percentages were computed to profile high-risk behaviors and health conditions among sexual minority students. SAS version 9.4 [23] was used for all other analysis and accounted for the complex sampling design of YRBS. The YRBS year was included as another stratum. CDC's Institutional Review Board (IRB) approved the survey administration; IRB approval was unnecessary for this secondary analysis. The analysis was conducted in 2017.

Results

Based on the classification statistics and interpretability, LCA classifies RI high school students into two distinct classes. The two-class LCA yielded good entropy R-squared, standard R-squared, and classification errors and provided the fit for all the five health domains (Table 1).

Fourteen percent (14%) of RI's high school students belonged to the high-risk class for the safety and being bullied domain: 30% or more in this class reported that they rarely/never wear a seatbelt, did not go to school due to feeling unsafe, fought at school, were hit by boyfriend/girlfriend on purpose, or were forced to have sexual intercourse. In the remaining 86% of the population, less than 7% reported any of these risky behaviors (Fig. 1A). Thirteen percent (13%) of the students belonged to the high-risk class for the depression and suicide domain: at least 48% in this class reported that they felt sad/hopeless, considered suicide, planned suicide, or attempted suicide. In the remaining 87% of the population, 4% or less reported any of these behaviors except felt sad/hopeless (16%) (Fig. 1B). Over one-third (35%) of the student population belonged to the high-risk class for the substance use domain: at least 47% of these reported having current alcohol use, consumed five+ drinks in a row,

Table 1. Fit of Latent Class Models Using Classification Statistics for Health Domains of the RI YRBS, 2007–2015

Health Domain	Classification Statistics											
	Entropy R-squared				Standard R-squared				Classification errors			
	2-Class Model	3-Class Model	4-Class Model	5-Class Model	2-Class Model	3-Class Model	4-Class Model	5-Class Model	2-Class Model	3-Class Model	4-Class Model	5-Class Model
Safety and Bullied	0.5856	0.6034	0.4896	0.4908	0.5999	0.5836	0.4702	0.4500	0.0607	0.0631	0.1302	0.1381
Depression and Suicide	0.8359	0.6621	0.5936	0.3802	0.8490	0.6554	0.5982	0.2789	0.0224	0.0683	0.0928	0.4424
Substance Use	0.9070	0.8263	0.8347	0.8043	0.9218	0.8291	0.8095	0.7694	0.0238	0.0642	0.0834	0.1096
Sexual Behavior	0.8276	0.8954	0.7877	0.5555	0.8263	0.9019	0.7876	0.4653	0.0693	0.0388	0.0713	0.2943
Health Condition	0.7217	0.6665	0.5814	0.6551	0.7855	0.6928	0.6001	0.6598	0.0648	0.1022	0.1595	0.1292

Models were sequentially fitted from 2 to more latent classes and compared to successive models using Classification Statistics.
Entropy R-squared and Standard R-squared indicate how well one can predict class memberships based on the indicators. The closer these values are to 1, the better the predictions.
Classification Errors: When classification of cases is based on modal assignment (to the class having the highest membership probability), the proportion of cases that are estimated to be misclassified is reported by this statistic. The closer this value is to 0, the better.

current marijuana use, ever tried cigarette smoking, or ever used marijuana. Less than 15% of the remaining 65% of the student population reported those behaviors (Fig. 1C).

The classification of the first three domains clearly separated the high school students into distinct classes. However, the classes of the last two domains did not separate very well. Thirty-six percent (36%) of RI's student population belonged to the high-risk class for the sexual behavior domain: at least 82% of this group reported they were currently sexually active or ever had sexual intercourse. In the remaining 64% of the population, less than 8% were currently sexually active or ever had sexual intercourse (Fig. 1D). In terms of a health condition, 34% of the high school student population belonged to the high-risk class: at least 65% in this class reported being overweight based on percentile for body mass index (BMI) or described themselves as overweight. In the remaining 66% of the population, 7% or less reported actual or perceived overweight (Fig. 1E).

