

## REVIEW

# Sex, gender and alcohol: implications for males, men and the communication of risk

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## Abstract

Sex and gender related factors affect the ingestion and impacts of alcohol. This article explores these factors with a focus on males and men. While alcohol use has more negative health effects for females than males at lower levels of consumption due to sex related factors, gender related factors underpin many of the negative social impacts of alcohol for men. We present a narrative review of alcohol impact literature, apply a sex and gender-based analysis plus (SGBA+), and summarize the health and social impacts on males and men. We make suggestions for communicating risk regarding the impacts of sex/gender on men's alcohol use. Messages are most needed that undermine hegemonic masculinities that link alcohol use to male camaraderie, differentiation from the feminine, drinking to excess and intoxication, along with information on the impacts of alcohol on aggression, fathering and intimate partner violence. Sex specific messaging on the male-specific health impacts of high tolerance and risky drinking on male reproductive health, and a range of diseases and conditions including cancer and alcohol use disorder, is also required. The impacts of social context are highlighted, and suggestions made for shifts in drinking norms that reflect gender transformative approaches that foreground gender equity. Similar to women, risk communications need to include sex/gender related factors that affect men, and fundamentally be health and equity promoting.

## Keywords

Alcohol; Men; Males; Sex; Gender; Risk; Impact; Communication

## 1. Introduction

Men's alcohol use is an important health issue. It is well established that men consume more alcohol, more frequently and in greater quantities than women, a pattern consistent across the globe [1, 2]. And, more men drink at risky levels, such as heavy episodic or binge drinking than women, across cultures. However, such gendered gaps in prevalence are narrowing globally [3], possibly in response to changes in gender norms, and/or the impact of gendered alcohol marketing. According to the 2019 Canadian Alcohol and Drugs Survey (CADS) three-quarters of Canadians (76% or 23.7 million) reported consuming an alcoholic beverage in the past year, with males being more likely to report past year alcohol use than females [4]. Slade *et al.* [3] (2016) conducted a systematic review on the birth cohort changes in male to female ratios from 1891 to 2001 in indicators of alcohol use and related harms [3] and found 68 studies indicating that there is evidence that the gender gap is narrowing for alcohol use and related harms. This trend is more obvious among young adults, highlighting the importance of age [3]. Similar findings regarding age were found in an Australian study where gender differences were found for all age groups except adolescents (14–17 years old) [5].

Sex and gender matter in understanding men's alcohol use and its varied health and social impacts. However, historically health research has used men or males as the "norm" in experiments, sampling, clinical trials and analysis and has not always explicitly examined the sex and gender related factors that shed light on the mechanisms or processes that underlie health impacts. Each person's responses to alcohol represent a complex interplay between biology, genetic, social and environmental factors, underscoring the importance of fully understanding sex and gender related factors and mechanisms that underlie responses to alcohol, in addition to sex differences [6]. But research on sex, gender and alcohol that integrates these factors is under-developed and, in many cases, missing entirely [1, 7].

Males exhibit a greater tolerance for alcohol than females, in that higher volumes can be consumed before bodily damage or impact, impairment or intoxication is done or reported. This capacity to consume higher quantities of alcohol contributes to risky drinking, accidents and intentional injuries, and a range of long-term consequences reflecting prolonged and higher exposure. Alcohol use in males increases risks and rates of various diseases and conditions, including all gastrointestinal cancers, hypertension, liver disease, pancreatitis, cardiovascular disease and stroke, erectile dysfunction, lower sperm

quality, alcohol use disorder, possible links to fetal alcohol spectrum disorder (FASD) in offspring, and some association with prostate cancer [8–14].

Socially, men's alcohol use, especially at risky levels, contributes to the perpetration of aggression and violence, including stranger-violence and fighting, intimate partner violence and sexual assault, and relationship and family issues. These impacts are enhanced in contexts such as bars, college environments, occupational and sport settings and in sexual or romantic relationships and are noteworthy among younger men. Prevailing notions of masculinities often reinforce pro-drinking, bingeing, intoxication, and aggressive behaviours in many cultures, contributing to these patterns and impacts of alcohol use in men. Cultural views of masculinities, a lack of stigma attached to men's drinking, sparse intervention on alcohol and male reproductive health or fathering practices, and alcohol advertising that reinforces male gender norms, all play a part in supporting and generating the negative impacts of alcohol on males and men. This article reviews current evidence on the impacts of alcohol on male bodies and men's health with a focus on explicating the sex and gender related factors affecting the impact of alcohol on men. We then apply a sex and gender-based analysis plus (SGBA+) to the evidence, in order to assess it for sex/gender specific impacts on men/males based on sex, gender and a range of diversity factors [15].

## 2. Materials and methods

We undertook a comprehensive narrative review of recent academic literature aimed at identifying how sex and gender related factors influence alcohol use and its effects on men [16, 17]. This approach was deliberately broad and descriptive, which aligns with the scope of a narrative review [17]. Unlike systematic reviews, which employ precise and rigorous methodologies, narrative reviews are designed to cover a wider range of topics. Narrative reviews do not have strict guidelines, allowing for a more flexible exploration of topics. In this review, topic areas and parameters for risk factors were initially informed by a separate review on the evidence on the impact of alcohol on women and girls [18], and additional topics and search terms specific to the impacts of alcohol on males, men and boys were added accordingly.

