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Minority Stress and Substance Use in Sexual Minority Adolescents: A Meta-analysis

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Abstract Lesbian, gay, and bisexual (LGB) adolescents report disparate rates of substance use, and often consume more cigarettes, alcohol, marijuana, cocaine, and ecstasy than their heterosexual peers. It is therefore crucial to understand the risk factors for substance use among LGB adolescents, particularly those unique to their minority status. In an effort to organize the current knowledge of minority-related risk factors for substance use among LGB youth, this study presents results from a systematic review and meta-analysis of the published research literature. Results from 12 unique studies of LGB youth indicated that the strongest risk factors for substance use were victimization, lack of supportive environments, psychological stress, internalizing/externalizing problem behavior, negative disclosure reactions, and housing status. Results are discussed in terms of their implications for targeted intervention programs that address minority stress risk factors for substance use among LGB youth.

Keywords Lesbian · Gay · Bisexual adolescence · Meta-analysis · Minority stress theory · Substance use

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High rates of substance use exist among lesbian, gay, and bisexual (LGB) adolescents (Moon et al. 2007; Remafedi 1987), almost three times the rate of their heterosexual peers (Marshal et al. 2008). LGB adolescents report higher use of cigarettes, alcohol, and marijuana (Bontempo and D'Augelli, 2002; Russell et al. 2002), cocaine, and ecstasy (Corliss et al. 2010). These youth may be more likely to use multiple substances concurrently (Garofalo et al. 1998) and more rapidly increase their use as they age (Marshal et al. 2009).[1]

Early age of initial use increases the chances of addiction later in life (Jones and Battjes 1985; Grant et al. 2001), impairs decision making (Dom et al. 2005), and is associated with poor school performance (Kandel et al. 1997; Wu and Anthony 1999), risky sexual practices (Herrick et al. 2010), and HIV exposure (Solorio et al. 2003). Moreover, there are numerous physical health consequences of substance use in terms of morbidity and mortality (Rehm et al. 2006), and significant economic costs associated with substance use, with estimates as high as $151.4 billion annually in lost productivity, physical, and property damages (Miller and Hendrie 2009).

Due to these negative outcomes, leading health organizations are particularly interested in the prevention of substance use by delaying the onset of and reducing the progression of use through "culturally focused, universal, selective, and indicated prevention programs" (SAMHSA 2011, p. 15). Furthermore, Healthy People 2020 includes the goal of "eliminating LGBT health disparities and enhancing efforts to improve LGBT health" (US DHHS 2011). Given

[1] The authors recognize that several other subgroups fall within the umbrella of "sexual minority" (e.g., transgender); however, in order to conduct the meta-analytic approaches, the study was limited to sexual behavior: lesbian, gay, and bisexual (LGB).

this, it is notable that no targeted evidence-based interventions currently exist to reduce substance use patterns among adolescents that identify as LGB.

Risk and Protective Factor Models

In 2009, a synthesis of studies by the Institute of Medicine explored the impact of a multitude of risk and protective factors on youth. For example, the presence of neighborhood violence in early childhood is linked to increased substance use, while supporting early learning is related to lower rates of use (IOM 2009). In short, prevention interventions are most successful when they reduce risk factors and promote resilience and a number of interventions support this conceptualization (i.e., Kumpfer and Alvarado 2003; Waller 2001). More recently, research has explored the unique effects of minority stress as a risk for behavioral health outcomes. For example, research has found that Hispanics may experience stress around acculturation and immigration (Cervantes et al. 2011; US DHHS 2001) and that this chronic stress is related to substance use (Vega et al. 1993, 1998).

As Meyer (2003) explains, there is an array of social and psychological stressors related to being part of a sexual minority group. Hughes and Eliason (2002) describe this as the experience of stigmatization from being LG, along with its influence on negative behavioral health outcomes, such as substance use. These minority-related stressors include negative events (e.g., discrimination, bullying), negative attitudes towards homosexuality, internalization of discomfort with sexuality, and emotional distress related to acceptance (Rosario et al. 2002, 1996). Multiple minority status is also an important factor and may have cumulative effects outcomes. For example, sexual minority status, gender minority status, and racial or ethnic minority statuses may all contribute to substance use, with higher rates of substance abuse occurring among individuals reporting more types of minority-related discrimination (McCabe et al. 2010).

Numerous studies have described the theoretical utility of a minority stress framework in LGB adults (e.g., Meyer 2003), as well as its application to young adults (e.g., Holloway et al. 2012; Traube et al. 2012), yet little organization exists around understanding these unique stressors in adolescents. Although the literature on substance use in adult LGB communities (particularly young adults) is expanding rapidly, our understanding of minority stress in LGB adolescents remains limited. The current paper responds to this gap through a systematic review and meta-analysis of the literature on the relationship between minority stressors and substance use in this population.