Thirty-four indicators were summarized in five health domains to crosstab sexual minority categories. Bisexually-identified students had higher health-related risks and conditions than lesbian and gay individuals. Unsure students were more likely to have risky behaviors and health conditions than heterosexual students (Fig. 2A). Students who reported sexual contact with persons of both sexes were more likely to have engaged in risk behaviors and have health conditions than students who reported sexual contact with a person of the same sex (Fig. 2B). Students who identified as heterosexual (straight) but who reported sexual contact with a person of the same sex or persons of both sexes were more likely to have engaged in risk behaviors and have health conditions than students who identified as heterosexual (straight) and who did not report sexual contact with a person of the same sex or persons of both sexes (Fig. 2C).

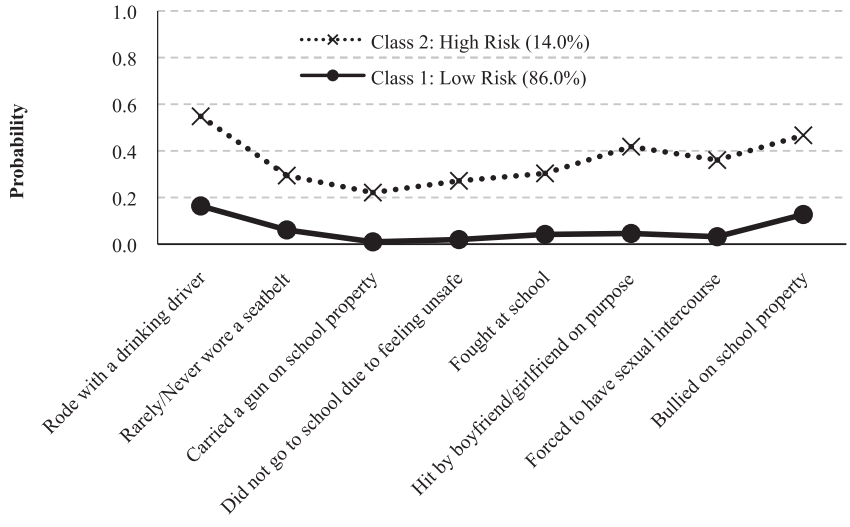
Discussion

The LCA with two classes fitted four of the five domains well based on standard R-squared and classification error. The LCA with three classes fitted the sexual behavior domain well based on all three classification statistics. In addition to model fit, interpretation of the meaningful classes and suitable numbers of students in each group were considered. Finally, two classes were chosen across all domains. The latent classes themselves required interpretation and should be interpretable in light of the empirical evidence about the domain they represent. Each class should have a substantial number of students because small classes may be artefactual outliers [16].

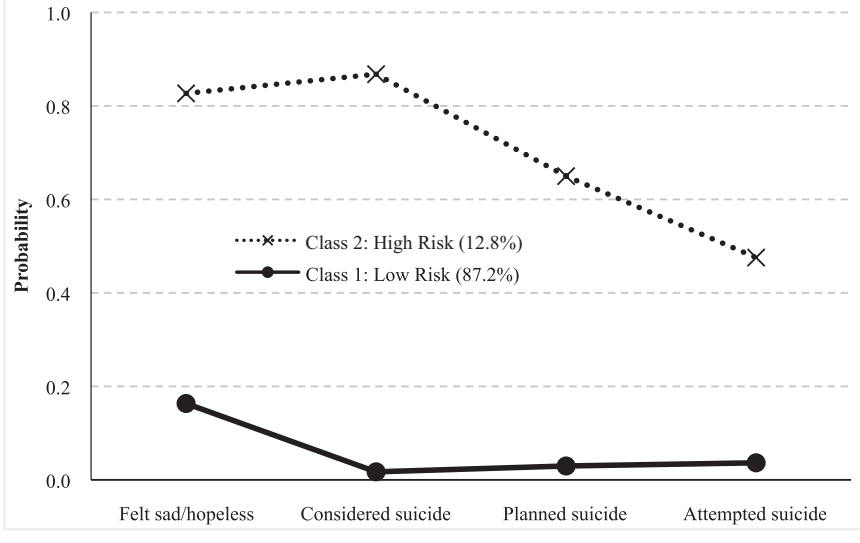
Our results are consistent with previous findings [6,14,24–27]. Individual risky behaviors or health conditions were higher among sexual minority students. Sexual minority youth report significantly higher rates of violent victimization in school, dating violence, depression, suicidality, substance use, sexual risk behaviors, overweight, stress, physical inactivity, and lower social support compared with their sexual nonminority counterparts [2–4,6,8,9,11–15,28]. Luo et al. note that youth having sexual contact with both sexes have significantly higher odds of dating violence than do youth with same-sex sexual contact only [2]. To avoid multicollinearity, previous studies evaluate only some risk behaviors or health conditions, which partially reflect a specific aspect of each domain. LCA allows the authors to go beyond these findings by including 34 correlated indicators for five domains.