### 2.1 Search strategy

An information specialist at the Canadian Centre for Substance Use and Addiction (CCSA) carried out an extensive literature search using PubMed, PsycINFO (American Psychological Association (APA) interface), and CINAHL (EBSCO interface) in January 2023. Articles were limited to the English-language, published from 2012 until September 2022. Keywords and Medical Subject Headings (MeSH) were used to create searches focused on a combination of alcohol, sex or gender, and male factors including identity, comparisons or differences, disparities, roles, masculinity, parenting and reproductive health. The full search strategy can be found in **Supplementary Table 1**. A total of 12,131 articles were retrieved, and after deduplication 8294 results remained. After

screening for relevance based on the title and abstract, as well as the exclusion criteria, 1673 articles were further screened. 190 articles were categorized by one of the authors according to the sex and gender related factor categories in the Figures, focusing on topics such as hormones, neurobiology, anatomy, gender relations, gender norms and identities, and on additional topics such as mental health, fathers and fatherhood, alcohol use disorder, *etc.* Then, each of these categories was assigned to one of the three authors, and articles were read and summarized accordingly. After this, the first author reviewed all summaries and outlined the narrative review themes and categories.

### 2.2 Inclusion/exclusion criteria

We developed inclusion and exclusion criteria for this review to include English language, peer-reviewed journal articles such as systematic reviews, meta-analyses and individual studies that provided information on risk factors and health outcomes related to alcohol use. Our primary focus was on recent studies published between 2012 and 2022. However, when the evidence on a certain topic was limited, we included studies that were published earlier.

For individual studies, we included literature published from Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States. We included systematic reviews and meta-analyses published in all other countries, or that include data from multiple countries.

### 2.3 Analysis and synthesis

Sex and gender-based analysis plus (SGBA+) is a method used to evaluate how sex, gender and various diversity factors impact evidence, programs, policies, treatments, prevention, messaging and health promotion. This analytic process aims to identify and address disparities, allowing for more equitable and tailored health interventions [15]. Applying SGBA+ in a narrative review involves systematically incorporating considerations of sex and gender into the process of reviewing and synthesizing existing research.

In this narrative review we applied SGBA+ in different ways. Firstly, the main aim of this manuscript was to synthesize the evidence on sex and gender related factors, their impacts on alcohol use, and their effects on alcohol use among men and males. Secondly, the search terms captured sex and gender terms such as male(s), men, boy(s), sex differences, gender disparity, fatherhood, *etc.* (see search strategy in **Supplementary Table 1**). The screening criteria were created to ensure the inclusion of studies focusing on sex and gender differences in addition to sex and gender related factors affecting men and males. All authors met weekly for 8 weeks to discuss the findings on alcohol-related risk factors and related health outcomes. A SGBA+ [18, 19] was applied to all included articles, identifying evidence that contributed to building a picture of the sex/gender related factors and interactions affecting males and men. This analytic approach considered both biological sex and socially constructed gen-

der, providing insights into how these factors play a role and interact in shaping the outcomes for this group. Based on discussions, we refined the summaries reflecting the outcomes in the articles—to categorize them according to the sex and gender related factors that impact alcohol use in men. In addition, other intersecting identities and factors such as age, ethnicity, or occupation, were included in our summaries. This information was used to create the recommendations for risk communication. We undertook a narrative summary approach to succinctly synthesize the main findings and implications of the included studies.

### 3. Results

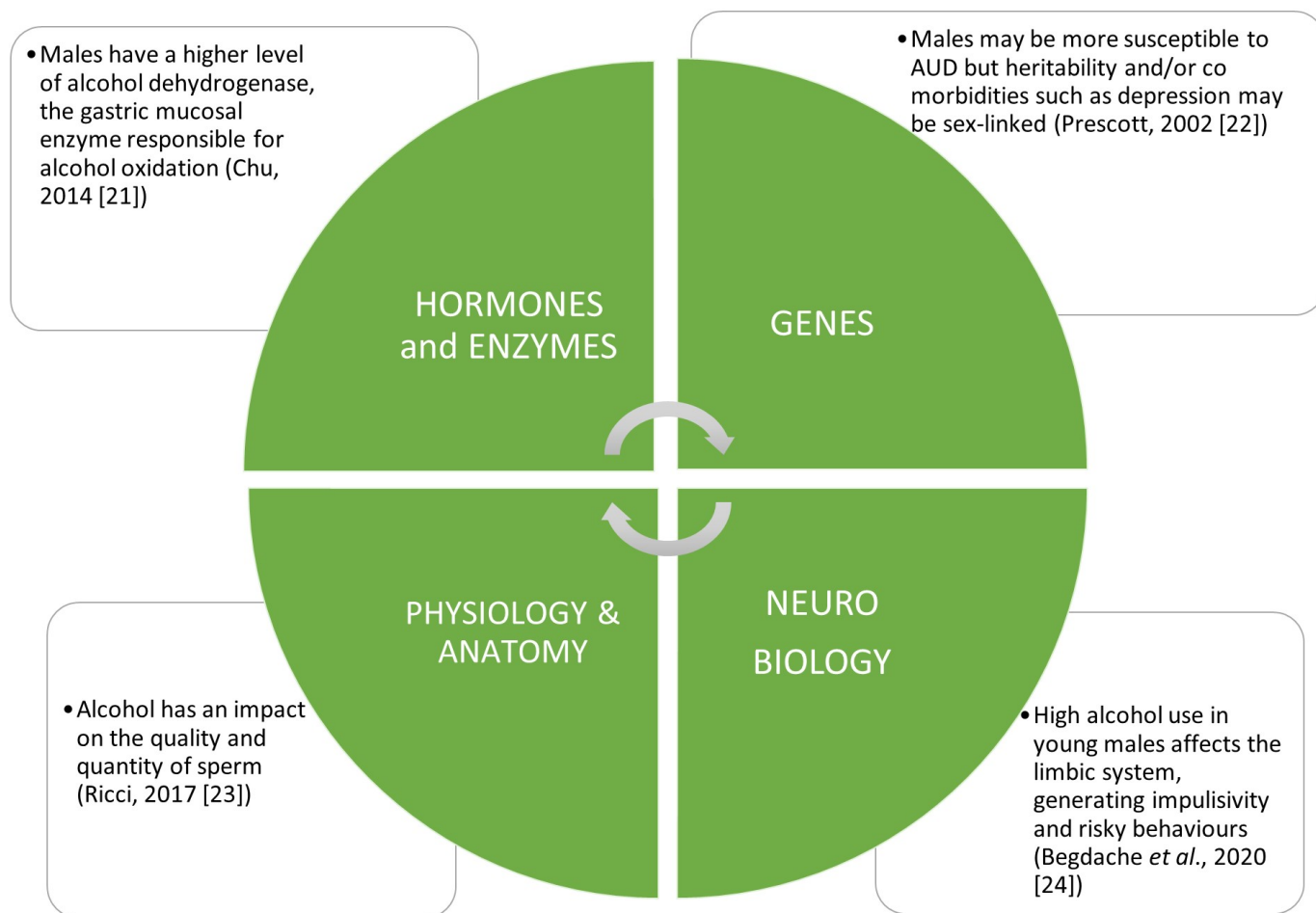
There are myriad ways in which sex, gender and/or sex/gender interactions affect the impact of alcohol on males and men. The findings were divided into sex related factors and gender related factors for analysis. The definitions for these categories are provided at the beginning of each subsection, with illustrative examples displayed in Fig. 1 Sex related factors and Fig. 2 Gender related factors. We used different terms when we referred to sex or gender related factors. We used “male(s)” to refer to individuals with biological traits such as XY chromosomes, higher testosterone levels, and male reproductive organs. The term “men” describes individuals who are exposed to social expectations, roles and behaviors