Methods

Eligibility Criteria and Search Strategy

Studies were required to empirically examine correlates of substance use in LGB youth, be published in a peer-reviewed journal, and present sufficient statistical information for the calculation of a correlation coefficient indexing the strength of the relationship between a risk factor and a substance use outcome during adolescence. Adolescence was initially operationalized as ages 12–18. However, studies that had a wider age range (i.e., 12–25) were eventually included because almost all studies included broader age ranges (this recurring challenge is described elsewhere in the literature, e.g., Elze 2007). Retrospective studies were included if they reported participants' experiences during adolescence. Studies with multiple time points were included if the first time point occurred during adolescence. Studies examining minority stressors but not drug use outcomes were not included. Finally, studies that only compared differences in substance use for LGB versus heterosexual adolescents were not included, as the purpose of the review was to examine minority stressors and substance use among LGB youth.

Studies were identified through searches of electronic databases, including PsychINFO, PubMED, and EBSCO. The search was conducted by the first author and repeated by the third and fourth author to enhance accuracy. The literature search was limited to studies published after 1990. Titles, abstracts, and subject lines were searched using the terms "gay," "lesbian," "bisexual," and "sexual minority" paired with "youth" or "adolescent" and "substance use" or "substance abuse." Finally, citation lists of articles that met inclusion criteria were searched for additional studies. This search yielded 64 articles retrieved and screened for eligibility by the first author and a master's level research assistant, a total of 15 reports representing 12 unique LGB participant samples met criteria. The first author and a research assistant independently coded study characteristics and met to reach consensus with particular focus on the categorization of minority stress constructs. The first and second author independently calculated effect sizes from each study and resolved discrepancies through discussion.

Statistical Procedures

We used standard meta-analysis procedures to synthesize correlation effect sizes (r) across studies (Lipsey and Wilson 2001). Product moment correlation coefficients were extracted from each study, representing the relationship between a minority stress risk factor and a substance use outcome for LGB youth. When correlation coefficients were not directly reported in the primary studies, effect sizes were

calculated based on reported statistics using procedures outlined in Lipsey and Wilson (2001). All effect sizes were coded so that positive correlations indicated higher levels of risk on the predictor variable were associated with higher levels of substance use. An examination of the effect size distribution indicated one outlier, which was Winsorized to the corresponding upper fence of the effect size distribution; this ensured that the study did not exercise a highly disproportionate influence on the results.

All meta-analyses were weighted using random effects inverse variance weights to ensure that each effect size's contribution to the mean was proportionate to its statistical precision (Lipsey and Wilson 2001). Analyses were conducted using the Fisher's *z*-transformation for correlation coefficients, with results reported back in the correlation metric for ease of interpretability. Many studies contributed multiple correlation coefficients on different risk factors and different types of substance use outcomes (as shown in Table 1). Only one effect size per participant sample was included in any given meta-analysis to ensure the statistical independence. This was accomplished by averaging effect sizes across different types of substance use outcomes and conducting separate meta-analyses for each risk construct category.[2]

Results

Descriptive Statistics Table 1 summarizes the 15 reports representing 12 unique LGB samples of adolescents, including the sample characteristics, study design, and effect sizes from each report. Studies were diverse in size, with sample sizes ranging from 51 to 1,846 (M=535, SD=562). Studies tended to focus on primarily male and white samples of LGB youth, with an average age of 17. Only one half of the studies reported participant response rates, but among those six studies that did, response rates were high and ranged from 81 to 98 % (M=92, SD=6). Only 25 % of studies reported using standardized, validated measures of the minority stress risk factors, and only 33 % reported using standardized and validated measures of substance use outcomes (e.g., Addiction Severity Index). Only two (16 %) of the studies were conducted internationally (Darwich et al. 2012; Savin-Williams and Ream 2003). Most (75 %) used convenience samples of LGB youth, with the remainder using subsets extracted from larger studies (e.g., National Longitudinal Study of Adolescent Health) with purposive strategies.

Average Correlations Between Risk Factors and Substance Use We calculated 86 correlation coefficient effect sizes from the 12 studies and categorized these into eight broad minority stress categories[3]: gay-related disclosures, gender/sexual identity, stress, victimization, supportive environment, demographics, and other individual characteristics. These broad categories were then further refined into more detailed risk constructs (shown in Table 1). We then calculated the random effects mean effect size within each construct category, representing the average correlation between that risk factor and substance use for LGB youth. Figure 1 presents the mean effect sizes and 95 % confidence intervals, along with the number of unique studies contributing to that mean effect size, sorted by minority stress risk factor construct and strength of correlation. Mean correlations falling to the right of the vertical line at zero indicate a statistically significant effect such that higher risk was associated with higher substance use. Only two risk constructs (sexual identity distress and social activities) had negative mean effect sizes, counter intuitively indicating that lower levels of risk were associated with higher substance use, but neither of those mean effects was significantly different from zero.

