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Alcohol research with transgender populations: A systematic review and recommendations to strengthen future studies

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Abstract

Background—There is a recent and growing research literature on alcohol use and related harms among transgender and other gender minority populations; however, current definitions and measures of hazardous drinking do not consider the complexity of physiological sex characteristics and socially constructed gender, raising doubts regarding their validity, applicability, and use with these populations. To address this, we reviewed current research on alcohol-related outcomes in transgender populations and critically summarized key issues for consideration in future research.

Methods—We conducted a systematic review of transgender alcohol research in English language, peer-reviewed journals, published 1990–2017, and extracted key details (e.g., sample composition, alcohol measures, results).

Results—Forty-four studies met all inclusion criteria for the review, the majority of which were conducted in the United States. The prevalence of hazardous drinking was high; however, estimates varied widely across studies. We noted frequent methodological weaknesses, including

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Contributors

PAG conceived of the study, and all authors helped refine the research question. PAG and LP conducted the systematic review, and ASK, TKG, and SLR assisted with interpretation of results. PAG and LP drafted the manuscript; ASK, TKG, and SLR revised and finalized the paper. All authors have approved the final manuscript.

Conflicts of Interest Statement

Conflicts of interest: none

few attempts to differentiate sex and gender, poor attention to appropriate definitions of hazardous drinking, and reliance on cross-sectional study designs and non-probability sampling methods.

Conclusion—Given findings that suggest high need for ongoing public health attention, we offer recommendations to improve future alcohol studies with transgender and other gender minority populations, such as being explicit as to whether and how sex and/or gender are operationalized and relevant for the research question, expanding the repertoire of alcohol measures to include those not contingent on sex or gender, testing the psychometric performance of established screening instruments with transgender populations, and shifting from descriptive to analytic study designs.

Keywords

Health disparities; research methods; hazardous drinking; binge drinking; alcohol use disorder; gender minority

1. Introduction

Gender minority populations, including transgender, gender non-binary, genderqueer, and other gender non-conforming people (hereafter referred to as transgender)¹ have gained unprecedented attention in recent years. For instance, in 2010 the Institute of Medicine (IOM) commissioned the largest comprehensive synthesis by a US federal body to date of knowledge about sexual and gender minority population health. The final report found important knowledge gaps and recommended that the National Institutes of Health prioritize transgender health within a rigorous LGBT-focused research program (Institute of Medicine, 2011). Subsequently, in October 2016, the National Institute on Minority Health and Health Disparities designated sexual and gender minorities as health disparity populations for research, recognizing the paucity of data on health outcomes for transgender persons (Perez-Stable, 2016). Transgender and sexual minority populations are also noted as priority populations in the National Institute on Alcohol Abuse and Alcoholism *2017–2020 Strategic Plan*; however, at present, there are no related action steps under the plan's goals and objectives (National Institute on Alcohol Abuse and Alcoholism, 2017). Most recently, the *American Journal of Public Health* devoted its February 2017 issue to transgender topics, publishing papers on population estimates and survey sampling, HIV prevention, and inclusive and affirming clinical practices. In a commentary in that issue, Landers and Kapadia (2017) noted the considerable progress over the last 15 years but also highlighted ongoing knowledge gaps and called for more research on the health status and needs of transgender populations.

¹Transgender individuals have a gender identity different than the sex assigned to them at birth, which is often based on visible indications of biological sex. (e.g., genitalia). This is in contrast to cisgender individuals, whose current gender identity aligns with their natal sex. Non-binary refers to an array of gender identities that fall outside the male/female and masculine/feminine dichotomies. Nonbinary individuals may identify as both male and female (e.g., bi-gender), have a mix of different genders not exclusively or in addition to male and/or female (e.g., pangender), they may feel without a gender (e.g., agender; neutrois), or they may feel fluid in their gender (e.g., genderfluid). Similarly, genderqueer and gender non-conforming describe individuals whose identity and expression differs from dominant gender norms. Following American Psychological Association (2015) guidelines, we use transgender as an umbrella term that is inclusive of the diversity of gender minority populations.

There are indications that alcohol use is an important behavioral health problem among transgender populations. Reviewing the extant evidence, the IOM report (2011) concluded that alcohol misuse was highly prevalent in transgender populations, particularly in early to middle adulthood. More recently, the 2015 US Transgender Survey, the largest assessment of transgender health status and needs to date, found a high prevalence of binge drinking overall, with binge drinking levels much higher in transgender communities of color than in white non-Hispanic peers (James et al., 2016). Those results were congruent with several observational studies with smaller samples of transgender participants that also found a high prevalence of binge drinking (Coulter et al., 2015b; Keuroghlian et al., 2015; Scheim et al., 2016) as well as alcohol use disorder (Keuroghlian et al., 2015; Reisner et al., 2016). We caution that these findings should be interpreted in light of contextual factors. Transgender individuals are not ipso facto “risky” populations; rather, the discrimination and stigma that gender minorities face likely create psychosocial conditions leading to higher risk of problematic alcohol use (Hatzenbuehler et al., 2013). Indeed, minority stress models (Clark et al., 1999; Meyer, 1995, 2003) posit that members of some social groups experience excess stress (i.e., above and beyond expected levels) because of their minority status, which in turn may be associated with maladaptive coping behaviors, including substance use. Focusing on gender minorities, Hendricks and Testa (2012) have identified relevant processes of stigma, discrimination, and internalised negative attitudes based on gender identity and presentation, and several recent studies have found an association between transgender-related discrimination and alcohol use (Nuttbrock et al., 2014; Reisner et al., 2015b; Rowe et al., 2015).

