

Vaping, Mental health and Sexual Identity in Adolescents: Analysis of Youth Risk Behavior Study Data

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Abstract

This study examined if there were associations between poor mental health and vaping behaviors controlling for sex and sexual identity. Given the public health implications, this research study provided insights in identifying potential higher risks youth for planning targeted public health interventions for youth. National data in Youth Risk Behavior Survey High school student survey for 2021 were used to analyze the data. Baseline statistics were carried out and used chi-square to test for differences. Statistical analysis were carried out using Epi Info 7 software. Sexual identity and sex were controlled for in the study and odds ratios were calculated for subgroups. The latest YRBS data was analyzed to explore association between vaping and mental health controlling for sexual identity. Twenty nine percent of youth reported mental health was most of the time or always not good. The prevalence of poor mental health was 29.3%. Forty four percent of gay or lesbian youth reported poor mental health. Highest reports of ever vaping reported among female youth (41%) and bisexual youth (49%) and current vaping were among females (21%) and bisexual youth (29%). Through analyzing 2021 YRBS data, bisexual youth were more likely to have ever used electronic vapor products than heterosexual youth. The results demonstrated an association between poor mental health and vaping. Statistically significant groups were who were found to have an association between reports of vaping and poor mental health were all youth with other/questioning youth reporting strongest association. These findings point for the need for improved school-based services for mental health and the need for schools to provide vaping cessation services or referral systems to community resources. These findings of association between vaping and mental health were consistent with previous studies.

Keywords: Vaping, Mental Health, Sexual Identity

1. Introduction

A significant percentage (29%) of youth reported poor mental health. Poor mental health includes stress, anxiety, and depression. Results of community surveys in regions of the United States have shown one in every four children experiences a mental disorder with few affected youth receiving adequate mental health care. However, there has been a lack of data on the prevalence and distribution of a wide range of mental disorders from a nationally representative sample of children or adolescents. This information is necessary to establish resource allocation priorities for prevention and treatment. (Cohen, et al. 1993) (Reinherz, et al., 1993) (Lahey, B. et al 1996)

Electronic vapor products include e-cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods, such as JUUL, SMOK, Suorin, Vuse, and blu. Recent entrance into the marketplace of electronic vapor products has increased the availability of vapor products to youth.

Previous research indicated that depression and e-cigarettes use are associated (Newport Institute 2023). A study of 2,500 youth found that vaping was associated with anxiety and depression when compared to youth who did not

use e-cigarette or vape. (Arnst 2023) Given previous research findings, additional research studies are needed to discover what associations and risk factors increase the probability that youth will present with mental health issues and exhibit vaping behaviors such as e-cigarette use and vape pen use. Is there an association between vaping and mental health controlling for sexual identity in youth? This study aims to seek if there are associations between poor mental health and vaping behaviors. Hypothesis is that poor mental health is associated with vaping behavior among youth. Youth who report poor mental health will be more likely to report vaping than youth who do not report poor mental health. In addition, it is hypothesized that there will be statistically significant differences by sex and sexual identity. Given the public health implications this research study can provide insights in identifying potential higher risks youth for planning targeted public health interventions for youth. Poor mental health was determined by respondents who answered their mental health was most of the time or always not good (CDC, 2021). A significant percentage (37%) of youth reported poor mental health during Covid.

2. Methods

Statistical analysis was performed on Youth Risk Behavior Study (YRBS) data imported into Epi Info 7 using procedures that accommodate the weighted sampling design of YRBS. YRBS is used to monitor priority health risk behaviors among youth in the United States. The national Youth Risk Behavior Survey (YRBS) uses a three-stage cluster sample design to produce a representative sample of 9th through 12th grade students. (CDC, 2023) National data in YRBS High school student survey for 2021 were used to analyze the data. Baseline statistics were carried out and used chi-square to test for differences. The national survey data was imported into Epi Info as a database file. Statistical analysis was carried out using Epi Info 7 software. Epi Info software analysis capabilities include odds ratios, confidence intervals and cross tabulations. Epi info menu analyze data allows users to import databases in the “read” dialogue box. Once data is imported, Epi Info can be used to analyze data using “analysis” commands and output to tables. Results appear in Epi Info in “analysis output” window. Sexual identity and sex were controlled for in the study and odds ratios were calculated for subgroups.