Sexual Identity Disclosures Several studies examined the correlation between measures of sexual identity disclosure risk factors and substance use among LGB youth. Although "coming out" (i.e., disclosing to others ones sexual orientation) has been linked to mental health benefits (Ragins, 2004), the process can be intensely stressful for LGB people (D'Augelli and Grossman 2001) and create a loss of well-being (D'Augelli 2006). As shown in Fig. 1, many of the sexual identity disclosure risk factors had small mean effect sizes that were close to zero and not statistically significant (i.e., size of disclosed network, disclosed to family, time since disclosure, and positive disclosure reactions).

[2] This strategy was necessary to avoid violating the assumption that all effect sizes within a given analysis are statistically independent. Sensitivity analysis (not shown but available upon request) that examined effects separately within each type of substance use outcome were substantively similar to those reported here that combine across substance use outcome types. Because results were substantively unchanged, and the small number of studies and low statistical power associated with those analyses, we elected to present results combined across substances. However, Table 1 provides the effect sizes split by each type of substance use outcome for readers interested in substance-specific effects.

[3] Minority stress categories refer broadly to risk factors unique to a specific minority group within a population. Even when the entire population experiences a particular risk factor, its prevalence and consequences may be contextually or qualitatively different among a specific minority subset of the population. For instance, physical victimization due to sexual orientation is clearly a minority stress risk factor, as it is experienced only by LGB youth (or youth perceived as LGB). Thus, although physical victimization occurs for both LGB and heterosexual youth, it can be conceptualized as a minority stress risk factor when experienced by LGB youth. Physical victimization may be directly related to LGB minority status, even if such minority related specificity is not explicitly measured in a given risk factor scale.

Table 1 Summary of studies included in the meta-analysis

Authors	Sample characteristics	Sampling strategy	Risk factor construct, substance use outcome effect size *r*, *N*
Bontempo and D'Augelli (2002)	*N*=315; age: 14–18: 34 % LGB	Statewide survey	Gender, mixed substance use (I) *r*=.09, *N*=315 Gender, other hard substance use (I) *r*=.07, *N*=315 General victimization, mixed substance use (I) *r*=.82, *N*=315
Darwich et al. (2012)	*N*=19,551 8th–12th grade students; final matched sample=680 with 170 in each of four groups: LG, bisexual, questioning, heterosexual students; 12 % identified as LGB or questioning	District wide survey to 18 secondary schools in British Columbia	Adult social support, mixed substance use (F) *r*=.39, *N*=753 Externalizing behavior, mixed substance use (F) *r*=.54, *N*=753 Sexual orientation victimization, mixed substance use (F) *r*=.48, *N*=753
Espelage et al. (2008)	*N*=13,921; age: *M*=15.8; 14 % LGB or questioning	County wide youth survey distributed to 18 high schools	Parental support, mixed substance use (F) *r*=.21, *N*=1,065 Sexual orientation victimization, mixed substance use (F) *r*=.18, *N*=1,065
Padilla et al. (2010)	*N*=1,906; 12–17 years; 100 % LGB	Purposive sampling: LGB subset from larger county wide survey of youth distributed within school systems	Age, mixed substance use (L) *r*=.05, *N*=1,846 Disclosed to family, mixed substance use (L) *r*=−.05, *N*=1,823 Internalizing behavior, mixed substance use (L) *r*=.13, *N*=1,821 LGB community support, mixed substance use (L) *r*=.06, *N*=1,824 Positive disclosure reactions, mixed substance use (L) *r*=.07, *N*=1,823 Race, mixed substance use (L) *r*=.03, *N*=1,846 Self-esteem, mixed substance use (L) *r*=.00, *N*=1,821
Pearson (2007) [a]	*N*=11,288; 6 % reported same sex attraction; 11 % reported no attraction	Purposive sampling of students from two data sets: National Longitudinal Study on Adolescent Health and the Adolescent Health and Academic Achievement.	Gender, mixed substance use (L) *r*=−.22, *N*=628
Poteat et al. (2009)	*N*=14,439; ages 14–19; 50.4 % girls; 6.4 % (*n*=921) were questioning; 7.3 % (1060) identified as LGB	County wide survey distributed to 18 high schools across all four grades (9–12)	Gender, mixed substance use (Y) *r*=.04, *N*=1,072

Table 1 (continued)