Transgender populations may also experience greater secondary harms related to alcohol use than cisgender peers. For example, alcohol use has been associated with interpersonal violence (Crane et al., 2016; Foran and O’Leary, 2008). Transgender individuals appear to be at increased risk of being targeted for violence, such as sexual and physical assault (Coulter et al., 2016; Tupler et al., 2017). There is recent evidence that heavy drinking is associated with victimization, including verbal abuse and sexual assault (Coulter et al., 2015a). Additionally, transgender populations may face an increased risk of harms due to others’ drinking. Namely, the combination of alcohol-induced disinhibition and anti-transgender bias may exacerbate the likelihood of perpetrating violence against transgender persons.

Despite growing attention and interest, transgender substance use research has been hampered by several methodological challenges. Foremost, it has been difficult to identify transgender respondents in general population research. Past work has suffered from poorly operationalized definitions of study populations, including non-standardized definitions of transgender that do not allow systematic comparisons across studies. In response, panels of experts have produced recommended measures of gender identity for use with both adolescents and adults (Temkin et al., 2017; The GenIUSS Group, 2014). Unfortunately, surveillance surveys have yet to adopt such measures uniformly. For example, the Behavioral Risk Factor Surveillance System (BRFSS) optional module on sexual orientation and gender identity was only adopted by a minority (n=21) of states in the 2015 survey, thus limiting US national surveillance of transgender health disparities, including alcohol use.

Most relevant for this paper, there are currently no standards for ascertaining alcohol use patterns in transgender populations other than general population guidelines, which make no distinction between transgender and cisgender populations. Thus, the guidelines do not clarify their use or applicability for research on transgender individuals' alcohol use (National Institute on Alcohol Abuse and Alcoholism, 2012). In response, this paper focuses on methodological challenges, with a special emphasis on measuring at-risk alcohol use for research with transgender populations. The overarching aim is to draw attention to essential issues, review and summarize current research practices, and make recommendations to improve the rigor of future work to characterize hazardous drinking in transgender populations.

2. How Sex and Gender Matter for Alcohol Use Research

Alcohol use is associated with a continuum of behaviors that may have negative physiological, psychological, or social consequences. For example, high quantity and frequent drinking increases risk of short-term impairment, such as acute intoxication, likelihood of longer-term health problems, such as gastrointestinal disease, cancers, stroke, and cognitive decline (Boffetta and Hashibe, 2006; Greenfield and Martinez, 2017; Meyerhoff et al., 2005; Thakker, 1998), and often leads to indirect harm through associated behaviors, such as interpersonal violence or drunk driving (Blomberg et al., 2009; Hingson and Winter, 2003; Lipsky et al., 2005; Peck et al., 2008; Testa et al., 2003). An ongoing challenge for alcohol research is to accurately assess behavior and classify the risk of alcohol-related harm, such as differentiating low-versus high-risk drinking (Greenfield and Kerr, 2008).

Sex and gender are inherent in drinking classifications, yet their roles are rarely made explicit. For example, the current recommended limits in the US for low-risk drinking are no more than four drinks per day for men or three drinks per day for women, and no more than 14 drinks in a week for men or seven drinks in a week for women (US Department of Health and Human Services and US Department of Agriculture, 2015). Whether the different heavy drinking criteria are based on physiological sex characteristics or socially constructed gender is not stated. In an exception, sex has been taken into account by the National Institute on Alcohol Abuse and Alcoholism to define binge drinking. Focusing on high-quantity consumption that will increase blood alcohol concentration to at least .08 percent, a binge episode is defined as five or more drinks for men, or four or more drinks for women, within about a two hour period (National Institute on Alcohol Abuse and Alcoholism, 2012). Although grounded in processes of ethanol metabolism, the definition's basis in physiological sex characteristics is rarely acknowledged. Further, the definition has not been without controversy. For example, the "in about two hours" measure has been found less predictive of negative consequences than the standard four-plus/five-plus binge definition without a time frame (Corbin et al., 2014). Additionally, there has been an ongoing criticism of the definition's shifting conceptual foundation (Berridge et al., 2009), low correspondence to clinical issues (Pearson et al., 2016), and potential misclassification of risk (Perkins et al., 2001).

