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Estimating the Risk of Attempted Suicide Among Sexual Minority Youths
A Systematic Review and Meta-analysis

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IMPORTANCE Suicide is the second-leading cause of death among adolescents. Sexual minority individuals are at a higher risk of suicide and attempted suicide, but a precise and systematic evaluation of this risk among sexual minority youths has not been documented to our knowledge.

OBJECTIVE To examine the risk of attempted suicide among sexual minority adolescents, differentiating for each sexual minority group.

DATA SOURCES Electronic databases (PubMed, Embase, and PsycINFO) were searched for articles published through April 30, 2017, with the following search terms: *heterosexual*, *homosexual*, *bisexual*, *transgender*, *adolescents*, *teens,* and *attempted suicide*.

STUDY SELECTION Studies that reported attempted suicide in sexual minority adolescents compared with heterosexual peers were included. Thirty-five studies satisfied criteria for inclusion of 764 records identified.

DATA EXTRACTION AND SYNTHESIS Pooled analyses were based on odds ratios (ORs), with relevant 95% CIs, weighting each study with inverse variance models with random effects. Risk of publication bias and analysis of heterogeneity through univariable and multivariable meta-regressions were also rated.

MAIN OUTCOMES AND MEASURES The evaluation of increased odds of attempted suicide among sexual minority youths compared with heterosexual peers.

RESULTS Thirty-five studies reported in 22 articles that involved a total of 2 378 987 heterosexual and 113 468 sexual minority adolescents (age range, 12-20 years) were included in the analysis. Sexual minority youths were generally at higher risk of attempted suicide (OR, 3.50; 95% CI, 2.98-4.12; c^2 = 3074.01; P < .001; I^2 = 99%). If estimated in each sexual minority group, the OR was 3.71 in the homosexual group (95% CI, 3.15-4.37; c^2 = 825.20; P < .001; I^2 = 97%) and 4.87 in the bisexual group (95% CI, 4.76-4.98; c^2 = 980.02; P < .001; I^2 = 98%); transgender youths were described as an individual group in only 1 study, which reported an OR of 5.87 (95% CI, 3.51-9.82). Meta-regressions weighted for the study weight highlighted that the presence of young participants (12 years old) was associated with heterogeneity in the bisexual group, whereas the year of sampling was associated with heterogeneity in the whole group when combined with other covariates.

CONCLUSIONS AND RELEVANCE Our findings suggest that youths with nonheterosexual identity have a significantly higher risk of life-threatening behavior compared with their heterosexual peers. Public awareness is important, and a careful evaluation of supportive strategies (eg, support programs, counseling, and destigmatizing efforts) should be part of education and public health planning.

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Supplemental content

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Suicide is the second-leading cause of death during adolescence.[1,2] The most recognized risk factors for suicide and attempted suicide are previous attempts, psychiatric illness, bullying, and childhood abuse and trauma.[3-6] Among these risk factors, sexuality and related issues have been investigated, particularly in connection with abuse and gender identity.[7-9] Gender identity is part of the self-identity that contributes to the full development of an adult human. Even if its roots are in childhood, gender orientation fully expresses itself during adolescence, especially because of the onset of sexual drive. Homosexual, bisexual, and transgender people are generally at higher risk of isolation, exposure to violence, and stigmatization, both self-inflicted and from peers or family members.[10-13] The calculation of the real extent of suicide and attempted suicide during adolescence often stems from research led by lesbian, gay, bisexual, and transgender (LGBT) communities or focused on bullying within the school context.[14-17] Neither of these situations is appropriate for the precise quantification of suicide among sexual minority youths. Studies within LGBT communities may have incorrect estimations because they are composed of people with higher self-consciousness about their sexual orientation and represent a place of aggregation and support. On the other hand, focusing on bullying may increase quantification because of a biased selection for the implication of an explicit risk factor.

Despite the increasing evidence of a greater risk of attempted suicide among sexual minority adolescents,[12,18-22] a systematic analysis of the extent of this phenomenon has not been performed to our knowledge. This study examined the risk of attempted suicide among sexual minority adolescents, differentiating for each sexual minority group, to identify preventive strategies.