Authors	Sample characteristics	Sampling strategy	Risk factor construct, substance use outcome effect size *r*, *N*
			Race, mixed substance use (Y) *r*=.06, *N*=1,072 Internalizing behavior, mixed substance use (Y) *r*=.26, *N*=1,072 General victimization, mixed substance use (Y) *r*=.34, *N*=1,072
Rosario et al. (1996)	*N*=136; age: 14–19; 100 % LGB	Convenience	Disclosed to family, mixed substance use (F) *r*=.13, *N*=136 Disclosed to friends, mixed substance use (F) *r*=.06, *N*=136 Distress, mixed substance use (F) *r*=.11, *N*=136 Externalizing behavior, mixed substance use (F) *r*=.36, *N*=136 Gay-related stress, mixed substance use (F) *r*=.22, *N*=136 Internalizing behavior, mixed substance use (F) *r*=.03, *N*=136 Self-esteem, mixed substance use (F) *r*=.14, *N*=136 Sexual orientation victimization, mixed substance use (F) *r*=.19, *N*=136
Rosario et al. (1997)[b]	N=164; age: 14–21, 75 % in high school; 98 % LGB	Convenience	Distress, mixed substance use (Q) *r*=.46, *N*=154 Self-esteem, mixed substance use (Q) *r*=.10, *N*=154 Social activities, mixed substance use (Q) *r*=−.01, *N*=154
Rosario et al. (2004)[b]	*N*=156; age: 14–21; 97 % LGB	Convenience	Distress, marijuana use (Q) *r*=.05, *N*=143 Gay-related stress, marijuana use (Q) *r*=.20, *N*=143 Internalized homophobia, marijuana use (Q) *r*=.06, *N*=143 LGB community support, marijuana use (Q) *r*=−.01, *N*=143

Table 1 (continued)

Authors	Sample characteristics	Sampling strategy	Risk factor construct, substance use outcome effect size *r*, *N*
			Sexual victimization, marijuana use (Q) *r*=.08, *N*=143 Size of disclosed network, marijuana use (Q) *r*=−.01, *N*=143
Rosario et al. (2008)[b]	*N*=76; ethnically diverse young lesbian and bisexual women in NYC; age: 14–21; 99 % LGB	Convenience	Gender identity, marijuana use (F) *r*=.22, *N*=72 Gender identity, mixed substance use (I) *r*=.10, *N*=72
Rosario et al. (2009)[b]	*N*=156; age: 14–21; 97 % LGB	Convenience	Gender, mixed substance use (I) *r*=.18, *N*=156 Externalizing behavior, marijuana use (F) *r*=.20, *N*=156 Externalizing behavior, mixed substance use (I) *r*=.20, *N*=156 Internalizing behavior, marijuana use (I) *r*=.27, *N*=156 Internalizing behavior, mixed substance use (Q) *r*=.18, *N*=156 Negative disclosure reactions, marijuana use (F) *r*=.21, *N*=156 Negative disclosure reactions, mixed substance use (I) *r*=.14, *N*=156 Positive disclosure reactions, marijuana use (F) *r*=.01, *N*=156 Positive disclosure reactions, mixed substance use (I) *r*=−.07, *N*=156
Rostosky et al. (2007) [a]	*N*=764; 113 reported same sex attraction at wave 1 and identified as LGB at wave 3; 351 did not identify same sex attraction at Wave 1 but did identify as LGB 6 years later during wave 3	Purposive eampling from wave 1 and wave 3 of the National Longitudinal Study of Adolescent Health	Age, marijuana use (F) *r*=−.01, *N*=113 Gender, marijuana use (F) *r*=.32, *N*=113 Race, marijuana use (F) *r*=.01, *N*=113
Savin-Williams and Ream (2003)	*N*=51; *M*=18.2; 100 % male; exclusively and predominantly same-sex attracted: 46 % and 36 %; significantly heterosexual: 10 %; same and opposite sex attractions: 8 %	Convenience	Age, mixed substance use (F) *r*=.34, *N*=51 Age at gay awareness, mixed substance use (F) *r*=.02, *N*=51

Table 1 (continued)