LCAs revealed consistent and unexpected patterns in Figures 1 and 2. (1) LCAs did differentiate the majority of the 34 indicators among five domains very well as expected, but not "not taught in school about AIDS/HIV" in sexual behavior and "have learning disabilities" in health condition (Fig. 1). (2) LCAs differentiated subgroups of sexual minority youth across five domains very well, but Figure 2 displays several unexpected features. Figure 2A shows that unsure students had the lowest probability of sexual behavior, and three groups (bisexual, gay/lesbian, and unsure) had a similar probability of multiple conditions. Figure 2B illustrates that "opposite sex only" students had higher probabilities of sexual behavior than "same-sex only" students, and "never had sexual contact" students had higher probabilities of multiple conditions than "opposite sex only" students. "Both sexes" students had the highest probability of substance use (66%). Figure 2C demonstrates that among those who identified as heterosexual but who had sexual contact with the same sex or both sexes, the probabilities of their first two domains were similar to unsure students, but the probabilities of their last three domains were similar to gay or lesbian or bisexual students. This subgroup experienced the highest probability of substance abuse and sexual behavior.

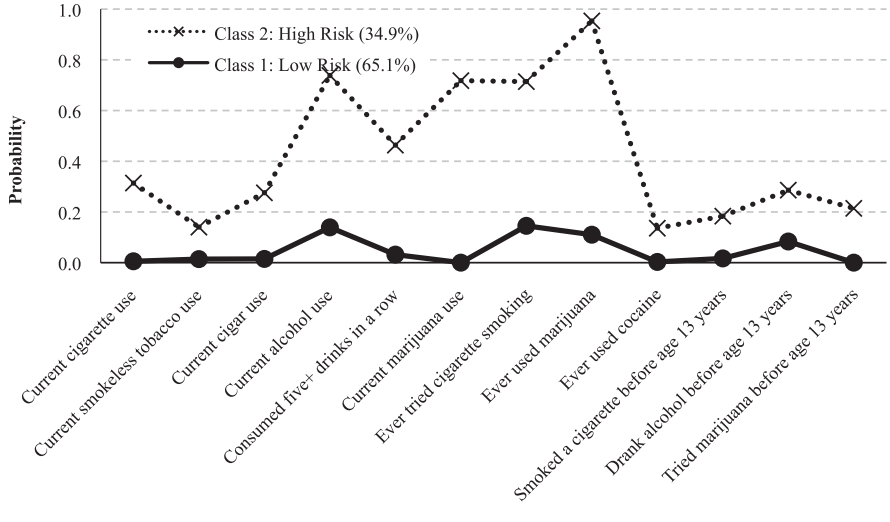
All students deserve a safe, supportive, and inclusive school climate with equal opportunities