Sex and gender are key—and complicating—factors in assessing alcohol-related risk. Although often considered together, even interchangeably, they are distinct constructs. In simple terms, sex refers to the physiological structures and processes inherent in a body, which is often assigned at birth as male or female but can include intersex variation. It is well established that biological factors, such as hormone profiles, fat and muscle composition, and body water content differ by sex, which in turn affects alcohol metabolism and the attendant risk of negative consequences (Kwo et al., 1998; Sutker et al., 1983; Thomasson, 1995). Additionally, it is important to note that physiological sex characteristics can shift for many transgender individuals, particularly for those who medically affirm their genders, such as accessing gender-affirming hormone therapy or gender-confirmation surgery. The subsequent impact of physiological changes in alcohol metabolism and associated health risks that come with different types of medical changes remains unknown as it has received scant research attention. To our knowledge, there have been no studies assessing the contributions of natal sex (i.e., sex assigned at birth) versus current sex-based physiological characteristics in relation to alcohol-related harm in transgender populations. Importantly, it should be noted that not all transgender individuals can or desire to affirm their gender identity medically. Thus, it is imperative that researchers clarify how “physical sex” is defined in study populations.

In contrast to sex, gender refers to social and cultural processes ascribed to a body. These processes impact one’s internal experience of gender as well as how individuals are perceived in society and experience gender relations on an interpersonal and institutional level (Johnson et al., 2009). Although often seen as a simple dichotomy, gender is a social construct that encompasses a continuum of characteristics, such as feelings, behaviors, perceptions, preferences, aspirations, and social relationships (Bornstein, 2016; Butler, 2010). Gender is relevant to alcohol research as drinking is a socially patterned behavior; onset of regular drinking, frequency and quantity of drinking, and risk of alcohol use disorders vary by gender (Grant et al., 2015; Nolen-Hoeksema, 2004; Wilsnack et al., 2000). Underscoring both its central role and multi-dimensional nature, several recent studies have found that gender-related characteristics, such as personality traits and social roles, are more predictive of certain alcohol-related behaviors than physiological sex characteristics (Fugitt et al., 2017; Iwamoto et al., 2016; Peralta and Barr, 2017; Ricciardelli et al., 2001). Gender is likely to play a fundamental role in shaping alcohol use in transgender populations. For example, drinking may be a coping strategy in response to social stressors, such as transgender stigma and experiences of discrimination.

Sex and gender have distinct, yet potentially interacting, pathways in population health that have not been adequately examined (Krieger, 2003). In alcohol research, as in other health research fields, sex and gender are often incorrectly and interchangeably used, leading to missed opportunities to accurately identify and describe risk and protective pathways. Additionally, the lack of clarity about how sex and gender are defined and measured in alcohol research precludes the ability to develop adequate definitions for hazardous alcohol use in populations whose gender identity differs from the one assigned to them at birth. Although the National Institutes of Health (NIH) have made a sweeping change calling for greater attention to biological sex in human and animal research that they support (Clayton and Collins, 2014), an analogous call for greater attention to gender as a determinant of

health has yet to appear from NIH. Indeed, as regards alcohol and other drug behavior, gender has received some attention, though primarily with a cisgender focus (Room, 1996). Thus, our focus on transgender populations forces us to return to a central question: how do sex and gender drive alcohol risk? We posit that clarity about this issue is fundamental for sound science in alcohol-related research.

3. Review of Current Research

3.1. Methods

To assess current practices in alcohol research about transgender populations, we conducted a systematic review of the published literature following standard procedures, including the PRISMA guidelines (Egger et al., 2001; Glasziou, 2001; Moher et al., 2009). Ethics board approval was not necessary as the project did not constitute human subjects research. We searched PubMed, PsycINFO, and CINAHL databases using combinations of search terms (Appendix A)², supplementing the searches with bibliography reviews and targeted searches (i.e., by author name). To be included, papers had to report quantitative assessments of alcohol use in transgender populations and be published in English language peer-reviewed journals between January 1, 1990, and April 30, 2017. There was no restriction on sample age or study location.

We identified 53 non-duplicative papers and screened titles and abstracts for inclusion criteria. Next, full texts were retrieved and screened a second time to confirm inclusion, producing an analytic sample of 44 papers (Figure 1). From those papers, key study characteristics (e.g., sample composition, alcohol measures) were identified using a data extraction form and entered into an Excel spreadsheet. The first and second authors performed all screenings and data extraction; discrepancies about inclusion or data were resolved through discussions among all authors.

3.2. Results

The majority (80%) of papers in the final analytic sample were based on studies conducted in the United States; however, seven papers reported findings from Brazil, Canada, El Salvador, Peru, Portugal, and South Africa (Table 1). Slightly more than half (55%) of samples were drawn from a city or municipal areas; there were fewer state/provincial/regional (16%) or national (23%) samples. The largest proportion (41%) of studies focused on transgender women (e.g., natal males who identified as women). Equivalent smaller proportions (27%) included both transgender men and women or did not differentiate transgender subgroups. Only two papers (5%) focused exclusively on transgender men. A minority of papers (22%) defined transgender status using broad terms such as gender non-conforming, non-binary, and genderqueer; however, nearly papers all collapsed such groups for analysis. The large majority of papers (95%) had been published within the past five years.