Authors	Sample characteristics	Sampling strategy	Risk factor construct, substance use outcome effect size *r*, *N*
			Locus of control, mixed substance use (F) *r*=.19, *N*=51 Self-esteem, mixed substance use (F) *r*=.17, *N*=51 Sexual identity, mixed substance use (F) *r*=.31, *N*=51
Savin-Williams and Ream (2003)	*N*=681; *M*=15.4; 100 % male; Exclusively and predominantly same-sex attracted: 34 % and 40 %; same and opposite sex attractions: 8; 10 % somewhat to very feminine; 75 % somewhat to very masculine; 100 % LGB	Out proud sample: LGB subset taken from global survey administered via the world wide web	Age, mixed substance use (F) *r*=.20, *N*=681 Gender identity, mixed substance use (F) *r*=.13, *N*=681 Internalizing behavior, mixed substance use (F) *r*=.42, *N*=681 Self-esteem, mixed substance use (F) *r*=−.03, *N*=681 Sexual identity, mixed substance use (F) *r*=−.03, *N*=681 Sexual orientation victimization, mixed substance use (F) *r*=.02, *N*=681 Time to identity acceptance, mixed substance use (F) *r*=.10, *N*=681
Willoughby et al. (2010)	*N*=81; age: 14–25; 100 % LGB	Convenience	Disclosed to family, mixed substance use (I) *r*=.07, *N*=81 Gender, mixed substance use (I) *r*=.02, *N*=81 Internalizing behavior, mixed substance use (I) *r*=.24, *N*=81 Internalized homophobia, mixed substance use (I) *r*=.16, *N*=81 Negative disclosure reactions, mixed substance use (I) *r*=.33, *N*=81 Sexual orientation victimization, mixed substance use (I) *r*=.25, *N*=81 Time since disclosure, mixed substance use (I) *r*=.13, *N*=81
Wright and Perry (2006)	*N*=156; age: 13–21 years, *M*=18.19; 91 % LGB	Convenience	Age, marijuana use (F) *r*=.02, *N*=156

Table 1 (continued)

Authors	Sample characteristics	Sampling strategy	Risk factor construct, substance use outcome effect size *r*, *N*
			Age, other substance use (F) r=−.12, N=156 Gender, marijuana use (F) *r*=−.06, *N*=156 Gender, other substance use (F) *r*=.15, *N*=156 Housing status, marijuana use (F) *r*=.21, *N*=156 Housing status, other substance use (F) *r*=.22, *N*=156 LGB community support, marijuana use (F) *r*=.18, *N*=156 LGB community support, other substance use (F) *r*=.22, *N*=156 Race, marijuana use (F) *r*=.13, *N*=156 Race, other substance use (F) *r*=.05, *N*=156 Sexual identity distress, marijuana use (F) *r*=−.16, *N*=156 Sexual identity distress, other substance use (F) *r*=.01, *N*=156 Size of disclosed network, marijuana use (F) *r*=.01, *N*=156 Size of disclosed network, other substance use (F) *r*=.01, *N*=156 Size of social network, marijuana use (F) *r*=.09, *N*=156 Size of social network, other substance use (F) *r*=.07, *N*=156 Time since disclosure, marijuana use (F) *r*=.06, *N*=156 Time since disclosure, other substance use (F) *r*=−.09, *N*=156

Notes: [a,b] Subscripts used to indicate multiple reports based on the same participant samples of LGB adolescents

Substance use construct noted by Frequency (F) Quantity (Q), Lifetime Use (L), Use in Past Year (Y) or Other Index (I)

Negative disclosure reactions, however, were significantly correlated with substance use among LGB youth ($\bar{r}$=.24). Although only a handful of studies contributed to each of these mean effect sizes, it is nonetheless telling that negative disclosure reactions may be an important contributor to substance use, whereas other disclosure factors—even positive reactions—may be less predictive of substance use among LGB youth.

Gender/Sexual Identity Very few studies measured the relationship between gender/sexuality identities and substance use. As shown in Fig. 1, there was no evidence that sexual identity distress, age at gay awareness, or internalized homophobia were significant predictors of substance use. However, results from a single study indicated that time to sexual identity acceptance was a significant predictor of substance use ($\bar{r}$=.10), such that the length of time it took youth to accept their LGB identity had a significant positive correlation with substance use. Aggregating results across two studies of lesbians, there was also evidence that gender identity ($\bar{r}$=.13) had a modest but statistically significant correlation with substance use, such that having a more masculine/butch gender identity was positively correlated with substance use. Again, however, it is important to note that the correlations between these gender and sexual identity risk factors and substance use outcomes were only reported in one or two studies.

Psychological Stress Psychological stress was another risk factor for substance use present in the literature, including studies measuring general distress as well as those measuring gay-related stress specifically. Gay-related stress includes the experience of negative events, attitudes towards homosexuality, discomfort, and emotional stress (anxiety and depression). Additionally, available literature indicates that a great deal of psychological stress among LGB youth comes from the coming out process (Pilkington and D'Augelli 1995), and LGB youth may use substances to "ameliorate social anxiety and boost self-confidence" (Hughes and Eliason 2002, p. 3). Thus, coming out was included under the umbrella of psychological stress. Overall, results from the meta-analysis indicated that both general measures of stress ($\bar{r}$=.19), as well as gay-related stress ($\bar{r}$=.21), were significantly and positively correlated with substance use among LGB youth.