typically expected of males in a society.

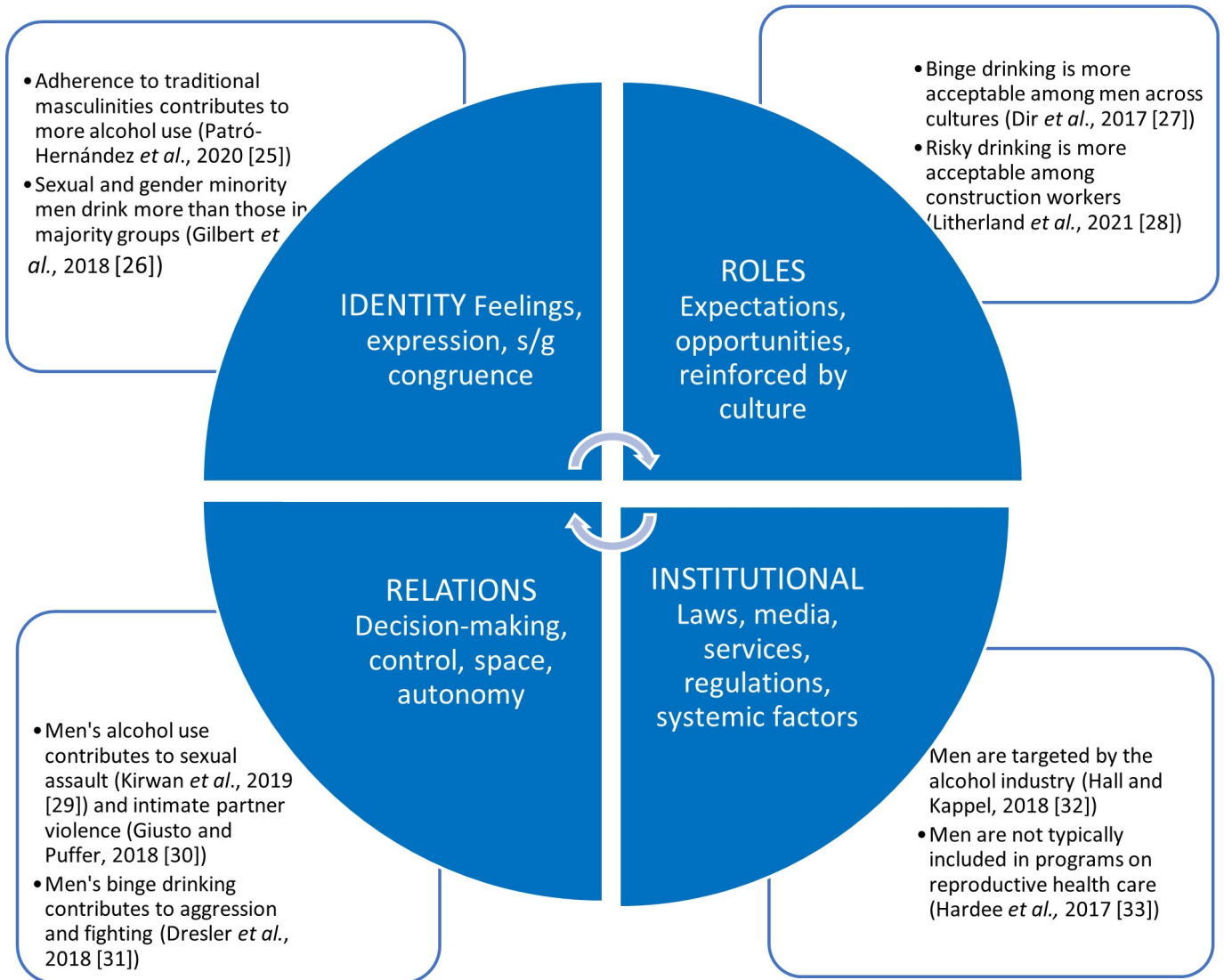
#### 3.1 Key sex related factors affecting male alcohol use