Key Points

Question Are sexual minority youths at higher risk of attempting suicide?

Findings In this systematic review and meta-analysis of nearly 2.5 million adolescents, sexual minority youths were found to have greater risk of life-threatening behaviors compared with their heterosexual peers. Transgender youths were the most affected followed by bisexual and homosexual teens.

Meaning Sexual minority adolescents may have a greater risk of life-threatening behaviors compared with heterosexual peers.

Methods

This systematic review and meta-analysis was performed according to the Meta-analyses of Observational Studies in Epidemiology guidelines.[23] Procedures and study inclusion criteria were defined a priori and registered in PROSPERO (an international prospective register of systematic reviews).

Data Sources and Search Strategy

A systematic search for articles published in electronic databases (PubMed, Embase, and PsycINFO) through April 30, 2017, was performed with no language or time restrictions. Search phrases combined thesaurus and free-search indexing terms related to age, attempted suicide, self-threatening behavior, and sexual orientation, using combinations of the following search terms: *heterosexual*, *homosexual*, *bisexual*, *transgender*, *adolescents*, *teens*, and *attempted suicide*. We contacted corresponding authors of selected studies if additional information was required.

Eligibility Criteria

We included observational studies with a comparative estimation on rates of heterosexual, homosexual, bisexual, and transgender among high school students. We included studies that defined LGBT and attempted suicide according to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* criteria.[4] We excluded studies without an appropriate comparison group, those that did not clearly specify gender orientation or adherence to criteria for attempted suicide, and case reports. To reduce the risk of misclassification errors, we included only high-quality studies, with unequivocal definitions. If data from the same sample were published in multiple works, we retained only the study with more exhaustive information. Finally, we included only the studies published in peer-reviewed journals, excluding conference abstracts and dissertations.

Terms and Definitions

After 1973, the American Psychological Association no longer considered LGBT orientation as a mental disorder and has since worked intensively to eradicate the stigma historically associated with homosexual orientation. Therefore, a precise and impartial definition of sexual orientation was derived from several publicly recognized, free, online dictionaries and studies[24-27] performed on LGBT orientation after its declassification from mental illness (eBox in the Supplement).

Data Collection Process

Three authors (E.d.G., F.C., and F.A.) preliminarily reviewed titles and abstracts of traced articles. The initial screening was followed by the analysis of full texts to check compatibility regarding inclusion and exclusion criteria. Discordances were analyzed and disagreements were resolved by discussion among all the authors. When reported information was unclear or ambiguous or numerical data were not obtainable by percentages, the relevant corresponding author was contacted for clarification.

Data Extraction

A standardized form was used to extract data, including information on year of publication, country, setting, characteristics of study participants (sample size, age, and percentages of men and women), sexual orientation, and life-threatening behavior. If raw numerical data were not reported, they were calculated by percentages, deriving crude odds ratios (ORs). Two authors (E.d.G. and F.C.) conducted data extraction independently; extraction sheets for each study were cross-checked for consistency, and any differences were resolved by discussion among the coauthors.

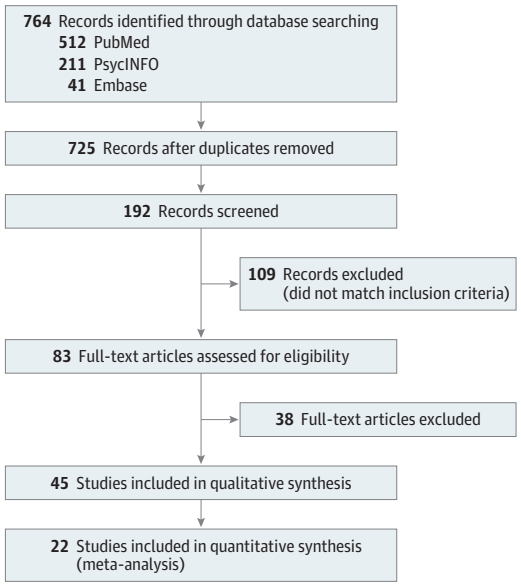
Statistical Analysis

Meta-analysis of the overall comparison of attempted suicide rates among sexual minority youths and each sexual minority