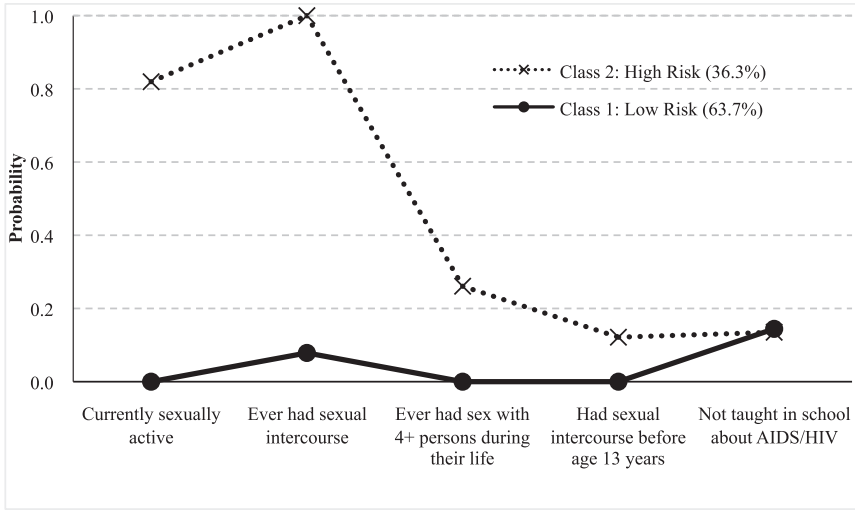
(A) Safety and being bullied*



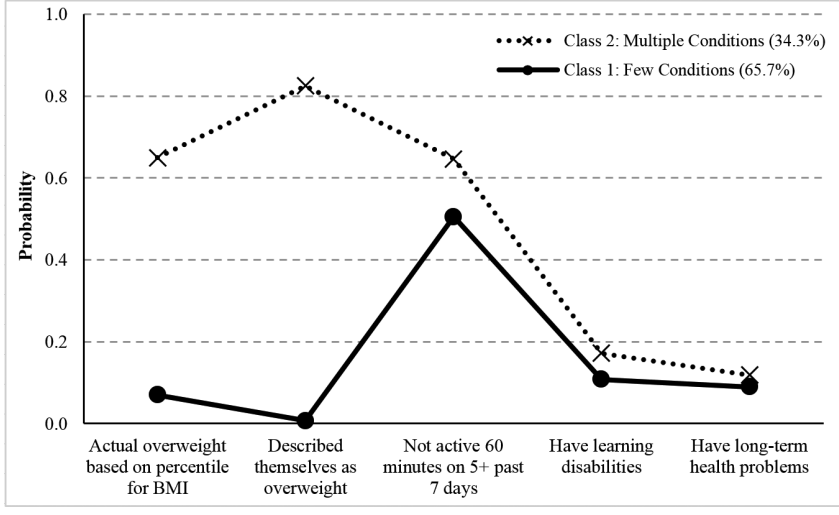
(B) Depression and suicide



(C) Substance use



(D) Sexual behavior



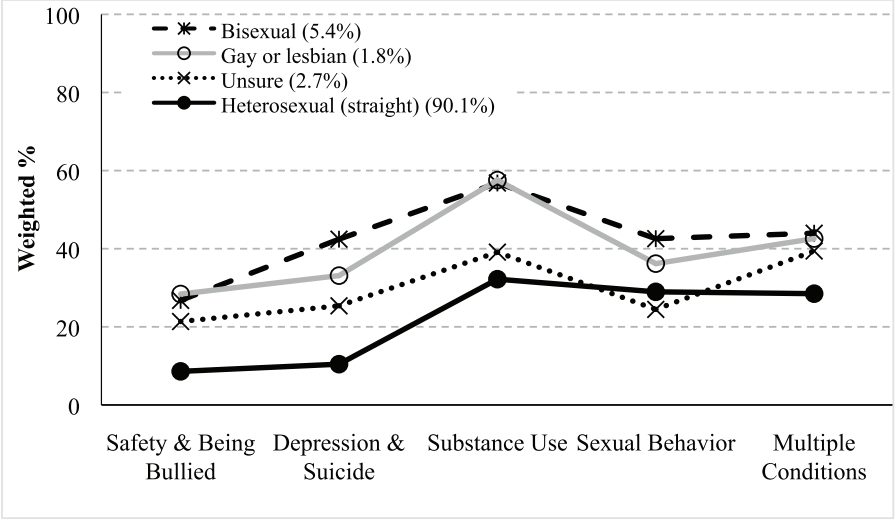
(E) Health condition

Figure 1. Probabilities of (A) safety and being bullied, (B) depression and suicide, (C) substance use, (D) sexual behavior, and (E) health condition by latent class, RI YRBS, 2007–2015.
*Bullied question was initiated in the RI YRBS in 2009.