Sex related factors (characteristics such as body weight, water content, organ size, anatomy, genetics, hormones, and processes such as metabolism, pharmacokinetics, pharmacodynamics, neurobiological processes and epigenetics) affect the impact of ingesting alcohol. See Fig. 1 [21–24]. Generally, sex related factors or processes may explain how males are able to tolerate and ingest alcohol more frequently and at higher volumes [34]. A key aspect is that males have highly active and higher levels of the enzyme (alcohol dehydrogenase (ADH)) in the stomach and liver that speed up the metabolism of alcohol and reduce its absorption into the blood stream [20]. The speed of gastric emptying, along with genetic factors, affects this process [35]. Males have a higher first pass metabolism and a greater volume of distribution compared to females [36].

Hormones might also play an important role in understanding the impacts of alcohol. For example, drinking alcohol excessively and persistently can damage the liver and decrease testosterone and increase estrogen levels, which can negatively affect erectile function [13]. Erol *et al.* [37] (2019) reviewed the role of sex hormones in alcohol consumption in both animal and human studies and found a link between higher



**FIGURE 1. Sex related factors.** Adapted from Greaves L *et al.* [20] 2020. References cited in this figure [21–24].



**FIGURE 2. Gender related factors.** Adapted from Greaves L *et al.* [20] 2020. References cited in this figure [25–33].

testosterone and an increased risk of alcohol use and alcohol use disorder (AUD) in males. Further, testosterone exposure in utero increases risk of developing alcohol dependence later in life, suggesting more comprehensive research on sex hormones and alcohol use is required [37].

### 3.1.1 Disease impacts

There are sex-based differences in the pathophysiological effects of alcohol consumption and risk profiles for specific diseases. For example, moderate drinking is associated with atrial fibrillation (AF) in males but not females, whereas heavy drinking is linked to AF in both sexes [38]. Sex specific processes underpinning these outcomes are unknown. For hypertension, males are more likely to experience a linear progression of hypertension, whereas females may experience a slight protective effect of alcohol at lower levels of consumption [39].

### 3.1.2 Cancers

Among non-smoking men, drinking the equivalent of 1 bottle of wine per week increases the absolute lifetime risk of cancer by 1% and the equivalent of 3 bottles per week increases

the risk to 1.9% [11]. While there are many alcohol related cancers—including larynx, mouth, esophagus, colon and liver—gastrointestinal cancers are the most common in men. Emerging evidence indicates that other cancers may also be alcohol-related, such as melanoma, gallbladder, pancreas, lung and of specific interest to men, prostate. A systematic and meta-analysis showed some evidence that alcohol consumption may play a role in fatal prostate cancer risk [9] and the Global Cancer Observatory (2023) found that countries with higher alcohol consumption had higher prostate cancer incidence and mortality [40]. The mechanisms underlying these cancer effects are multiple and unclear, but include genotoxic, hormonal, genetic and inflammatory influences.

### 3.1.3 Liver disease

The development of alcoholic liver cirrhosis and the progression of alcoholic liver disease is affected by sex related factors [8]. Males can consume more alcohol with potentially less damage to the liver, compared to females, even when consuming higher quantities of alcohol [41]. However, men have twice the likelihood of dying from chronic liver disease and cirrhosis compared to women [42].

### 3.1.4 Alcohol use disorders (AUD) & psychiatric comorbidities

For men who develop AUD under age 40 the relative risk of death is 9× population samples—a statistic that could be part of messaging to men [43]. Males experience more symptoms than females when withdrawing from alcohol [44] such as delirium tremens and seizures [6] as estradiol may mitigate neuron damage. Men are more present in treatment settings [1] as stigma and lack of childcare [45] are greater barriers for women and some research indicates that relapse post withdrawal is more common for women, but time to return to heavy drinking is shorter for men [6]. However, relapse among men is often due to social pressure [6]. These patterns reflect a mix of sex and gender related factors, including stress, response to cues, stigma and social isolation [46]. Men have fewer psychiatric comorbidities than women, including anxiety, depression and other mood disorders, less alcohol related morbidity and mortality, but 3× more alcohol related accidents and injuries [2] and other behavioral problems. Men with other psychiatric comorbidity, however, take longer to seek treatment (compared to women) for AUD [47].

### 3.1.5 Genetics and epigenetics

Genes play a role in AUD development. Kendler *et al.* [48] (2016) found sex differences in the etiology of AUD with stronger genetic effects among males than females and stronger externalizing psychopathological pathways to genetic risk to AUD in males [49]. Genetic influences can also affect the selection of peers among men, explaining some of the intergenerational transmission of alcohol problems, while gene-environment interactions can predict alcohol problems for young women [50]. The results of multiple studies suggest there are complex ways in which multiple variables might influence the intergenerational transmission of alcohol use disorders and sex/gender plays an important role in these pathways [50].