The following are statistical definitions and purpose of p values, 95% confidence interval and odds ratios used in this study. P values are defined as the probability assuming no effect or difference of obtaining a result that what was observed. P value measures how likely it is that any observed difference between groups is due to chance. A p-value of 0.05 or lower is generally considered statistically significant. 95% confidence interval is a range of values that is likely to include a population's value with a certain degree of confidence. It is expressed as a percentage whereby a population mean lies between an upper and lower interval. Odds ratio is the ratio of the odds of the event happening in an exposed group versus a non-exposed group. The odds ratio is used to report the strength of association between an exposure and an event. The larger the odds ratio the more likely the event is to be found with exposure.

Calculation of odds ratio is described below as shown in Equation 1. The odds ratio is odds of the event in the exposure group (a/b) divided by the odds of the event in the control or non-exposure group (c/d). Therefore, the odds ratio is (a/b) / (c/d) which can be simplified to ad/bc.

Equation 1. Calculating Odds Ratio (OR)

Exposure	Outcome	
	Yes	No
Yes	a	b
No	c	d

$$Odds\ Ratio = \frac{Odds\ of\ the\ Outcome\ in\ Exposed\ Group}{Odds\ of\ the\ Outcome\ in\ Non - Exposed\ Group}$$

$$Odds\ Ratio = \frac{a/b}{c/d} = \frac{a \times d}{b \times c}$$

3. Results

The analysis included 17,232 high school students from the YRBS. As depicted in Tables 1-3, twenty nine percent of youth reported poor mental health. Compared with heterosexual youth, gay, lesbian, or bisexual youth were more

likely to report mental health was most of the time or always not good. Forty percent of female youth and 18 % of male youth reported mental health was most of the time or always not good. Heterosexual youth 22% reported incidence of poor mental health when compared to 51% gay, lesbian, or bisexual youth. Sexual minority youth were comprised of gay, lesbian, or bisexual and other/questioning youth. In all tables below the group of (gay, lesbian, or bisexual) is a combination of (gay or lesbian) and (bisexual) into a larger subgroup.

Table 1. Poor mental health and sexual identity

Reported mental health was most of the time or always not good			
Sexual Identity	N	%	95% C.I.
Heterosexual	9,239	22.2	(20.8–23.6)
Gay or lesbian	414	44.3	(39.1–49.7)
Bisexual	1,402	53.2	(49.4–57.0)
Gay, lesbian or bisexual	1,816	51.3	(48.0–54.6)
Other/Questioning	1,106	52.2	(47.9–56.4)

Table 2. Percentage of youth reporting poor mental health by sexual identity and sex.

Sex	Total	Heterosexual	Gay or Lesbian	Bisexual	Gay, lesbian or bisexual	Other/Questioning
Total	29.3	22.2	44.3	53.2	51.3	52.2
Female	40.8	32.0	49.7	56.5	55.5	54.8
Male	18.1	15.6	36.0	38.1	37.3	35.9

Table 3. Comparison of gay or lesbian youth with heterosexual youth for poor mental health

Sexual Identity	Heterosexual (straight)	Gay or lesbian	p-value	Gay or lesbian More Likely Than Heterosexual (straight)
Sex				
Total	22.2 (20.8–23.6); 9,239	44.3 (39.1–49.7) 414	0.00	Yes
Female	32.0 (29.6–34.6); 3,697	49.7 (41.0–58.4) 245	0.00	Yes
Male	15.6 (14.3–17.0); 5,482	36.0 (26.3–46.9) 148	0.00	Yes

Regardless of sex, gay or lesbian youth were more likely than heterosexual youth to report that their mental health was most of time or always not good. P=0.00

Table 4. Ever Used Electronic Vapor Products by sex

Sex	Total	Female	Male
Year			
2021	36.2 (33.7–38.8); 16,806	40.9 (37.6–44.2); 7,968	32.1 (29.7–34.5); 8,593

Female youth reported higher ever use of vapor products than male youth.