Victimization Victimization (i.e., the experience of violence and abuse because of sexual orientation) has been theorized to be a critical risk factor for substance use among LGB youth given its association with the development of a negative LGB identity and other internalized problems (Willoghby et al. 2010). Based on results from five studies, there was a significant mean correlation between gay-related victimization (e.g., homophobic teasing) and substance use ($\bar{r}$=.24). General victimization (i.e., not specifically gay related) had an even stronger correlation with substance use among LGB youth ($\bar{r}$=.60).

Supportive Environment Several articles explored the correlation between various measures of supportive environments (e.g., parental support, other adult support, connectedness to the LGB community) and substance use in LGB youth. As shown in Fig. 1, while LGB community support and size of social support network were not correlated with substance use, parental support ($\bar{r}$=.21) and support from other adults at school ($\bar{r}$=.39) had significant correlations with substance use among LGB youth. Thus, LGB youth who perceived less support from parents and other adults at school reported higher levels of substance use than their LGB peers with more perceived support.

Demographics The next section of shows that race ($\bar{r}$=.04) and gender ($\bar{r}$=.06) had small but statistically significant correlations with substance use, indicating that minority and male LGB youth had slightly higher levels of substance use compared to their white and female counterparts, respectively. There was no evidence of a significant mean correlation between age and substance use.

Other Individual Characteristics The final section of Fig. 1 shows other individual risk factors that were reported in the literature. There was no evidence that social activities, self-esteem, or locus of control were significantly correlated with substance use. However, substance use was positively correlated with housing status ($\bar{r}$=.22), internalizing behavior such as anxiety, depression, or suicidal ideation ($\bar{r}$=.23), and externalizing problem behavior such as conduct problems and truancy ($\bar{r}$=.38).

Sensitivity analysis Because so few studies were available for synthesis in each meta-analysis, it was not feasible to conduct multivariate meta-regression models. For those risk factors represented in at least five studies, we conducted exploratory bivariate meta-regression models to examine whether the effect sizes were associated with the gender distribution of the sample, the percent of LGB youth in the original sample, average age of the sample, and geographic region. Results (available upon request) indicated no evidence of any effect size moderation.

This systematic review only included peer-reviewed journal articles and therefore might be subject to publication bias (Rothstein et al. 2005). Visual inspection of a funnel plot of all effect sizes (available upon request) indicated no obvious asymmetry, providing some evidence against the possibility of publication bias. Results from Egger's regression test [b=.93, p=.30, 95 % CI (−.86, 2.72)] as well as the trim and

fill analysis (which yielded no trimmed/filled studies) provided some additional assurance against publication bias.

Discussion

The current study identified and explored the existing empirical literature on minority stress risk factors for substance use among LGB youth through a meta-analytic approach. Despite a limited number of studies available for inclusion, or perhaps because of it, it is clear that further research is needed to explore minority stress among LGB adolescents and its association with substance use outcomes.

Previous research with LGB adults has indicated that there is a positive impact of disclosing sexual orientation on self-esteem (Postmes and Branscombe 2002), as well as positive implications for physical health conditions (Cole et al., 1996). Higher self-esteem, in turn, has a negative relationship to substance use (Emery et al. 2009). Results from this meta-analysis indicated that negative disclosure reactions were indeed significantly related to higher rates of substance use among LGB youth. However, there was no evidence that positive disclosure reactions or self-esteem were associated with substance use.

Greater length of time for LGB adolescents to "come out" regarding their sexual orientation was significantly and positively correlated with rates of substance use. In addition, among lesbian and female bisexual adolescents, having a more masculine/butch gender identity was positively correlated with substance use. It is possible that