²Supplementary material can be found by accessing the online version of this paper at <http://dx.doi.org> and by entering doi:...

Half of the papers reviewed (51%) did not report transgender-specific prevalence estimates of alcohol outcomes. Among the papers that did, prevalence of binge drinking ranged from 7%-61% (Arayasirikul et al., 2017; Horvath et al., 2014), the proportion reporting drinking to intoxication was 25%-58% (Hotton et al., 2013; Operario et al., 2014), and the prevalence of sexual risk behaviors while intoxicated was 32%-53% (Garofalo, 2006; Santos et al., 2014). Only one paper presented disaggregated findings for transgender men, transgender women, and genderqueer/non-binary individuals (Smalley et al., 2016). Across papers, estimates of Alcohol Use Disorders Identification Test (AUDIT) scores indicative of hazardous drinking were fairly stable, at 47%-48% (Herrera et al., 2016; Kerr-Corrêa et al., 2017). Alcohol use disorder was rarely assessed; however, two studies found lifetime and past-year alcohol use disorder prevalence of 26% and 11%, respectively (Blosnich et al., 2017; Reisner et al., 2016). Noting that prevalence of current drinking outcomes varied widely, this may be evidence of high methodological variability across studies, which could impede the development of a coherent evidence base.

Many of the studies suffered from constrained research designs. For example, the majority (77%) relied on non-probability sampling, which limits the generalizability of findings; however, we noted that a minority (16%) used respondent-driven sampling, a quasi-probability method that can approximate a representative sample of an otherwise hidden population. Nearly all studies (95%) relied on cross-sectional data, which precludes causal inferences. Additionally, nearly half (43%) utilized exclusively transgender samples. There are recognized advantages of within-group studies, such as better statistical power and reduced error variances (Schwartz and Meyer, 2010); however, between-group research (comparing transgender to cisgender people) is necessary to characterize the degree and direction of risk as well as to monitor widening or to lessen health disparities. Although slightly more than half (56%) of the papers reviewed mixed cisgender and transgender samples, the proportions of transgender participants were often low, thereby preventing transgender-specific prevalence estimates and comparisons to cisgender peers. Indeed, of nine papers reporting mixed samples with 10% transgender participants, only four presented subgroup-specific results (Bryan et al., 2017; Corte et al., 2016; Herrera et al., 2016; Livingston et al., 2015). Additionally, variation by race/ethnicity within transgender populations received little attention. No papers based on multi-racial samples reported results by race/ethnicity. One persistent weakness across studies was the lack of standard operationalization and measurement of transgender status, including subgroups within this broad category. For example, participants were assessed in highly inconsistent ways, using self-reported dichotomous transgender status, multi-category identity labels, cross-tabulations of birth sex by current gender identity, or diagnosis of gender identity disorder. Nine papers (20%) included no details about how transgender status was assessed.

Examining methods to assess alcohol-related outcomes, six papers provided no description of their alcohol measures (Almeida et al., 2014; Maticka-Tyndale et al., 2016; Rowe et al., 2015; Santos et al., 2014; Smalley et al., 2016; White Hughto et al., 2015); however, for three of those papers we inferred the measures based on reported results or tables accompanying the text. Over half (56%) of papers used multiple items to assess alcohol outcomes, often mixing items for frequency, quantity, and binge drinking episodes. A minority (33%) of papers relied on a single item, most often binge drinking episodes. The

Alcohol Use Disorders Identification Test (Saunders et al., 1993) was the most frequently used scale to classify hazardous drinking.

The examination of measures highlighted this paper's central question about sex, gender, and their interrelated implications for alcohol research with transgender populations. The majority (67%) of papers did not explain their selection of alcohol measures. A minority (19%) presented a justification based on general population psychometric performance of the measure (Kalichman et al., 2015; Newcomb et al., 2012; Stewart et al., 2015); the established relationship of a variable with a study outcome (Sun et al., 2016); compatibility with a larger study (Reisner et al., 2013); or characteristics of the study population other than sex and gender (Bryan et al., 2017; Ebersole et al., 2012; Huebner et al., 2015). Strikingly absent from any papers was consideration of gender as a social factor that may shape alcohol outcomes, especially through mediating variables such as alcohol stigma and group norms.