Table 5. Ever Used Electronic Vapor Products by sexual identity

Sexual Identity	Total	Heterosexual (straight)	Gay or lesbian	Bisexual	Gay, lesbian, or bisexual	Other/Questioning
Year						
2021	36.2 (33.7–38.8) 16,806	34.7 (32.4–37.1) 12,167	34.4 (25.5–44.6) 503	48.9 (44.2–53.6) 1,791	45.8 (42.2–49.4) 2,294	33.5 (29.2–38.0) 1,446

Bisexual youth reported the highest percentage of ever used vapor products followed by gay or lesbian youth.

Table 6. Ever Used Electronic Vapor Products–Compare Bisexual with Heterosexual

Sexual Identity	Heterosexual (straight)	Bisexual	p-value	Bisexual More Likely Than Heterosexual (straight)
Year				
2021	34.7 (32.4–37.1); 12,167	48.9 (44.2–53.6); 1,791	0.00	Yes

Bisexual youth were more likely than heterosexual to have ever used vapor products.

Table 7. Ever Used Electronic Vapor Products -Gay, lesbian or bisexual compared to heterosexual youth

Sexual Identity	Heterosexual (straight)	Gay, lesbian, or bisexual	p-value	Gay, lesbian, or bisexual More Likely Than Heterosexual (straight)
Year				
2021	34.7 (32.4–37.1); 12,167	45.8 (42.2–49.4); 2,294	0.00	Yes

Gay, lesbian or bisexual more likely than heterosexual youth to have ever used vapor products.

Table 8. Ever Used Electronic Vapor Products - Heterosexual youth compared to other /questioning youth

Sexual Identity	Heterosexual (straight)	Other/Questioning	p-value	Heterosexual (straight) More Likely Than Other/ Questioning	No Difference
Year					
2021	34.7 (32.4–37.1); 12,167	33.5 (29.2–38.0); 1,446	0.44	No	Yes

No statistical difference between other/questioning youth and heterosexual youth for ever use of vapor products.

Table 9. Ever Used Electronic Vapor Products and Mental Health

Ever used electronic vapor products	Mental health was most of the time or always not good.	
	Yes	No
Yes	1858	2896
No	1763	5823

Odds ratio of 2.12 indicates increased risk for ever having used vapor products in youth who reported poor mental health.

Table 10. Currently used electronic vapor products by sex

Sex	Total	Female	Male
Year			
2021	18.0 (16.3–19.8); 16,077	21.4 (19.2–23.8); 7,559	14.9 (13.3–16.7); 8,282

Females reported higher rate than male youth of current vapor product use.

Table 11. Currently used electronic vapor products by sexual identity

Sexual Identity	Total	Heterosexual (straight)	Gay or lesbian	Bisexual	Gay, lesbian, or bisexual	Other/Questioning
Year						
2021	18.0 (16.3–19.8) 16,077 [†]	16.4 (15.1–17.8) 11,640	15.8 (11.1–22.0) 477	29.0 (25.4–32.8) 1,715	26.2 (23.5–29.1) 2,192	15.7 (12.9–18.9) 1,381

Bisexual youth reported highest current vapor product use.

Table 12. Currently Used Electronic Vapor Products and Mental Health

Currently used electronic vapor products	Mental health was most of the time or always not good.	
	Yes	No
Yes	1042	1343
No	2379	7087

Odds ratio of 2.31 indicates increased risk for current use of vapor products among those who reported that their mental health most of the time or always not good.

Table 13. Currently Used Electronic Vapor Products and Mental Health Sexual Identity: Heterosexual

Currently used electronic vapor products	Mental health was most of the time or always not good.	
	Yes	No
Yes	564	1031
No	1307	5687

Odds ratio of 2.38 indicates there was an increased risk for current use of vapor products among heterosexual youth who reported that their mental health most of the time or always not good.