group compared with their heterosexual peers was performed, and pooled ORs with 95% CIs were generated using inverse variance models (DerSimonian-Laird[28,29]) with random effects. Results were summarized using conventional forest plots. Standard χ^2 tests and the I^2 statistic (ie, the percentage of variability in prevalence estimates attributable to heterogeneity rather than sampling error or chance, with values ≥75% indicating high heterogeneity) were used to assess between-study heterogeneity.[30] To test for publication bias, we performed funnel plot analysis and the Egger test on all studies stratified by sexual orientation (homosexual, bisexual, transgender, or LGB). Thus, 4 separate Egger tests were performed. The Egger test quantifies bias captured in the funnel plot analysis with linear regression using the value of effect sizes and their precision (SE) and assumes that the quality of study conduct is independent of study size. If analyses showed a significant risk of publication bias, we would use the trim and fill method to estimate the number of missing studies and the adjusted effect size.[31-34] Meta-regression analysis was performed to examine sources of between-study heterogeneity if of a high level (I^2>75%) on a range of study prespecified characteristics (ie, sample size, age, and country).

All analyses were performed using R, version 3.2.3 (meta and metaphor packages; R Foundation for Statistical Computing). Statistical tests were 2-sided and used a significance threshold of $P < .05$.

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses Flow Diagram



Results

Study Characteristics

Thirty-five[1,7,12,18,20-22,35-48] studies reported in 24 articles that involved a total of 2 378 987 heterosexual and 113 468 sexual minority adolescents (age range, 12-20 years) were included in the analysis (**Figure 1**). The studies were conducted in 10 countries (Iceland, United States, Ireland, Canada, Switzerland, Norway, New Zealand, China, Taiwan, and Korea). Ten of the articles were published between 2005 and 2010, 13 in the 1990s, 4 after 2010, 5 between 2000 and 2005, and 1 in 1986, and 2 do not report timing of sampling. Eleven studies enrolled participants between 2005 and 2010, 14, in the 1990s; 4, after 2010; 5, between 2000 and 2005; and 1, in 1986. Most of the studies had sample weights of less than 5%, whereas 5 studies had sample weights between 10% and 40%. All the study characteristics are summarized in the **Table**.

Prevalence of Attempted Suicide Among Sexual Minority Adolescents

Sexual minority adolescents had an increased risk of attempted suicide compared with their heterosexual peers, with significant evidence of between-study heterogeneity (OR, 3.50; 95% CI, 2.98-4.12; $c^2 = 3074.01$; $P < .001$; $I^2 = 99\%$). Sensitivity analysis, in which the meta-analysis was serially repeated after the exclusion of each study, showed that most studies affected the overall OR at an SD of 0.07 except for 3 studies: exclusion of the study by Lucassen et al[18] from the total sample revealed a decrease in OR to 3.31 (95% CI, 2.82-3.90), exclusion of National American Indian Adolescent Health Survey of 1990 from the study by Saewyc et al[42] revealed an increase in OR to 4.05 (95% CI, 3.58-4.59), and exclusion of the Minnesota Student Survey of 1992 in the study by Saewyc et al[42] revealed an increase in OR to 3.61 (95% CI, 3.10-4.22). Exclusion of the study by Peter et al[22] from the homosexual group revealed an increase in the homosexual OR to 4.22 and global OR to 4.55, exclusion of the British Columbia Adolescent Health Surveys of 1992 in the study by Saewyc et al[42] from the bisexual group revealed an increase in bisexual OR to 5.13 and global OR to 4.66, and exclusion of the Youth Risk Behavior Surveillance System[39] from the LGBT group revealed a decrease in the LGBT OR to 2.73 and an increase of the global OR to 4.4 (**Figure 2** and eFigures 1 and 2 in the Supplement).

Prevalence of Attempted Suicide in Different Sexual Minority Groups

All the groups had increased odds of attempted suicide compared with their heterosexual peers. Transgender youths were the most highly weighted (OR, 5.87; 95% CI, 3.51-9.82). Homosexual adolescents had an OR of 3.71 for attempted suicide (95% CI, 3.15-4.37; $c^2 = 825.20$; $P < .001$; $I^2 = 97\%$), and bisexual youths had an OR of 3.69 (95% CI, 2.96-4.61; $c^2 = 980.02$; $P < .001$; $I^2 = 98\%$). Both these analyses showed high heterogeneity (eFigures 1 and 3 in the Supplement).