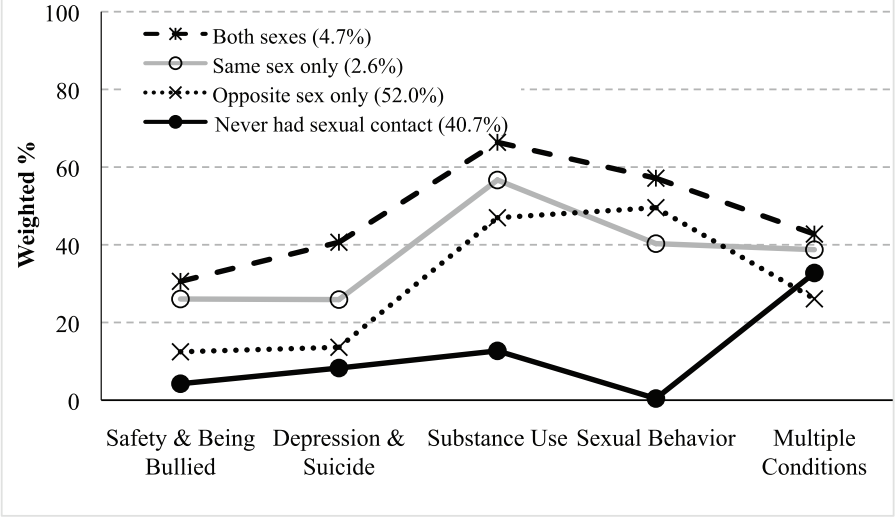
for participation and achievement [29]. Targeted health interventions to reduce these risk behaviors are needed. School-based strategies, such as mental health screening, which could help to identify youth at higher risk, need to consider confidentiality concerns related to the targeting of subgroups. Interventions focused on clustering substance use and sexual behaviors may be beneficial for this subgroup and can include screening adolescents who present with problematic behaviors and connecting them to mental health and other support services [30,31]

School nurses, school psychologists, and social workers play a critical role in advocating for practices and policies that provide for the physical, psychological, and social safety of all students [29,32–34]. These school support professionals need to be sensitive to health disparities experienced by sexual minority students and increase their cultural competence to care for and support these youth. Schools should consider utilizing the "Whole School Whole Community Whole Child" framework and these research findings to support all youth in their schools [32].

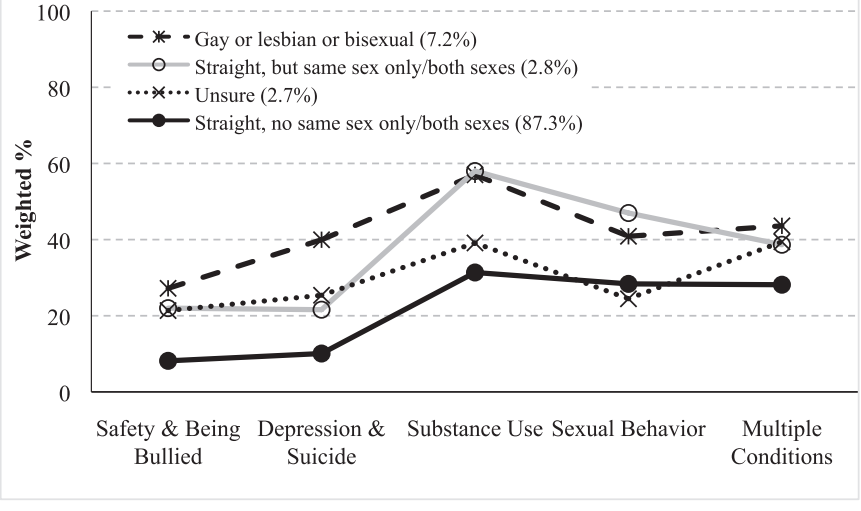
This study has several limitations. (1) YRBS is a cross-sectional survey. Our findings cannot indicate causality and only indicate an association between sexual minority status and health-risk behaviors and health conditions [27]. (2) Because YRBS students self-report information, not being able to validate



(A) Sexual orientation identity



(B) Sex of sexual contact



(C) Sexual orientation identity/sex of sexual contact

Figure 2. Distribution of (A) sexual orientation identity, (B) sex of sexual contact, and (C) sexual orientation identity/sex of sexual contact by high-risk behaviors and conditions, RI YRBS, 2007–2015.

this information and possible recall bias may have affected the observed distributions. (3) Since we combined 5 years of data that span 8 years, it is possible that the behaviors or characteristics of the students may have changed over time. (4) If the same school was examined in the 2007, 2009, 2011, 2013, and 2015 surveys, it is possible that a small number of students were sampled twice. However, the situation is different from asking respondents twice since each year was treated as a different survey.