The frequent use of binge drinking as an outcome further highlights measurement issues. As noted above, the NIAAA differentiates risk thresholds by physiological sex characteristics, defining a binge episode as five or more drinks for men or four or more drinks for women within two hours (National Institute on Alcohol Abuse and Alcoholism, 2012), although most epidemiological studies have used four or five drinks per occasion, sitting, or day (Greenfield and Kerr, 2008). Among 19 studies assessing binge episodes in transgender individuals, over three-quarters (84%) utilized the male threshold, defining it as five or more drinks in a single occasion. A small number of studies differed, with one paper using the female threshold (Gonzalez et al., 2017), and two papers using both female and male thresholds (Horvath et al., 2014; Meyer et al., 2017). Two additional papers did not report any definition of binge drinking. We noted that few studies addressed the question of congruence of the measure with the transgender study participants. Notable exceptions were three papers that explained that the study used a risk threshold based on the study participants' sex (Horvath et al., 2014; Meyer et al., 2017; Tupler et al., 2017). Further, three papers explicitly noted that there were no established guidelines for binge drinking for transgender populations (Coulter et al., 2015a; Gonzalez et al., 2017; Meyer et al., 2017). These later papers used male, female, and both male and female thresholds, respectively.

4. Recommendations to Strengthen Future Work

Considering the expansive field of alcohol research, the small number of search results found in our review and the documented high prevalence of adverse alcohol-related outcomes in transgender samples support the conclusion made in the IOM report (2011) that research about alcohol use among transgender persons is urgently needed. Based on our review and critique of the literature, we suggest several strategies to improve alcohol research with transgender populations.

First and foremost, we urge careful conceptualization of research objectives before beginning a study. Clarity about which factors, physiological sex characteristics and/or gender, are relevant and the pathways these may operate through will inform the execution of a study (e.g., measure selection, drinking classification). Early attention to such

conceptual matters may avoid later problems like the largely unsupported use of risk thresholds for binge drinking that we found in the literature review.

Second, we caution against over-reliance on easy-to-measure alcohol variables, such as self-reported frequency and quantity of drinking, that may have limited utility. We advocate for expanding the repertoire of alcohol outcomes to include ones that are not contingent on sex or gender, such as subjective assessments of intoxication and maximum consumption (Greenfield and Kerr, 2008) or drinking in risky contexts and negative consequences of drinking (Midanik et al., 2007). This is consistent with other scientists' calls for greater nuance in alcohol research. For example, Rehm and colleagues (2010) have argued that studies should consider the health effects of average alcohol consumption in addition to hazardous drinking patterns. Further, De Jong (2003) has asserted that greater attention to patterns of high-risk drinking (e.g., drinking in conjunction with driving or sex) and negative consequences (e.g., violence, victimization) may be more instructive than traditional consumption measures (e.g., quantity, frequency).

Third, there is a great need to test established screening instruments, such as the Alcohol Use Disorders Identification Test (AUDIT), the CAGE Questionnaire,³ or the Michigan Alcoholism Screening Test (MAST), for use with transgender populations. For example, the widely used AUDIT is designed to detect hazardous drinking and has demonstrated good psychometric performance in diverse populations and settings (Reinert and Allen, 2002, 2007); however, to our knowledge, no study has assessed its validity or reliability in transgender populations. It goes against scientific principles to presume that a measure developed in one population will perform equivalently in a different population. In contrast, we note that the diagnostic criteria for alcohol use disorder appear to be free from dependence on sex or gender (American Psychiatric Association, 2013); however, this may be of limited usefulness given that much of population research, and even clinical practice, relies on brief screeners to identify hazardous drinking rather than attempting to make a diagnosis of alcohol use disorder.

Fourth, our literature review suggests a need to expand the range of study designs used in transgender alcohol research. We found great reliance on cross-sectional data and non-probability sampling. Given well-known limitations to internal and external validity (Shadish et al., 2002), we raise this as an area of concern as inattention to it may stunt the emergent knowledge base. For example, having established basic associations of transgender status and adverse alcohol outcomes in cross-sectional data, scientists may now shift to other designs, which could elaborate the causal pathways and intervening mechanisms responsible for differential alcohol outcomes over time (i.e., longitudinal and mediational analyses). Further, we urge future studies to take advantage of sampling strategies to ensure sufficient participation by transgender individuals. For example, oversamples, obtained through respondent-driven sampling or quota sampling, can permit disaggregated and more nuanced analyses, which will extend the current knowledge base. In particular, we encourage future

³CAGE is a mnemonic device based on the content of four screening questions: (1) Have you ever felt you should cut down on your drinking?; (2) Have people annoyed you by criticizing your drinking?; (3) Have you ever felt bad or guilty about your drinking? and (4) Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover (eye-opener)?

studies that can examine alcohol risk under multiple marginalized statuses, such as racial/ethnic minority transgender individuals.