In-depth Meta-analysis on the Prevalence of Attempted Suicide Among Sexual Minority Youths

In-depth analyses based on the country of selection, grouping of countries (North America and Canada, New Zealand, Asia, and Northern Europe [Iceland and Norway], and Europe [Switzerland and Ireland]), and the year of sampling as grouping of years (1990, 2000 and 2005, 2005-2010, and after 2010) were

Table. Characteristics of the Studies Included in the Meta-analysis

Source, Year (Country)	Date	Study Design	No. of Participants (% Female)					Females, %	Sample Size Weight, %	Age, Mean (Range), y
			Homosexual	Bisexual	Transgender	Sexual Minority	Heterosexual			
Arnarsson et al,[35] 2015 (Iceland)	2009, 2010	In-school survey	NR	NR	NR	198	2800	49.2	0.12	15.6 (15-16)
Bagley and Tremblay,[20] 2000; Massachusetts, 1995 (United States)	1995	In-school survey	NR	NR	NR	178	3603	NR	0.15	NR (14-18)
Bagley and Tremblay,[20] 2000; Massachusetts, 1993 (United States)	1993	In-school survey	NR	NR	NR	134	1772	NR	0.08	NR (14-18)
Bagley and Tremblay,[20] 2000; Minnesota (United States)	1997	In-school survey	215	200	NR	NR	326	NR	0.03	NR (14-18)
Bagley and Tremblay,[20] 2000; Seattle, Washington (United States)	1995	In-school survey	NR	NR	NR	399	7624	NR	0.32	NR (14-18)
Bostwick et al,[36] 2014 (United States)	2005, 2007	In-school survey	7666	NR	NR	NR	70 831	49.7	3.10	15.67 (13-18)
Clark et al,[37] 2014 (New Zealand)	2012	In-school survey	NR	NR	114 (54.4)	NR	8025 (55)	NR	0.32	NR (14-18)
Cotter et al,[12] 2014 (Ireland)	NR	In-school survey	39	NR	NR	NR	1297	45.3	0.05	14 (13-16)
Lee et al,[48] 2016 (Korea)	2008, 2012	In-school survey	2306 (69.6)	NR	NR	NR	137 651 (112)	NR	5.53	NR (14-18)
Duncan and Hatzenbuehler,[1] 2014 (United States)	2008	In-school survey	NR	NR	NR	119 (78.4)	1097 (53.5)	NR	0.05	16.31 (14-18)
Eisenberg and Resnick,[38] 2006 (United States)	2004	In-school survey	NR	NR	NR	3066 (35.6)	23 366 (53.1)	NR	1.04	15.94 (14-18)
Hatzenbuehler,[21] 2011 (United States)	2006, 2008	In-school survey	360 (39.2)	1357 (75)	NR	NR	31 719 (50.5)	NR	1.32	16 (NR)
Kann et al,[39] 2011 (United States)	2001, 2009	In-school survey	1963	5976	NR	NR	112 542	NR	4.76	15.42 (14-18)
Langhinrichsen-Rohling et al,[7] 2011 (United States)	NR	In-school and juvenile justice system survey	39	NR	NR	205	1297	48	0.06	15.8 (14-18)
Lian et al,[40] 2015 (China and Taiwan)	2006, 2007	In-school survey	NR	NR	NR	693	8486	49.4	0.36	NR (15-19)