Despite these limitations, LCA provides some strength in analyzing data from surveys. (1) By grouping multiple correlated health indicators into a few health domains, LCA allows these indicators to be analyzed together through the domains and minimizes multi-collinearity [16]. (2) This analysis suggests that LCA can be adopted in other states, surveys, or programs. (3) Our findings suggested that bisexuals have different health-related risks and health conditions than lesbian and gay individuals. Therefore, it is important to recognize these differences within the broader category of "sexual minority youth." (4) LCA simplified the patterns [19]. Five latent class models provided a fuller picture of sexual minority students.

Conclusions

Risk behaviors and health conditions may differ substantially between heterosexual and sexual minority students. Risk appears to be highest among bisexual students, and lower among unsure students. LCA may help public health and education officials to intervene with sexual minority students who may need extra attention due to their risk behaviors and health conditions. LCA is an effective statistical approach for identifying populations and the allocation of public health and education resources.

Implications for Practice

Results from this report can aid educators and public health professionals in planning to reduce those risk health behaviors. There are at least five implications for practice.

(1) Effective school-wide programs to support sexual minority youth must address safe, supportive, and inclusive environments. Inclusivity means that differences within subgroups are recognized, acknowledged, and accepted (Bisexual Invisibility and the Bisexual Report) [35,36]. Although the term sexual minority youth is used for research purposes, in practice, it is important to distinguish among sexual minority categories. Our research highlighted the unique disparities in risk among youth who identify as bisexual. When youth feel included they are less likely to take harmful risks. When sexual minority adolescents are able to build relationships with teachers, nurses, and other school staff, they will feel comfortable asking for help, knowing that they are accepted for who they are [2].

(2) School-based efforts such as anti-bullying, dating violence, substance use prevention, and sexual health education programs are opportunities to promote inclusivity and acceptance of differences [2,4,6]. Public health interventions should be tailored to promote positive health behaviors and consider the unique needs of sexual minority subpopulations [2].

(3) Public health programs can utilize mass media interventions to reduce health risk behaviors for sexual minority youth. Intervention programs need to help them overcome individual- and structural-level barriers by reinforcing healthy community norms, strengthening networks, and incorporating self-efficacy and family support to eliminate perceived barriers to reduce risk health behaviors.

(4) The American Academy of Pediatrics recommends pediatricians "create teen-friendly offices that are welcoming to sexual minority youth, strive to obtain a comprehensive psychosocial and sexual history and avoid biased language that implies that all patients are heterosexual". Healthcare providers are encouraged to assess sexual behaviors and risks, and not make assumptions about sexual identity and behaviors [37].

(5) Disparities among subcategories of sexual minority youth need additional research and consideration [35,36]. Furthermore, continued research in this area is needed to create intervention programs that are relevant to different subpopulations within sexual minority students.

Acknowledgments

The authors would like to express their thanks to Kerri Kanelos for reviewing and commenting on

an earlier version of this article. We also appreciate John Fulton, C. Kelly Smith, Sarah Bowman, and Jordan Kennedy as the Rhode Island Department of Health (RIDOH) Sexual Orientation and Gender Identity Equity group for reviewing and discussing it. The RIDOH contracted with Market Decisions LLC, of Portland, ME, to administer the 2007–2015 YRBS in high schools statewide. The RI YRBS is conducted through a cooperative agreement between the CDC and the RIDOH. This publication was supported by CDC Cooperative Agreement #U87PS004179. Funding and other support for the 2007–2015 RI YRBS were provided by the RIDOH, the Department of Elementary and Secondary Education, the Executive Office of Health and Human Services, and the Department of Behavioral Health, Developmental Disabilities, and Hospitals.

Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

[1] Gebrekristos HT. Health inequalities among sexual minority youth: a need for sexual orientation and gender expression sensitive school environment. Sex Transm Infect 2012; 88(4):236–7.

[2] Luo F, Stone DM, Tharp AT. Physical dating violence victimization among sexual minority youth. Am J Public Health 2014; 104(10):e66–73.

[3] Mustanski B, Andrews R, Herrick A, Stall R, Schnarrs PW. A syndemic of psychosocial health disparities and associations with risk for attempting suicide among young sexual minority men. Am J Public Health 2014; 104(2):287–94.

[4] Lowry R, Dunville R, Robin L, Kann L. Early sexual debut and associated risk behaviors among sexual minority youth. Am J Prev Med 2017; 52(3):379–84.

[5] Martin-Storey A. Prevalence of dating violence among sexual minority youth: variation across gender, sexual minority identity and gender of sexual partners. J Youth Adolesc 2015; 44(1):211–4.

[6] Patrick DL, Bell JF, Huang JY, Lazarakis NC, Edwards TC. Bullying and quality of life in youths perceived as gay, lesbian, or bisexual in Washington State, 2010. Am J Public Health 2013; 103(7):1255–61.

[7] Garofalo R. A personal reflection on the history of population-based research with sexual minority youths. Am J Public Health 2014; 104(2):198–200.

[8] Goldbach JT, Raymond HF, Burgess CM. Patterns of bullying behavior by sexual orientation. J Interpers Violence 2017; 1:886260517741623.

[9] Stone DM, Luo F, Ouyang L, Lippy C, Hertz MF, Crosby AE. Sexual orientation and suicide ideation, plans, attempts, and medically serious attempts: evidence from local youth risk behavior surveys, 2001–2009. Am J Public Health 2014; 104(2):262–71.

[10] Calzo JP, Masyn KE, Austin SB, Jun HJ, Corliss HL. Developmental latent patterns of identification as mostly heterosexual versus lesbian, gay, or bisexual. J Res Adolesc 2017; 27(1):246–53.

[11] Jordan JN, McElroy JA, Everett KD. Smoking initiation, tobacco product use, and secondhand smoke exposure among general population and sexual minority youth, Missouri, 2011–2012. Prev Chronic Dis 2014; 11:E113.

[12] Watson RJ, Lewis NM, Fish JN, Goodenow C. Sexual minority youth continue to smoke cigarettes earlier and more often than heterosexuals: Findings from population-based data. Drug Alcohol Depend 2018; 1(184):64–70.

[13] Talley AE, Hughes TL, Aranda F, Birkett M, Marshal MP. Exploring alcohol-use behaviors among heterosexual and sexual minority adolescents: intersections with sex, age, and race/ethnicity. Am J Public Health 2014; 104(2):295–303.

[14] Rosario M, Corliss HL, Everett BG, Reisner SL, Austin SB, Buchting FO, et al. Sexual orientation disparities in cancer-related risk behaviors of tobacco, alcohol, sexual behaviors, and diet and physical activity: pooled Youth Risk Behavior Surveys. Am J Public Health 2014; 104(2):245–54.

[15] Calzo JP, Roberts AL, Corliss HL, Blood EA, Kroshus E, Austin SB. Physical activity disparities in heterosexual and sexual minority youth ages 12–22 years old: Roles of childhood gender nonconformity and athletic self-esteem. Ann Behav Med 2014; 47(1):17–27.

[16] Jiang Y, Zack MM. A latent class modeling approach to evaluate behavioral risk factors and health-related quality of life. Prev Chronic Dis 2011; 8(6):A137.

[17] US Department of Health and Human Services (Office of Disease Prevention and Health Promotion). Lesbian, Gay, Bisexual, and Transgender Health. Healthy People 2020 [Internet]. 2014 [cited 2017 July 17]. Available from https://www.healthypeople.gov/2020/topics-objectives/topic/lesbian-gay-bisexual-and-transgender-health?topicid=25

[18] Jiang Y, Mermin J, Cooper T, Viner-Brown S. Sexual risk behaviors of sexual minority students in Rhode Island, 2007–2013. R I Med J 2014; 97(11):39–42.