Finally, in considering the conceptual and practical complexities of sex and gender in alcohol research, we recommend that researchers clarify the definitions of physiological sex characteristics and gender that they use in their studies. For example, more research is needed to understand the unique (if any) contributions of natal sex (i.e., sex assigned at birth) and current sex-based physiological characteristics (e.g., phenotypic expression of sex-specific attributes induced by hormone therapy for medical gender affirmation) in relation to alcohol-related harm. Likewise, more nuanced understanding is needed of the psychological, behavioral, and social dimensions of gender (Reisner et al., 2015a). Salient dimensions include gender identity (a person's felt sense of their gender), gender expression (how a person communicates their gender in terms of behaviors and mannerisms), and gender roles (how a person interacts their gender in relation to others), which is better conceptualized as a continuum rather than a dichotomy. Better specificity about the multiple dimensions of sex and gender, including using standardized measures and theoretically grounded approaches (Johnson et al., 2009), will increase rigor and facilitate cross-study comparisons in future research.

5. Conclusion

There is a small, recent, and growing literature devoted to alcohol use among transgender populations; however, this body of work is in its nascence and suffers from considerable methodological constraints. Notably, there have been few attempts to differentiate the roles of physiological sex and gender, scant attention to within-group heterogeneity among gender minorities (e.g., transgender, gender non-binary, gender non-conforming individuals), infrequent attention to appropriate definitions of hazardous drinking, and great reliance on cross-sectional study designs. Despite the limitations of current research, there are consistent findings of a high prevalence of hazardous drinking among transgender populations, such as binge drinking in excess of general population estimates (Kanny et al., 2013), highlighting this as an area in need of ongoing public health attention. To ensure rigorous research, we offer several recommendations to improve future studies. Further, we draw attention to the recent finding by Glynn and van den Berg (2017). Their systematic review identified only two published reports of substance use interventions specifically for transgender populations, suggesting a lag in the translation of research to application. Ultimately, effective risk-reduction efforts with transgender populations will depend on an expanded and scientifically sound understanding of the associations of sex and gender with alcohol use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Hazardous alcohol use is highly prevalent among transgender populations.
- There is confusion about the roles of physical sex and social gender.
- We recommend ways to improve alcohol studies with transgender populations.

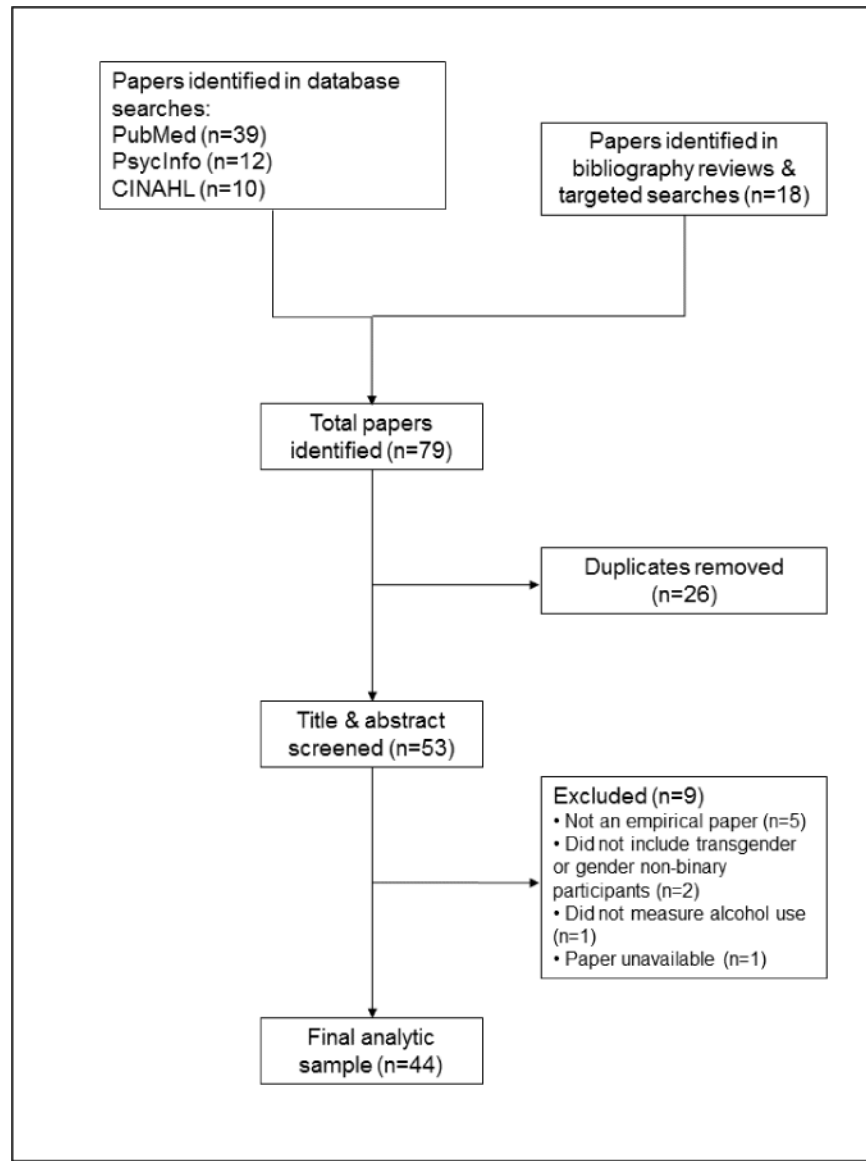


Figure 1.
Literature search and review process

Table 1

Summary of studies examining alcohol use among transgender populations.