Lucassen et al,[18] 2011 (New Zealand)	2007	In-school survey	83	NR	NR	329	7661	47	0.32	NR (15-180
Mustanski and Liu,[15] 2013 (United States)	2007, 2008	Community survey	162	76	NR	NR	255	50.8	0.02	18.31 (16-20)
Peter et al,[22] 2017 (Canada)	1993, 1998, 2008, 2013	In-school survey	6532 (56)	23 437 (280)	NR	NR	918 920 (72.2)	NR	37.47	15.4 (12-18)
Reisner et al,[41] 2014 (United States)	2007	In-school survey	NR	NR	NR	263 (60.8)	3031 (40.8)	NR	0.13	NR (14-18)
Saewyc et al,[42] 2007; AI, 1990 (Canada and United States)	1990	In-school survey	107	140	NR	NR	8072	47.3	0.33	NR (12-18)
Saewyc et al,[42] 2007; BC, 2003 (Canada and United States)	2003	In-school survey	8438	7814	NR	NR	266 408	50.4	11.16	NR (12-18)
Saewyc et al,[42] 2007; BC, 1992 (Canada and United States)	1992	In-school survey	4745	4143	NR	NR	247 735	50.5	10.13	NR (12-18)
Saewyc et al,[42] 2007; BC, 1998 (Canada and United States)	1998	In-school survey	5274	4991	NR	NR	286 538	52.7	11.72	NR (12-18)
Saewyc et al,[42] 2007; MAHS, 1986 (Canada and United States)	1986	In-school survey	339	334	NR	NR	29 587	52.3	1.20	NR (12-18)
Saewyc et al,[42] 2007; MN, 1992 (Canada and United States)	1992	In-school survey	1017	1197	NR	NR	28 080	47.7	1.20	15 and 18 (NR)
Saewyc et al,[42] 2007; MN, 1998 (Canada and United States)	1998	In-school survey	1304	1366	NR	NR	23 656	49.3	1.04	15 and 18 (NR)
Saewyc et al,[42] 2007; SE, 1995 (Canada and United States)	1995	In-school survey	194	161	NR	NR	7618	50.9	0.31	NR (15-18)
Saewyc et al,[42] 2007; SE, 1999 (Canada and United States)	1999	In-school survey	404	178	NR	NR	7949	51.4	0.34	NR (15-18)
Seil et al,[43] 2014 (United States)	2009	In-school survey	NR	NR	NR	1324 (69.5)	8457 (54.3)	NR	0.39	16.19 (14-18)
Stone et al,[44] 2014 (United States)	2001, 2009	In-school survey	3372 (67.2)	NR	NR	NR	45 020 (51.2)		1.91	NR (14-18)
Teasdale and Bradley-Engen,[45] 2010 (United States)	1995	In-school survey	921	NR	NR	NR	12 816	52	0.54	15.9 (14-18)
Wang et al,[46] 2012 (Switzerland)	2002	In-school survey	66	NR	NR	NR	2946	NA	0.12	NR (16-20)
Wichstrøm and Hegna,[19] 2003 (Norway)	1992	In-school survey	363	NR	NR	NR	3029	NR	0.13	14.9 (12-18)
Kann et al,[39] YRBS, 2015 (United States)	2015	In-school survey	NR	NR	NR	28 846	210 136	48.7	9.44	15.91 (14-18)
Zhao et al,[47] 2010 (Canada)	2004	In-school survey	75	130	NR	NR	1757 (46.6)	NR	0.08	14 (NR)