[19] Laska MN, Pasch KE, Lust K, Story M, Ehlinger E. Latent class analysis of lifestyle characteristics and health risk behaviors among college youth. Prev Sci 2009; 10(4):376–86.

[20] Jiang Y, Dumont DM, Cooper T, Paiva KA, Viner-Brown S. A latent class model to identify city/town chronic disease patterns. Prev Med 2015; 73:139–44.

[21] Vermunt JK, Magidson J. Latent GOLD 4.0 user's guide. Statistical Innovations Inc., Belmont, USA, 2005.
[22] Little RJA, Rubin DB. Statistical analysis with missing data. John Wiley, New York, 1987. http://www.sciepub.com/reference/157210
[23] SAS Institute Inc. SAS® 9.4 Software. SAS Institute Inc., Cary, NC, 2017.
[24] Ott MQ, Wypij D, Corliss HL, Rosario M, Reisner SL, Gordon AR, et al. Repeated changes in reported sexual orientation identity linked to substance use behaviors in youth. J Adolesc Health 2013; 52(4):465–72.
[25] Duncan DT, Hatzenbuehler ML. Lesbian, gay, bisexual, and transgender hate crimes and suicidality among a population-based sample of sexual-minority adolescents in Boston. Am J Public Health 2014; 104(2):272–8.
[26] Freedner N, Freed LH, Yang YW, Austin SB. Dating violence among gay, lesbian, and bisexual adolescents: results from a community survey. J Adolesc Health 2002; 31(6):469–74.
[27] Kann L, Olsen EO, McManus T, Harris WA, Shanklin SL, Flint KH, et al. Sexual identity, sex of sexual contacts, and health-related behaviors among students in grades 9–12—United States and Selected Sites, 2015. MMWR Surveill Summ 2016; 65(9):1–202.
[28] Whitton SW, Newcomb ME, Messinger AM, Byck G, Mustanski B. A longitudinal study of IPV victimization among sexual minority youth. J Interpers Violence 2016; doi: 10.1177/0886260516646093 [Epub ahead of print].
[29] LGBTQ Students. The role of the school nurse. NASN Sch Nurse 2017; 32(2):129–31.
[30] Ballard ED, Musci RJ, Tingey L, Goklish N, Larzelere-Hinton F, Barlow A, et al. Latent class analysis of substance use and aggressive behavior in reservation-based American Indian youth who attempted suicide. Am Indian Alsk Native Ment Health Res 2015; 22(1):77–94.
[31] Kosciw JG, Greytak EA, Giga NM, Villenas C, Danischewski DJ. The 2015 national school climate survey: The experiences of lesbian, gay, bisexual, transgender, and queer youth in our nation's schools. New York, 2016.
[32] National center for chronic disease prevention and health promotion. Whole School, Whole Community, Whole Child (WSCC). 2015 [cited 2017 July 20]. Available from: https://www.cdc.gov/healthyschools/wscc/index.htm
[33] Perron T, Kartoz C, Himelfarb C. LGBTQ youth part 1. NASN Sch Nurse 2017; 32(2):106–15.
[34] Perron T, Kartoz C, Himelfarb C. LGBTQ part 2. NASN Sch Nurse 2017; 32(2):116–21.
[35] San Francisco Human Right Commission. Bisexual Invisibility: Impacts and Recommendations. LGBT Advisory Committee. 2011. Available from https://sf-hrc.org/sites/default/files/Documents/HRC_Publications/Articles/Bisexual_Invisiblity_Impacts_and_Recommendations_March_2011.pdf
[36] Barker M, Richards C, Jones R, Bowes-Catton H, Plowman T, Yockney J, et al. The bisexuality report: Bisexual inclusion in LGBT equality and diversity. In: The Open University Centre for Citizenship, Identities and Governance, Milton Keynes, 2012. Available from https://bisexualresearch.wordpress.com/reports-guidance/reports/thebisexualityreport/
[37] Committee on Adolescence. Office-based care for lesbian, gay, bisexual, transgender, and questioning youth. Pediatrics 2013; 132(1):198–203.