Author (Year)	Design	Location	Sample	Measure(s)
Almeida et al. (2014)	Cross-sectional; medical and administrative record review	Lisbon, Portugal	151 sex workers; 13% transgender	No details reported in paper
Arayasirikul et al. (2017)	Cross-sectional; baseline data of longitudinal HIV prevention study	San Francisco, CA	259 transgender women	Past six-month binge drinking (5+)
Blosnich et al. (2017)	Cross-sectional; medical record review	US (national)	6,308 transgender military veterans	ICD-9 alcohol dependence syndrome
Bryan, Kim, & Fredriksen-Goldsen (2017)	Cross-sectional; 2014 wave of longitudinal Aging with Pride study	US (national)	2,351 LGB-identified adults age 50 or older; 11% transgender	Past 30-day alcohol use, frequency, quantity, and largest number of drinks
Conron et al. (2012)	Cross-sectional; survey	Massachusetts, US	28,662 adults; <1% transgender	Past 30-day binge drinking (not defined)
Corte et al. (2016)	Cross-sectional; CASI questionnaire	Not reported (presumed US)	53 sexual & gender minority women; 40% transgender	Past 90-day drinking via Timeline Followback; Drinker Self-Schema; age at drinking debut
Coulter et al. (2015)	Cross-sectional; collapsed three waves of National College Health Assessment	US (national)	75,192 college students; <1% transgender	Past 30-day drinking days; past 2-week binge drinking (5+); past-year alcohol-related problems
Dowshen et al. (2011)	Cross-sectional; used baseline data of HIV prevention intervention	Chicago, IL	92 transgender women	Past 3-month intoxication
Ebersole, Noble, & Madson (2012)	Cross-sectional; online survey	US (national)	143 LGBT-identified college students; 3% transgender	Three multi-item scales: Daily Drinking Questionnaire; Rutgers Alcohol Problem Index; modified Drinking Motives Questionnaire
Garafalo et al. (2006)	Cross-sectional; self-administered paper questionnaire	Chicago, IL	51 racial/ethnic minority adolescent and young adult transgender women	Past-year alcohol use & past-year sex while using alcohol via CDC HIV Risk Assessment
Gilbert et al. (2014)	Cross-sectional; face-to-face survey	North Carolina, US	190 sexual & gender minority Latino immigrant men; transgender proportion not reported	Current alcohol use; reason for drinking; past 30-day binge drinking (5+)
Gonzalez, Gallego & Bockting (2017)	Cross-sectional; secondary analysis of 2003 online survey data	US (national)	1,210 transgender adults	Past 3-month binge drinking (4+)
Heck, Flentje, & Cochran (2013)	Cross-sectional; online survey	US (national)	145 LGBT-identified college students; 7% transgender	Hazardous drinking via Alcohol Use Disorders Identification Test
Herrera et al. (2016)	Cross-sectional; used baseline data of sexual risk cohort study	Lima, Peru	401 high-risk clinic patients; 22% transgender women	Hazardous drinking via Alcohol Use Disorders Identification Test
Holloway et al. (2014)	Cross-sectional; ACASI questionnaire	Los Angeles, CA	263 house and ball community members; 5% transgender	Past 30-day drinking days; past 30-day binge drinking (5+); summary binary indicator of past 30-day alcohol misuse; past 3-month intoxication with social network members
Horvath et al. (2014)	Cross-sectional; online survey	US (national)	1,215 transgender adults	Past 3-month heavy drinking; past 30-day binge drinking (4+/5+)
Hotton et al. (2013)	Cross-sectional; ACASI questionnaire at baseline visit of HIV prevention intervention	Chicago, IL	116 adolescent and young adults transgender women	Past 3-month intoxication (any v. none)
Huebner, Thoma, &	Cross-sectional; ACASI questionnaire	Boston, MA; Indianapolis, IN;	504 LGBT adolescents; 7% transgender	Past-year drinking days; past-year binge drinking (5+); past-year negative consequences