Abbreviations: AI, National American Indian Adolescent Health Survey; BC, British Columbia Adolescent Health Survey; MAHS, Minnesota Adolescent Health Survey; MN, Minnesota Student Survey; NR, not reported; SE, Seattle Adolescent Health Survey; YRBS, Youth Risk Behavior Surveillance System.

Figure 2. Forest Plot of Attempted Suicide Among Sexual Minority Adolescents Compared With Heterosexual Peers

Source, Year	Sexual Minority Youths: No. of Events	Sexual Minority Youths: Total No.	Heterosexual Youths: No. of Events	Heterosexual Youths: Total No.	Odds Ratio M-H, Random (95% CI)	Weight, %
Arnarsson et al,[35] 2015	37	139	165	2635	5.43 (3.61-8.16)	2.7
Bagley and Tremblay et al,[20] 2000 (Massachussets 1995)	50	128	366	3237	5.03 (3.47-7.29)	2.8
Bagley and Tremblay et al,[20] 2000 (Massachussets 1993)	29	105	209	1563	2.47 (1.57-3.88)	2.6
Bagley and Tremblay et al,[20] 2000 (Minnesota)	81	334	13	313	7.39 (4.02-13.58)	2.3
Bagley and Tremblay et al,[20] 2000 (Seattle)	68	331	479	7145	3.60 (2.71-4.77)	3.0
Bostwick et al,[36] 2014	1423	6243	4385	66446	4.18 (3.91-4.47)	3.3
Clark et al,[37] 2014	19	95	315	7710	5.87 (3.51-9.82)	2.5
Cotter et al,[12] 2014	6	33	85	1212	2.95 (1.18-7.33)	1.6
Duncan and Hatzenbuehler et al,[1] 2014	17	102	26	1071	8.04 (4.20-15.40)	2.2
Eisenberg and Resnick et al,[38] 2006	811	2255	3694	19672	2.43 (2.21-2.67)	3.3
Hatzenbuehler et al,[21] 2011	304	1413	1280	30439	6.24 (5.44-7.17)	3.2
Kann et al,[39] 2011	1695	6244	8721	103821	4.06 (3.83-4.31)	3.3
Langhinrichsen-Rohling et al,[7] 2011	38	167	85	1212	3.91 (2.56-5.97)	2.7
Lee et al,[48] 2016	609	2306	10057	127594	4.19 (3.81-4.61)	3.3
Lian et al,[40] 2015	29	664	182	8304	2.04 (1.37-3.04)	2.8
Lucassen et al,[18] 2011	69	143	291	7370	22.68 (16.01-32.13)	2.9
Mustanski and Liu,[15] 2010	17	221	9	255	2.28 (0.99-5.22)	1.8
Peter et al,[22] 2016	6205	23764	44796	874214	6.54 (6.35-6.75)	3.3
Reisner et al,[41] 2014	44	219	119	2912	5.90 (4.04-8.61)	2.8
Saewyc et al,[42] 2007 (AI 1990)	46	6916	1269	6803	0.03 (0.02-0.04)	3.0
Saewyc et al,[42] 2007 (BC 2003)	2996	13256	14532	251876	4.77 (4.56-4.98)	3.3
Saewyc et al,[42] 2007 (BC 1992)	1706	7182	15514	232221	4.35 (4.11-4.61)	3.3
Saewyc et al,[42] 2007 (BC 1998)	1905	8360	16215	270323	4.62 (4.38-4.88)	3.3
Saewyc et al,[42] 2007 (MAHS 1986)	130	543	3002	26585	2.47 (2.02-3.02)	3.1
Saewyc et al,[42] 2007 (MN 1992)	466	1748	4850	23230	1.38 (1.23-1.54)	3.3
Saewyc et al,[42] 2007 (MN 1998)	688	1982	3609	20047	2.42 (2.19-2.67)	3.3
Saewyc et al,[42] 2007 (SE 1995)	58	297	484	7134	3.33 (2.47-4.51)	3.0
Saewyc et al,[42] 2007 (SE 1999)	138	444	467	7482	6.77 (5.43-8.46)	3.1
Seil et al,[43] 2014	296	1028	575	7882	5.14 (4.38-6.03)	3.2
Stone et al,[44] 2006 (Malawi)	609	2763	2677	42343	4.19 (3.80-4.62)	3.3
Teasdale and Bradley-Engen,[45] 2010 (Engen)	134	787	905	11911	2.50 (2.05-3.04)	3.1
Wang et al,[46] 2012	2	64	43	2903	2.15 (0.51-9.05)	0.9
Wichstrom and Hegna et al,[19] 2003	30	333	105	2924	2.66 (1.74-4.06)	2.7
Kann et al,[39] 2011 (YRBS)	6160	22686	13562	196574	5.03 (4.86-5.20)	3.3
Zhao et al,[47] 2010	32	173	133	1624	2.54 (1.67-3.88)	2.7
Total (95% CI)		**113468**		**2378987**	**3.50 (2.98, 4.12)**	**100.0**
Total events	26947		153219			

Heterogeneity $\tau^2 = 0.21$; $\chi^2 = 3074.01$, $df = 34$ ($P < .001$); $I^2 = 99\%$

Test for overall effect: $z = 15.13$ ($P < .001$)