Epigenetics offers insights into how genes interact with environmental factors to impact alcohol use and AUD. Seglem *et al.* [51] (2016) estimate that the impact of genetic factors is low to moderate, while the impact of environmental factors is moderate to high. Sex/gender impacts these, with male alcohol use more predominant in young adulthood, and female alcohol use in middle adolescence, but with heritability impacting use more as males age into young adulthood. Preconception alcohol use also has epigenetic impacts on the genetic inheritance of future generations and can lead to AUD in future offspring [52]. Animal studies indicate that future offspring alcohol use can be influenced by alcohol exposure of male predecessors, but more translational work is needed. These studies indicate that the transgenerational genetic impact of alcohol use is transmitted via the male germline [53]. It is not clear yet exactly how transgenerational impacts occur, but Sarkar concludes that males are involved, and can transmit epigenetic changes begun by fetal alcohol exposure during pregnancy to a subsequent generation [53].

### 3.1.6 Neurobiological impacts

Sex-based neurobiological factors affect the impact of alcohol on stress, subjective experiences of alcohol, impairment and overall brain health. Neuroimaging findings indicate that adolescent males who used alcohol or engaged in risky drinking demonstrated larger prefrontal cortex volumes and more frontal activation compared to same-sex healthy controls [54]. In a study on the associations between binge drinking and spatial working memory brain activation, males with adolescent-onset AUD or binge-drinking males had greater frontal activation in response to a spatial working memory task compared to same-sex controls [55].

Experimental studies on sex differences shed some light on potential mechanisms, by measuring the neurobiological effects of different alcohol doses in males and females. Research using arterial spin labeling (ASL) to assess the acute intoxication of gray matter perfusion showed that acute intoxication increased perfusion in bilateral frontal regions in males, but not in females [56]. Begdache *et al.* [23] (2020) found that high alcohol use in young men contributes to brain changes linked to a higher cortical volume in the limbic system that supports impulsivity, generating complex risky behaviours, concluding that, “Collectively, high alcohol use in YM (young men) associates with behaviors and attitudes that reflect the hyperactivity of the limbic system and drug dependence” (p. 3). Findings of neurobiological vulnerability to alcohol use in males were reinforced due to changes in the anterior insula in another experimental study that indicated relationships to both externalizing behaviors and later alcohol use [57].

In a study investigating CRF (corticotropin releasing factor—involved in stress, anxiety and addiction) and its relation to age and sex and alcohol use behaviours, Agoglia *et al.* [58] (2020) note that anxiety contributes to development of AUD, and CRF is a key neurobiological component of that relationship. Sex and age of exposure to alcohol matter as CRF may impact adolescent brain development via brain changes and pruning. In an experiment with humans assessing stress responses and binge drinking, adolescent males with binge drinking histories experienced higher levels of cortisol, and higher blood pressure readings [59]. Kirson *et al.* [60] (2021) have identified the central amygdala, the region where stress and anxiety are processed, as likely where sex differences may be prominent.

Sex related factors affect both subjective and objective experiences of alcohol ingestion including feelings of intoxication and manifest differently in males and females and men and women. A study conducted with healthy social drinkers (0.60 g/kg ethanol for men, 0.55 g/kg for women) found that women reported feeling more intoxicated than men and had lower activity in their anterior cingulate cortex than men [61]. Similarly, in a study on the effects of alcohol in a simulated driving performance, men reported lower levels of subjective intoxication [62].

Alcohol appears to have sex-differential impacts on impairment, measured both subjectively and objectively. An experiment by Miller *et al.* [62] (2009) revealed that men and women respond differently to a single dose of alcohol (0.65 g/kg). Men showed less impairment in the three be-

havioral and cognitive functions important to driving performance: motor coordination, speed of information processing and information-processing.

It is possible that sex-specific neurobiological differences persist post recovery from AUD, influencing ongoing brain health. Evidence from a study that examined drinking history associations with regional white matter volumes in abstinent alcoholic men and women reported differences by sex. Men were more impacted in the corpus callosum while women were additionally impacted in the frontal, temporal, ventricular and corpus callosum regions [63].

In short, there is a wide range of sex related differences and factors affecting males and men with respect to alcohol use, development of AUD and the impacts of various diseases and conditions. There is a rich and varied set of issues yet to be researched and confirmed related to alcohol's effects on men's health, underlining the importance of taking a comprehensive methodological approach in further biological research.

### 3.2 Key gender related factors affecting men and alcohol use

Gender related factors interact with sex related factors to affect men's use and the impacts of alcohol. These dynamics operate in a real-world context of factors and life experiences, often raising fundamental questions about masculinities and men's health behaviours. Gendered influences on men's alcohol use have been identified, including: the impact of trauma and sexual abuse experienced by men as children or adults; peer and subcultural influences affecting norms of heavy drinking for men; and links between depression and anxiety for men and substance use problems. These influences affect gendered risks associated with heavy alcohol use by men, and its negative impact on social relationships, families, partners and children, and levels of aggression. These influences are amplified by intersecting gendered factors such as low income, poverty, indigeneity and occupational categories. They directly affect various aspects of alcohol-related issues including pathways to problems, protective factors, progression, maintenance of use, readiness for treatment, access, retention and treatment outcomes. Despite these factors, there is comparatively little research on the full range of gendered factors affecting sub populations of men, and few men-specific tailored responses and services.

Gender related factors, while temporal and culturally specific, include roles, relations, identities and institutional practices (See Fig. 2). Understandings of gender are changeable, and therefore need continuous examination to inform guidance on alcohol.