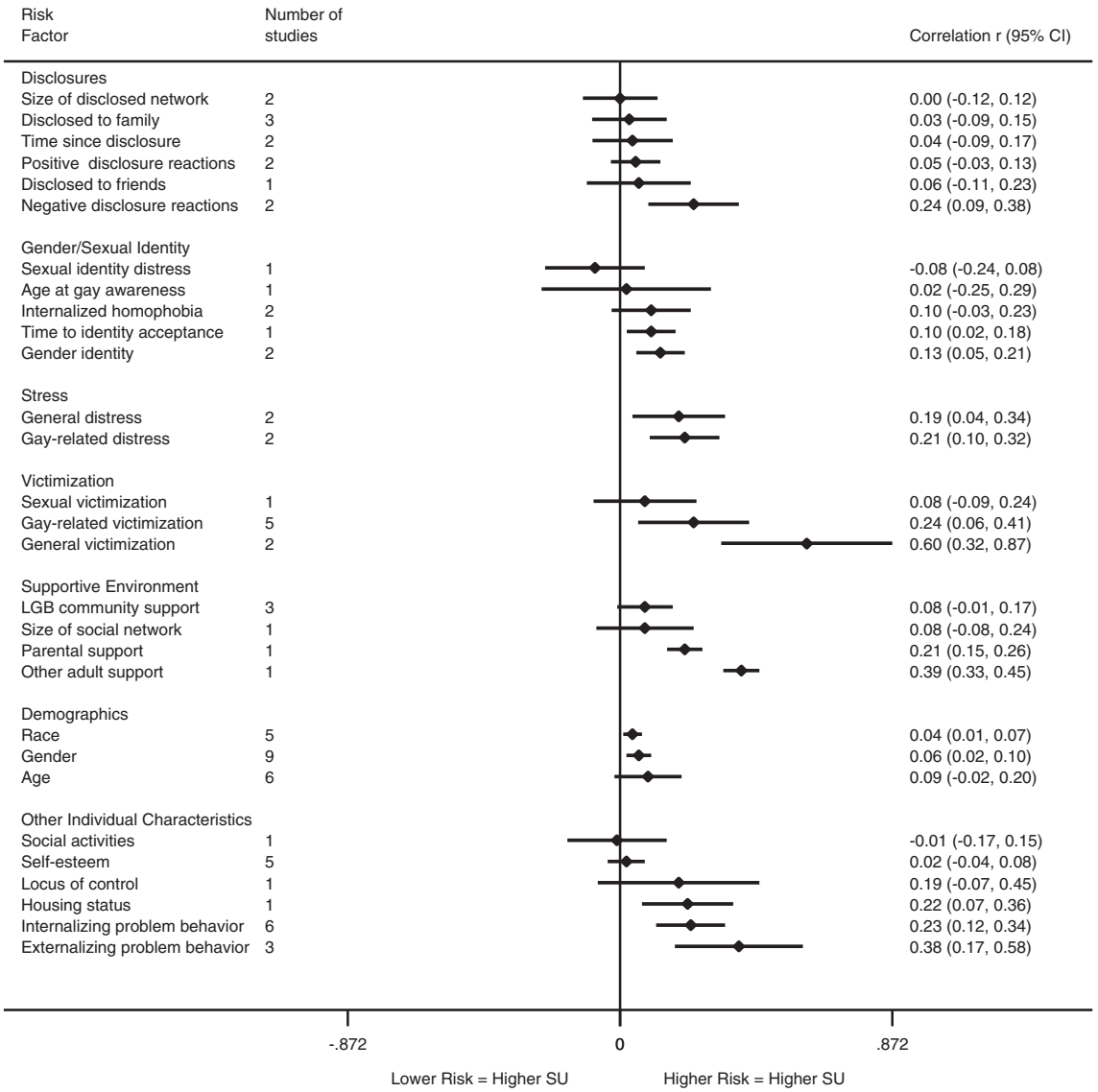

Fig. 1 Random effects mean correlation coefficients and 95 % confidence intervals for substance use risk factors among LGB youth, split by risk factor construct

adolescents who take longer to come out about their sexual orientation or deviate from more traditional gender norms face more heterosexism and higher levels of internalized homophobia, which have been shown to be associated with negative outcomes among sexual minority youth (Weber 2008). This hypothesis is in line with the minority stress theory: Those youth with higher levels of internal homophobia, or who face greater actual or perceived resistance in regards to their gender or sexual orientation identity, will have more stress engage in higher rates of substance use.

Not surprisingly, stress (both general and LGB specific), was moderately correlated with substance use in LGB adolescents. However, in our analysis, it became clear that the measurement strategy being employed by many researchers is not sensitive enough to account for stressful experiences specific to youth identifying as LGB. Indeed, although numerous studies reported that stress was related to substance use, the lack of measurement specificity meant it was impossible to assess the extent to which stress was LGB related or not, which may have important implications for intervention development. If LGB-related stress has a stronger correlation with substance use than general stress, then interventions should be designed with this unique factor in mind. This notion is supported by evidence that tailoring an intervention to a target population can increase its effectiveness (Hecht et al. 2003; Marsiglia et al. 2000).

Results from the meta-analysis also indicated that the experience of victimization, or threats and experiences of violence, was strongly correlated ($\bar{r}$=.60) with substance use by LGB adolescents. Five studies used measures of gay-related victimization specifically, whereas two studies asked about victimization more generally. Again, what remains unclear is whether these general victimization instruments are actually measuring minority stress among LGB adolescents. It is possible that LGB adolescents would report they had experienced being "bullied" at school, but the root cause of that bullying (e.g., "I was bullied because I identify as LGB") remains unknown. If we assume that the general victimization reported by LGB youth is in fact related to their LGB identification, then this is a striking finding with important implications for the development of prevention interventions. However, given the lack of sensitivity in the measures used in these studies, we are unable to make any definitive conclusions at this time.