AI indicates National American Indian Adolescent Health Survey; BC, British Columbia Adolescent Health Survey; MAHS, Minnesota Adolescent Health Survey; M-H, Mantel-Haenszel; MN, Minnesota Student Survey; NR, not reported; SE, Seattle Adolescent Health Survey; YRBS, Youth Risk Behavior Surveillance System.

conducted to determine whether those factors had an association with the increased odds of attempted suicide among sexual minorities. The highest odds for attempted suicide among sexual minority groups was in New Zealand (OR, 11.70; 95% CI, 3.09-44.25). This result might be influenced by the presence of the study by Clark et al,[37] which is the only one focused on transgender youths, who have the most increased odds. The other study[18] from New Zealand reported the highest odds compared with all the other studies included in this meta-analysis. If grouped on a continental basis, New Zealand had the highest odds as previously reported, whereas Europe (which included only 2 studies from Switzerland and Ireland) had the least increased odds (OR, 2.69; 95% CI, 1.25-5.81). Studies from Europe had no between-study heterogeneity (I^2 = 0%). Studies with participant enrollment between 2005 and 2010 had the most increased odds (OR, 5.20; 95% CI, 4.32-6.26). All the subgroups had high between-study heterogeneity except for the studies from Europe (eFigures 4-6 in the Supplement).

Publication Bias

There was no evidence of publication bias in studies focused on the homosexual groups (Egger test; SE, 1.57; 95% CI, −6.23 to −0.24; $P = .09$) and for studies focused on LGB youths (Egger test; SE, 2.81; 95% CI, −8.88 to 4.49; $P = .50$). Studies focused on bisexual youths found small evidence of publication bias (Egger test; SE, 2.40; 95% CI, −10.40 to −0.15; $P = .04$). When all the studies were taken into account, the evidence for publication bias increased (Egger test; SE, 1.97; 95% CI, −8.63 to −0.62; $P = .02$). The trim-and-fill method trimmed, with a random-effect model, 10 studies to the left of the mean (OR, 2.47; 95% CI, 1.93-3.16; $Q = 14\,603.96$).

Sources of Heterogeneity

Univariable and multivariable meta-regressions weighted for the study weight were performed on the following variables that were potentially associated with heterogeneity: (1) the country where the study was conducted, (2) grouping of those countries for their continent, (3) the inclusion in the sample of the youngest participants (12 years), (4) the inclusion in the sample of the oldest participants (20 years), and (5) grouping of the year of patient recruitment. The mean age of the samples and the percentage of females within each group were not available or calculable in most of the studies. The sex percentage was present in only 9 of 35 studies and the mean age in 13 of 35 studies.

The presence of young participants (12 years old) was associated with the variance in the bisexual group both as a single covariate or in combination with other covariates (country where the study was conducted, year of sampling, and oldest participants). This association was highly significant, explaining 60% of the true variance as a single covariate and 60% to 72% when combined with the other covariates ($P < .001$). The year of sampling was associated with the variance in the whole group in combination with other covariates; however, the true variance was less than 20% (eTable in the Supplement).

Discussion

This is the first extensive and comprehensive meta-analysis, to our knowledge, that attested the risk of attempted suicide among sexual minority adolescents compared with heterosexual peers with a specific, in-depth evaluation of risk in each sexual minority group (homosexual, bisexual, and transgender youths). A previous meta-analytic study was performed by Marshal et al,[49] but it had a smaller total sample compared with our meta-analysis (122 955 vs 2 390 455 adolescents) and was not exclusively focused on attempted suicide but included studies that reported attempted suicide and suicide ideation. The process of selection of the studies with a rigorous definition of self-threatening behaviors and sexual orientation in adolescents with ages ranging from 12 to 20 years identified 35 studies that involved nearly 2 500 000 participants. Sexual minority youths had an increased risk of attempted suicide compared with heterosexual peers. Among each sexual minority group, transgender youths appeared to be the most highly weighted, followed by homosexual and bisexual adolescents. The analysis of the forest plot showed that all the singular estimations were coherent in direction, but the CIs often did not overlap. High heterogeneity was attested with each I^2. Despite the between-study heterogeneity, the risk of publication bias was detected only if all the studies were analyzed together, whereas subgroup analysis within each sexual minority group demonstrated no risk of publication bias. In analysis of the source of heterogeneity with univariable and multivariable meta-regression, the specific weight of each sample was a significant contributor if all the studies were taken into consideration or in studies focused on bisexual youths. The country of selection was another important factor that influenced heterogeneity if combined with other factors, especially in the homosexual group in the presence of the youngest group in the sample. The LGB group was the only group influenced by the historical moment of sampling, particularly in the presence of the oldest groups in the samples. The influence of country and historical moment of selection might show the evolution in acceptance of the LGBT identify, especially when the influence is combined with the ages at the extremes of the range that we considered (young [12 years old] or almost young adults [20 years old]). These age limits seemed to be more influenced by self-acceptance and capability of disclosure about sexual orientation, and social acceptance of sexual minority orientation might affect these individuals more because of their varying self-esteem and consciousness.