#### 3.2.1 Gender norms and roles

Existing gender norms and roles in which girls, boys, women and men are immersed, also affect their norms and behaviours regarding use of, amount of, or intoxication related to alcohol use in a cultural or subgroup context. These roles and expectations regarding masculinities are well established in most cultures and are reinforced through strong socialization processes and media. Prevailing norms may encourage, excuse or tolerate intoxication among boys and men, while

stigma about alcohol use may be directed to women more often than men, and mothers more often than fathers. Gender norms are fluid and shift over time, so it is possible that norms surrounding boys and men's drinking can and will continue to change. A review focused on gender norms and roles examined the evidence between conformity with gender norms and alcohol use and/or abuse in adults [25], finding that conformity to traditional masculine roles (dominance, womanizing, aggressiveness, risk behaviours) is related to greater alcohol use, giving insight into the relationship between dimensions of gender and drinking and their impacts on men and boys. Addressing and modifying gendered beliefs and patterns associated with risk behaviours is a crucial component of communication and prevention efforts.

Gendered expectations about alcohol related behaviour affect modes of drinking, risk, behavioural impacts, aggression, and development of AUD, as well as treatments. In a study examining six cases of males recovering from AUD, Owen-Pugh & Allen (2012) note that psychological treatments must include considerations of trauma in men, male socialization and the under reporting of emotional distress among men [64]. Overall gendered socialization processes contribute to these attitudes. Young children absorb and express gendered views of alcohol use, with girls more likely to identify alcohol use as men's behaviour at age four, compared to boys, but with both boys and girls making this link by age six [65]. These gendered expressions may manifest in a range of ways as children develop. For example, Spanish adolescents report distinctly gendered experiences of drinking in public, with girls being protective of themselves and each other, and offering mutual support for safety reasons, while boys expressing gendered stereotypes about girls who drink, and seeing girls in a predatory context [66].

Gendered expectations regarding roles such as driving, combine with alcohol use to produce differential rates of impaired driving. For example, US data indicate that almost twice as many men drive under the influence of alcohol, compared to women—a pattern particularly true in young adults [67]. Across cultures binge drinking is more acceptable among men, considered masculine, and in some settings actively encouraged [27]. Social situations have more impact on boys' binge drinking than girls. Results from a systematic review indicate that adolescent males drink to enhance positive mood states [27] and that boys exhibit externalized symptoms and unique risk profiles for binge drinking, including sensation seeking and low inhibitions.

A qualitative analysis of risk perceptions and impact on drinking behaviour in New Zealand young people [31] indicated that young men drank more in both private residences and public venues, without counting drinks, eating food, or other mitigation strategies, and inebriation generated "a good story" that was tied to masculine behavioural stereotypes [31]. They were largely unconcerned about safety issues for themselves, but aware that young women were vulnerable in public places and would go to their aid [31]. They generated individualistic plans when drinking, even though the risks they perceived were about random violence and aggression from other males and fighting among young men while inebriated.

McCready (2019) investigated the impact of masculine

norms regarding alcohol use in fraternities, where adherence to such norms facilitates alcohol use [68]. He developed a context level model of both fraternity and individual adherence to masculine norms and found that fraternity level heterosexual norms were positively correlated with alcohol use, as members used alcohol to affirm heterosexuality [68]. Whitley *et al.* [69] (2018) found a positive relationship between conformity to traditional male norms and hazardous drinking. Peralta and Barr (2017) examined gender role orientation in heavy episodic drinking and weight control behaviours [70], finding that those with masculine orientation (men or women) were at higher risk for both of these behaviours, signalling an under acknowledgement of male weight and body image disturbances. They also examined gender role orientation and heavy episodic drinking and found that a masculine orientation was a risk factor [71].

Robertson *et al.* [72] (2020) reported that verbal, physical and relational aggression were linked to alcohol use among a young adult sample of university students in New Zealand, with more aggression among those who drank heavily. Most commonly, verbal and relational aggression were exhibited, and while both men and women used physical aggression, the males were most likely to self-report severe physical aggression.

Leone *et al.* [73] (2022) conducted a laboratory-based study to measure differences in masculine gender role stress (MGRS) which measures the extent to which men feel threatened in their roles as men and its links to sexual aggression. The study probed different scenarios where the man or woman or both were intoxicated, and the perpetration of sexual aggression. Men higher in MGRS who were intoxicated were more likely than sober men to enact sexual aggression when the woman was intoxicated; and less likely than sober men to enact sexual aggression when the woman was sober. These findings suggest that the perpetration of sexual aggression is more likely among men with higher MGRS, when there is concordance in drinking between the man and woman. Sexual aggression prevention efforts for men should target alcohol and also provide men with strategies to cope with MGRS, to deter sexual aggression.

Perrotte *et al.* [74] (2020) investigated the impact of Latino masculine norms to differentiate between positive and negative aspects of masculinity with respect to alcohol use. They conclude that masculinities can also be used to cultivate a safe mode of drinking, once drinking behaviour is established.

This finding and overall recognition of the fluid and changeable notions of adhering to masculine roles offers an indication that links between gender role expectations and alcohol use can be modified, an important consideration in creating communications messaging and content for men.

### 3.2.2 Gender relations

Relationships between people in romantic, sexual, household, work or friendship settings are typically gendered. Couple relationships can significantly influence drinking behaviours, influencing partners to drink more, less, or not at all, whether through coercion, encouragement, or other means. These dynamics are gendered and play a crucial role in substance use patterns, intersecting with other factors such as intimate partner violence, or pregnancy and parenting. Additionally,

other gendered relational factors are important in evaluating risky alcohol use in men, including vulnerability to aggression as victims or perpetrators, and involvement in intimate partner violence (IPV) or sexual assault.