Author (Year)	Design	Location	Sample	Measure(s)
Neilands (2015)		and Philadelphia, PA		
Kalichman et al. (2015)	Cross-sectional; CASI questionnaire	Atlanta, GA	671 HIV-positive clinic patients and social service agency clients; 1% transgender	Hazardous drinking via Alcohol Use Disorders Identification Test
Kerr-Correa et al. (2017)	Cross-sectional; semi-structured interview	Fortaleza, Brazil	304 transgender adolescents and adults	Hazardous drinking via Alcohol Use Disorders Identification Test;
Keuroghlian et al. (2015)	Cross-sectional; online survey	Massachusetts, US	452 transgender adults	Past 3-month binge drinking (5+)
Krishnan et al. (2015)	Cross-sectional; CASI questionnaire	Lima, Peru	359 HIV-positive adults; 13% transgender	Hazardous drinking via Alcohol Use Disorders Identification Test
Livingston et al. (2015)	Cross-sectional; online survey	US (national)	704 sexual minority adults; 20% transgender	Hazardous drinking via Alcohol Use Disorders Identification Test
Maticka-Tyndale, Kerr, & Mihan (2016)	Cross-sectional; community survey	Windsor, Ontario	510 Black, African, and Caribbean adolescents and young adults; 3% transgender	No details reported in paper.
Meyer et al. (2017)	Cross-sectional; survey	19 US states and Guam	151,456 adults; <1% transgender	Past 30-day binge drinking (4+/5+)
Molina & Ramirez-Valles (2013)	Cross-sectional; CASI questionnaire	Chicago, IL and San Francisco, CA	170 HIV-positive Latino GBT adults; 11% transgender	Past 6-month drinking frequency and quantity
Newcomb, Heinz, & Mustanski (2012)	Accelerated longitudinal cohort; 5 waves of surveys	Chicago, IL	246 LGBT adolescents and young adults; 8% transgender	Past 6-month drinking frequency and quantity
Nuttbrock et al. (2014)	Prospective cohort; face-to-face survey	New York, NY	230 HIV-negative transwomen or trans-feminine adults	Past 6-month binge drinking (5+)
Operario et al. (2014)	Cross-sectional; ACASI questionnaire	San Francisco, CA	191 transwomen adults	Past 30-day alcohol intoxication (any v. none)
Peacock, Andrinopoulos, & Hembling (2015)	Cross-sectional; face-to-face survey	San Salvador, El Salvador	670 MSM and transgender women; 24% transgender women	Past 30-day binge drinking (5+)
Reback & Fletcher (2014)	Cross-sectional; face-to-face survey	Los Angeles, CA	2,136 transgender women	Past 30-day alcohol use
Reisner et al. (2013)	Cross-sectional; qualitative & quantitative surveys	Philadelphia, PA	73 transgender men	Past 12-month alcohol use
Reisner et al. (2014)	Cross-sectional; medical record review	Boston, MA	23 transgender men	5+ drinks per week
Reisner et al. (2015)	Cross-sectional; online survey	US (national)	5,542 adolescents; 8% transgender	Past 12-month alcohol use
Reisner et al. (2016)	Cross-sectional; used baseline survey of longitudinal HIV prevention intervention	Chicago, IL and Boston, MA	298 trans feminine adolescents and young adults	Mini-International Neuropsychiatry Interview
Richter et al. (2013)	Cross-sectional; face-to-face survey	Johannesburg, Rustenburg, and Cape Town, South Africa	1,799 sex workers; 3% transgender	Binge drinking (5+) (time frame not specified); intoxication at last 2 sex work interactions
Rowe et al. (2015)	Cross-sectional; used baseline data of HIV risk cohort study	San Francisco, CA	292 transgender women	Past 6-month binge drinking (5+)
Santos et al. (2014)	Cross-sectional; face-to-face survey	San Francisco, CA	314 transgender women	Past 6-month alcohol use; past 6-month binge drinking (5+) via National HIV Behavioral Surveillance study items

Author (Year)	Design	Location	Sample	Measure(s)
Scheim, Bauer, & Shokoohi (2016)	Cross-sectional; survey	Ontario, Canada	404 transgender adolescents and adults	Past year binge drinking (5+)
Smalley, Warren, & Barefoot (2016)	Cross-sectional; online survey	US (national)	3,279 sexual and gender minority adults; 10% transgender	Frequency (no time frame) of any drinking, binge drinking (5+), drinking without intending to, driving while intoxicated
Stewart, Heck, & Cochran (2015)	Cross-sectional; online survey	US (national)	475 adolescent and young adult high school students; 8% transgender	Hazardous drinking via Alcohol Use Disorders Identification Test
Sun et al. (2016)	Cross-sectional; used baseline data of longitudinal HIV prevention intervention	North Carolina, US	186 Latino MSM and transgender women; 19% transgender	Days drunk in a typical week
Tupler et al. (2017)	Cross-sectional; online survey	US (national)	422,906 college students; <1% transgender	Past year alcohol use; past 14-day alcohol use (frequency; quantity; maximum drinks); Rutgers Alcohol Problem Index; Drinking Motives Questionnaire-Revised
White Hughto, Reisner, & Mimiaga (2015)	Cross-sectional; online survey	Massachusetts, US	433 transgender adults	Past 3-month binge drinking (not defined)

ACASI = audio computer-assisted self-interview

CASI = computer-assisted self-interview

MSM = men who have sex with men

Transgender = We use transgender as an umbrella term that is inclusive of the heterogeneity of gender minority populations, including gender non-binary, gender non-conforming, and genderqueer.