Table 14. Currently Used Electronic Vapor Products and Reported Mental Health Sexual Identity: GAY or Lesbian

Currently used electronic vapor products	Mental health was most of the time or always not good.	
	Yes	No
Yes	47	30
No	133	165

Odds ratio of 1.94 indicates there was an increased risk for current use of vapor products among gay or lesbian youth who reported that their mental health most of the time or always not good.

Table 15. Currently Used Electronic Vapor Products and Reported Mental Health Sexual Identity: Bisexual

Currently used electronic vapor products	Mental health was most of the time or always not good.	
	Yes	No
Yes	253	157
No	455	429

OR=1.52 indicates there was an increased risk current use of vapor products among bisexual youth who reported poor mental.

Table 16. Currently Used Electronic Vapor Products and Reported Mental Health :Sexual Identity= Other/questioning

Currently used electronic vapor products	Mental health was most of the time or always not good.	
	Yes	No
Yes	134	50
No	392	450

Odds ratio of 3.08 points to an increased risk or current use of vapor products among the other/questioning youth who reported poor mental health. This indicates there was an increased risk for other/questioning youth in current use of vapor products among those who reported that their mental health most of the time or always not good.

4. Discussion

Overall gay, lesbian, bisexual youth are at much higher risk for poor mental health. Female bisexual youth reported highest percentage (56.5%) of poor mental health. In this large survey of high school students, the prevalence of poor mental health was 29.3%. The prevalence of vaping was 27% of youth. Thirty six percent of youth reported having ever used electronic vapor products. As seen in previous research, females reported poor mental health more than males. Forty percent of females and 18% of males reported that their mental health was most of the time or always not good. This is consistent with findings from Reinherz, et al. (Reinherz, et al., 1993) “Moreover, consistent with national-level data, females in this population exhibited a significantly greater risk for both mental and physical health issues than males.” (Reinherz, et al., 1993) In addition, “... studies found relationships among physical activity, sedentary behavior, and depression, but more recent information is needed to inform research and practice” (Merikangas, et al., 2010) This study analyzed most recent 2021 YRBS survey data. “Approximately one in every four to five youth in the U.S. meets criteria for a mental disorder with severe impairment across their lifetime. The likelihood that common mental disorders in adults first emerge in childhood and adolescence highlights the need for

a transition from the common focus on treatment of U.S. youth to that of prevention and early intervention.” (Cohen, et al. 1993)

There appears to be an increased risk for ever having used vapor products among youth who reported poor mental health (OR 2.06). Female youth reported higher ever use and current use of vapor products than male youth. Bisexual youth reported the highest percentage of having ever used vapor products followed by gay or lesbian youth. When stratified by sexual identity, bisexual youth reported higher association between current vapor product use and poor mental health. Bisexual youth more likely than heterosexual youth to use vapor products. Gay, lesbian, or bisexual youth were more likely than heterosexual youth to have ever used vapor products. Bisexual youth reported highest current vapor product use. For heterosexual youth there was also an increased risk for current use of vapor products among those who reported that their mental health most of the time or always not good. (OR=2.38). Results indicated increased risk for current use of vapor products among those who reported that their mental health most of the time or always not good (OR 2.31).

For gay or lesbian youth, there was an increased risk for current use of vapor products among those who reported that their mental health most of the time or always not good (OR=1.94) For bisexual youth there was an increased risk current use of vapor products among those who reported that their mental health most of the time or always not good (OR=1.52). The association between sexual identity and current vaping was strongest for other/questioning youth (OR 3.08).