In short, gendered relations are not to be ignored in considering the content and impact of messaging for men and boys surrounding drinking guidelines. Gender relations between men and women can have an impact on alcohol use patterns and behaviours and can be impacted by developmental stage and context. For example, Keenan *et al.* [75] (2015) examined the drinking trajectories in Russian men in qualitative research and determined that younger men react to peer pressure to drink excessively and binge, in response to prevailing masculinities, but for middle-aged men, maturity and family can lead to more moderate approaches to drinking alcohol.

Iwamoto *et al.* [76] (2014) examined fraternity college men in California, who were 60% Asian, 20% Caucasian and 9% Latino, to determine which aspects of masculine norms were related to heavy drinking. Those who exhibited aspects of “playboy” (wanting multiple sexual partners), risk taking, and competitiveness were at higher risk. However, those men who displayed more “heterosexual presentation” and emotional control were less likely to engage in risky drinking, suggesting that masculinities are multi-faceted and need to be addressed accordingly in prevention. Wells *et al.* [77] (2013) found similar results in a survey of Canadian university student sample, reinforcing that adherence to masculine norms was a risk factor in heavy drinking and more negative consequences, but also noting that it could serve as a route and topic in prevention.

Kirwan *et al.* [29] (2019) examined detailed differences between alcohol-involved and nonalcohol-involved assaults among men who were repeat perpetrators of sexual aggression. Eighty US men who self-reported perpetration of two or more sexual assaults (including at least one assault in which the participant was drinking and one assault in which they were sober), were recruited for a within-subjects survey. A variety of differences were observed between nonalcohol and alcohol-involved assaults including the participants’ primary appraisals, secondary appraisals, and the degree of force they used to obtain unwanted sex. During the alcohol-involved assault, perpetrators had more thoughts consistent with having sex, utilized more isolating and controlling behaviors during the incident, and used more force during the assault. While drinking, perpetrators tend to be more dedicated to ensuring that sex will occur through behaviors, appraisals, and the use of force, suggesting how alcohol interferes with appraisals of such situations.

In a Canadian study Kehayes *et al.* [78] (2018) focused on sex differences in the emotional harms experienced by sexually victimized, first year college students when either the perpetrator or victim were drinking. Among the 510 (153 males, 357 females) study participants, similarly high rates of sexual victimization were reported by both men and women. Men who were sexually victimized by someone drinking experienced significantly more anxiety than men who were not so victimized. Perpetrator intoxication during sexual victimization was associated with increased anxiety in both sexes, with an even stronger association observed among

men than women. These authors identify the need for sexual violence prevention interventions for both men and women on college campuses, and supportive interventions need to focus on reducing victims' anxiety. They recommend that preventative interventions should focus on intervening with intoxicated individuals who are potential perpetrators of sexual violence as well as with potential victims.

These relational gender influences on men's alcohol use suggest that settings like schools, colleges and sexual health clinics could be effective for disseminating lower risk alcohol guidelines. Taken together, these studies on the impact of alcohol use on gender relations, including IPV and sexual assault, indicate potential for messaging regarding the impact of men's alcohol use in various contexts, life stages, and on gender equality.

### 3.2.3 Gender identity and sexual orientation

All persons acquire a gender identity, usually in synch with their biological sex. For most males, an identity of being a man is underpinned and supported by prevailing masculinities. Masculine identities and their implications for alcohol use have been well studied. One trait associated with masculine identities is emotional suppression. Berke *et al.* [79] (2020) investigate the mechanisms underlying the link between alcohol use and aggression by focusing on thought suppression of feelings. They found that the suppression of thoughts that do not conform to a masculine identity is an antecedent to alcohol related physical aggression. In an experimental model, masculine qualities such as suppressing emotion and showing physical toughness that support normative masculinities were both linked to alcohol use and aggressive behaviour.

Masculine identities are not all the same, or unidimensional and some elements can be pro-social. Wilkinson *et al.* [80] (2020) provide a nuanced understanding of masculinities in the drinking situation based on interviews with young English men. They indicate that different versions of masculinities can co-exist in the drinking setting, including hypermasculinity based on the exclusion of femininity, along with an inclusive masculinity that involves aspects of femininity such as caring, caretaking, protection and love. They argue that pluralistic versions of masculinity are expressed in the context of drinking with friends. Several researchers have investigated masculinity traits in both men and women, or examined the balance, and found that higher masculine traits are linked to alcohol use, hazardous use, and aggression [81–83]. Emslie *et al.* [84] (2013) examined the meanings of drinking alcohol among middle aged Scottish men using a qualitative approach and determined that some reinforced hegemonic masculinities (such as linking type of drinks with gender, class and economic status), but others were beneficial and health promoting (such as caring, sharing mental health issues, alleviating loneliness and social support). They suggest that male drinking can potentially provide an opportunity for men to express care and relax traditional gendered behaviours for men.

Similarly, Duncan *et al.* [85] (2020) provide an analysis of the place of "care" in Australian men's drinking behaviour to make more complex the presumption of the link between alcohol use and typical aspects of masculine identity (competitiveness, toughness, control, risk taking, misogynistic

and homophobic banter, *etc.*). They note that while drinking together enabled homosocial activity, caring and deeper communications, it was mediated by men's need to maintain control, capacity and agency (autonomy) in such settings, or maintaining self-respect. This can set boundaries between men in terms of caring or preventing drunk driving or becoming inebriated, for example. Masculine caring was expressed indirectly via "looking out" for male friends, or "looking after" them in order to prevent violence, fighting or the victimization of women. The limits on men's caring in alcohol related situations needs more exploration, in order to explain group male behaviour in alcohol related situations.