Even if a single factor does not explain the heterogeneity, the observation of the characteristics of the studies indicate that they might have points of discrepancies among them. First, the year of sampling was different (from the 1990s to 2017), and it is possible to presume that gradual social acceptance might be influential on self-acceptance and, consequently, on self-harming behaviors. Second, different sample sizes appear to be the most explanatory factor. It is possible that greater samples would attest the rate of attempted suicide more precisely because of the greater number of participants or that smaller communities might contribute to self-acceptance as supporting or ostracizing. Third, the influence of including very young people or the oldest participants (both these categories are not present in all the studies) is highly plausible. Self-consciousness and self-acceptance are influenced by personal maturity, and the presence of ages at the extremes of the range could be a factor in the consciousness and disclosure of sexual orientation. Nevertheless, the high heterogeneity detected would not seem to be a limitation but instead an indication of the trend of self-harming in LGBT people through time and in its possible declination at different ages. The low detection of publication bias, not detectable when a meta-analysis included a specific sexual minority group alone, seems to support this interpretation.

Clinical Implications

The social involvement in comprehension and protection of adolescents passes through the analysis of factors that might influence their well-being. The present study aimed to examine the association of nonheterosexual orientation with the risk of attempting suicide. Our comprehensive meta-analysis revealed an increase in the risk of attempted suicide if youths' sexual orientation was nonheterosexual, independently from sexual minority group (homosexual, bisexual, or transgender). Transgender youths had the highest risk, but all the subgroups were consid-

erably burdened. Therefore, any of these sexual orientations should be considered an important risk agent. Our quantification was planned to avoid bias, such as bullying or LGBT-community peer support, which might overrate or underrate the risk of attempted suicide. Community and in-school surveys provide a reliable representation of adolescent population, producing a trustworthy quantification of self-threatening behaviors. The magnitude and importance of being a youth with sexual minority identity justify social attention and effort in supplying preventive strategies. Avoiding the possible influence of bullying or peer support to provide an unbiased evaluation of the rates of attempted suicide, our results are suitable to sustain possible explanations other than exclusion or oppression. One of the possible explanatory keys might involve personal resources of self-comprehension and acceptance. Most adolescents have to face the management of the activation of sexual impulsions. The understanding and acceptance of personal sexual orientation, if different from most youths, might require greater self-esteem and psychic resources. Nonheterosexual youths also lack comparison with peers, a mechanism on which most of adolescents rely, because of their different experiences compared with their heterosexual peers. Consequently, at least at the beginning of their self-disclosure, nonheterosexual adolescents might perceive themselves as different and isolated. Those sensations, often accompanied by discomfort and fear, could contribute to personal difficulties that might exhibit in self-threatening behavior if not adequately managed and supported.

Limitations

One limitation of this study is that, although most of the studies involved large samples, all the data are self-reported. In addition, even though questionnaires were accurate, self-disclosure might have limited the findings.

Conclusions

Our systematic review and meta-analysis found that adolescents with nonheterosexual orientation had a significantly higher risk of life-threatening behavior compared with their heterosexual peers. Public awareness appears to be needed, and a careful evaluation of support strategies (eg, support programs, counseling, and destigmatizing efforts) should be part of education and public health planning.

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