The findings in this study are consistent with previous research. Current research evidence suggests that the strongest risk factors for youth vaping are being female and bisexual. (TruthInitiative, 2023) In previous research, sexual minority adolescents had greater odds of ... using e-cigarettes relative to heterosexual adolescents. Sexual minority-tailored interventions may be warranted to prevent tobacco product initiation. (Garcia, et al., 2021) Previous research indicates higher rates of trying e-cigarettes: Young people who identify as LGB reported that they had ever vaped at much higher rates than their heterosexual peers (52.1% vs 38.6%). (TruthInitiative, 2023) Higher rates of currently using e-cigarettes: LGB youth vaped at higher rates than their heterosexual peers (19.8% vs. 13.2%). (TruthInitiative, 2023)

More concerning is that the rates increase over time: Between 2020 and 2021, the difference between LGB and heterosexual young people who currently vape increased by 32%, and those who had ever tried e-cigarettes increased by 26%. (TruthInitiative, 2023) These findings point for the need for improved school-based services in the area of mental health and vaping cessation with a priority need for focus on LGBTQ youth. “We recommend that sexual and reproductive health services should be accessible to adolescents to address their needs and help to prevent any adverse mental health outcomes.” (Vanderkruik, et al. 2021) “Schools can be a setting to address mental health needs of sexual and gender minority (SGM) youth. Gender-Sexuality Alliances (GSAs), as extracurricular support groups, provide an existing structure that could be leveraged to reach SGM youth and deliver services” (Poteat, et al., 2021) In addition, “data highlighting the unique biological, behavioral, social, and structural contextual factors surrounding health risks and resiliencies for transgender people. To mitigate these risks and foster resilience, a comprehensive approach is needed that includes gender affirmation as a public health framework, improved health systems and access to health care informed by high quality data, and effective partnerships with local transgender communities to ensure responsiveness of and cultural specificity in programming. Consideration of transgender health underscores the need to explicitly consider sex and gender pathways in epidemiological research and public health surveillance more broadly.” (Reinherz, et al., 1993)

5. Conclusion

Previous research indicates sexual minority adolescents were more likely to have friend(s) who vape. In adjusted models, sexual minority adolescents had greater odds of ever smoking tobacco; or using e-cigarettes relative to heterosexual adolescents. Past-month e-cigarette use did not differ by sexual identity. (Garcia, et al., 2021)

Another study showed sexual minority status was associated with heightened risk of current and lifetime e-cigarette use only among females. Sexual minorities have been found to use e-cigarettes at higher rates than heterosexuals, but little is known about reasons for this disparity. (Struble, et. al., 2022)

Recommendations from researchers include: improving data collection on topics including tobacco use rates, perceptions, and disease risk in the LGBT community to ensure data driven interventions for this group, conducting research on reducing vaping specifically in the LGBT community to identify effective methods to reduce e-cigarette use among sexual and gender minority populations, ensuring access to cessation services and reduce barriers to care for the LGBT community, cessation and outreach programs should be tailored and targeted to the unique challenges and experiences of LGBT youth, addressing mental health concerns, increasing access to mental health resources to combat the unique stressors in the LGBT community, evaluating tobacco control policies in the community: tobacco control policies should be evaluated on their effectiveness in reducing vaping rates specifically in the LGBT community. (TruthInitiative, 2023)

E-cigarettes are now the used tobacco product among US youth. Studies have linked e-cigarette use to long-term health risks, ... there is a need to understand disparities in e-cigarette use. (Celeste, 2023)

Research showed that e-cigarette use is more prevalent among sexual minority youth (SMY) populations. E-cigarette use prevalence was higher for most sexual minority youth groups than their counterparts. Findings revealed that sexual minority youth have a higher prevalence of e-cigarette use than heterosexual youth across races and ethnicities. These findings are in line with previous studies showing that disparities persist in substance use in general among sexual minority youth. (Celeste, 2023) Sexual minority status was associated with heightened risk of current and lifetime e-cigarette use only among females. (Azagba, 2023)

These findings point for the need for improved school-based services in the area of mental health. "The findings of a study indicate a need to target or adapt direct services and programming for sexual and gender minority adolescents." (Poteat, et al., 2021) Therefore, there is a need for schools to assess youth for mental health and provide mental health services or referral systems to community resources.

Limitations of this study. Study measures are self-reported, resulting in social desirability bias from study participants (e.g., sexual identity status). Furthermore, the data come from a school-based survey and may not be generalizable to youth not attending schools.

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