Results also indicated that low levels of perceived parental support were related to higher rates of substance use, as were low levels of perceived support from other adults at school. However, the complex role that parental and other family support plays in health outcomes for LGB youth is an area in need of further exploration (Bouris et al. 2011). There was no evidence that peer support was a protective factor for substance use among LGB youth. For instance, in the study of Padilla et al. (2010), youth involvement in a school gay–straight alliance was not correlated with lower substance use patterns. These findings should be interpreted with caution, however, as they are limited by the methods of the studies included in the analysis. It could be the case that variables of peer relationships among LGB youth in these studies are conceptually confounded with variables of parental and adult support. That is, perhaps LGB adolescents without strong parental support are more likely to cluster with other gay youth, creating an alternative support network to family and adults. Were this the case, clustering may intensify shared stress in some adolescents, while provide buffering support for others. Furthermore, this clustering effect may operate conditionally as either a protective or risk factor contingent on other factors, such as youth comfort with sexual identity. Although there is no empirical basis for offering such an explanation, these possibilities illustrate the need for additional research in the area.

Substance use among homeless and runaway youth has been well supported in the literature (Savin-Williams and Ream 2003; Tyler and Melander 2013). Homelessness and housing instability, while often viewed as risk factors for youth substance use, may also be considered minority stress factors particularly for adolescents. For LGB youth, homelessness is often related to their sexual-minority status (running away or being evicted by their parents). Thus, individual and environmental stressors, uniquely faced by LGB adolescents, deserve special consideration in prevention and treatment efforts for this population.

Overall, the factors that have the greatest relationship to substance use in LGB youth are not distinct from those reported by teens in the general population, regardless of sexual minority status. For example, both victimization and lack of family support are related to substance use among adolescents in general; these findings are not necessarily unique to LGB youth. However, if these stress experiences only exist because of their relationship to a youth's sexual minority identification, they have important implications on the development of interventions, as approaches designed to meet a group's unique stressors and minority related challenges tend to be effective in changing negative behavioral health patterns (i.e., Castro et al. 2004; Cervantes et al. 2011). Furthermore, participants in such programs also tend to report higher satisfaction with their content (Holleran Steiker et al. 2011). Given the unique stressor experiences of LGB youth described here, including parental disapproval, loss of friendship, victimization, and school problems (e.g., Remefadi 1987; Russell et al. 2001), targeted interventions may be more effective than universal interventions in reducing substance use in this population (Goldbach and Holleran Steiker 2011). For instance, targeted programs may address ways for LGB youth to avoid and cope with peer victimization or provide mentoring opportunities that can strengthen perceived support from adults at school.

It is important to acknowledge the limitations of the current review. Of particular concern is the lack of standardization concerning which ages constitute an "adolescent" or "youth," with studies ranging in populations of 13–25. Initially, we wished to restrict this review to only those studies that described an adolescent population between 13 and 18 years of age. However, this limited scope would have drastically reduced the total number of eligible studies, making the current meta-analysis impossible. Other authors have also written about this concern (Elze, 2007), so future research with LGB youth should more carefully attend to the issue of age. In short, the experience of a 25-year-old participant should be cautiously combined with the experience of a 15 year old, as developmental and life stages differ drastically between these two types of participants.

As with any meta-analysis, this study is also limited by the quantity and methodological quality of the primary studies it synthesized. There were a small number of studies (n=15) with even fewer unique samples (n=12). The majority of studies (75 %) were cross-sectional and lacked longitudinal findings, making it difficult to examine change over time. The lack of prospective studies has been noted previously (e.g., Hughes and Eliason 2002), and thus, a causal link between these minority stressors and substance use outcomes cannot be determined. The nonprobability strategies for recruitment in many of the studies may have also increased self-selection bias, and thus, caution is warranted when generalizing findings to all LGB adolescents. Furthermore, only 25 % of studies reported using standardized, validated measures of risk factors, and only 33 % reported using validated measures of substance use. Better measurement of these minority stress risk constructs is needed, so that researchers can better distinguish between traditional adolescent stressors (e.g., family turmoil) and those related specifically to identifying as LGB (e.g., family rejection due to sexual orientation). Finally, all of the studies relied on self-report, and fear of stigmatization could have reduced honest reporting (Stronski and Remafedi 1998). Given these limitations, there may be other salient risk factors contributing to substance use in LGB adolescents that remain currently unexplored.

Future research should also explore the relationships among and between the themes highlighted in this review and examine their combined influence on substance use outcomes among LGB youth. These numerous, complicated risk constructs have predominantly been studied independently; what is needed is a better understanding of how they interact and relate to one another. Further research must evaluate how these established correlates influence each other and, in turn, affect substance use among LGB youth. A better understanding of this may help to inform the development of effective targeted substance use preventive interventions for LGB youth and reduce this troublesome health disparity.

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Studies included in the meta-analysis are marked with an asterisk

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