Other manifestations of masculinities can also reinforce gender differences, and inequities. Willott and Lyons (2012) examined drinking behaviour and masculine gender expression in the context of changing drinking behaviours that include increasing engagement with women and mixed gender groups [86]. They argue that hegemonic masculinity involves differentiation from femininity and gay male identities, but that masculinity is more nuanced in contemporary settings. Their qualitative research reveals masculine identity linked to certain drinks (beer vs. wine), brands (advertised as manly, class specific or feminine) and drinking practices (competitive bingeing in all male groups vs. drinking with food). However, the authors note that male gender identities are becoming more complex in relation to more female drinking and evolving intersecting factors affecting male drinking, such as taste, class, or occupation.

At times, alcohol related aggression is directly linked to preserving a masculine gender identity, often as differentiation from gay men and women. Leone and Parrott investigated masculinities and alcohol use to anti-gay aggression among heterosexual men, particularly the norm of antifemininity common to masculinities [87]. They note that expression of masculine norms is context-dependent, however, reflecting settings such as work, family, home, bars, *etc.* In experimental conditions, they show that anti-gay aggression is activated by alcohol, reinforcing norms of toughness and antifemininity. They suggest prevention programs should focus on traditional masculine norms and the impact of alcohol on anti-gay aggression.

Miller *et al.* [88] investigated the bar context to test relationships between male alcohol related aggressive behaviour, heavy episodic drinking, and masculinity norms among Australian young men. They found that episodic drinking and "male honour" (a norm reflecting the need to be tough and protective of masculine identity) were linked to alcohol related aggression in the bar context.

Generally, individuals in sexual minority groups (based on sexual orientation) or gender minority groups (based on gender identity) tend to consume more alcohol compared to those in majority groups. However, many studies face limitations due to reliance on non-representative samples, and other methodological issues [26, 89]. Various sexual orientation groups such as heterosexual, homosexual (gay or lesbian), or bisexual individuals may align with different aspects of femininity or masculinity while experiencing sexual attraction to same sex persons. In a systematic review of 44 studies on alcohol use and related harms among transgender and other



gender minority populations, Gilbert *et al.* [26] (2018) found that despite the methodological limitations, there is a high prevalence of binge drinking among trans populations with important implications for public health for tailoring interventions. In a study conducted with cisgender women, cisgender men, transgender women, transgender men, and people with nonbinary/other identities from the 2018 Global Drug Survey (GDS), transgender men were more likely to use and become dependent on alcohol, compared to cisgender women [90] and transgender and non-binary respondents were more likely to want help with reducing their use of alcohol [91].

Kiekens *et al.* [92] (2022) examined alcohol use and patterns of relationship experiences, sexual and physical dating violence, and sexual and physical assault among sexual and gender minority adolescents using data from the USA based LGBTQ National Teen Survey (N = 12,534) and found that gay and lesbian adolescents tend to consume alcohol more frequently compared to asexual, questioning, and those reporting “other”. Heterosexual adolescents have higher rates of heavy episodic drinking than gay and lesbian adolescents, while asexual and those with “other” sexual identities have lower rates. The authors emphasize the relevance of dating violence, sexual harassment and assault that might explain disparities in alcohol use and see benefits of programs that support sexual and gender minority youth by focusing on relationships, along with mitigating alcohol use.

### 3.2.4 Gendered institutional impacts

Policies, laws, regulations and cultural prohibitions that are gendered affect all gender groups, including men. For example: alcohol policies allowing advertising or relaxed labelling; cultural and religious norms prohibiting alcohol use; regulations regarding age guidelines for purchase all have differential impacts on men and women, boys and girls. While most institutional gender disadvantages women, there are gendered institutional aspects that negatively affect men and boys. Notably, the media are key players in exemplifying and reinforcing masculinities. Towns *et al.* [93] (2012) examined the thematic content of alcohol advertising to determine descriptions of gender relations, finding that alcohol advertising reinforced women as “other” to heterosexual men, cast as either sexual objects or, if a wife or girlfriend, nagging “bitches”. These characterizations exclude women from the masculine world and reinforce traditional masculinities. They speculate that these themes are negative reinforcers of objectification and gender inequality and are similar to attitudes underlying domestic violence.

Atkinson *et al.* [94] (2012) identify how alcohol-related behaviours of males and females are differentially depicted in magazines targeted at a UK teen male readership, compare to those aimed at teen women. Males are depicted as frequent drinkers, as drinking beer, largely in pubs, and as part of drinking practices connected to sports fandom, and alcohol use depicted as an important aspect of male friendship, bonding and normative masculinity. The magazines construct and reproduce differential expectations about men’s and women’s alcohol use and behaviours. In the US, Hall and Kappel (2018) examined 77 alcohol commercials for their portrayal of gender and found gendered representations of men and

women increasingly stereotypical and rigid [32]. They describe constructions of masculinity that show male bonding, association with sporting events, male power over nature and women, hyper-sexualization and trivialization of women. Alcohol advertisements continue to portray gender-specific and sexist messages about social life, that affect the maintenance of masculinity and masculine drinking behaviours and show men and women “typed and boxed with their roles clearly defined and exaggerated in the context of consuming alcohol” [32] (p. 581).

Certain occupational categories also heighten the impacts of hegemonic masculinities and links to alcohol use. For example, Litherland *et al.* [28] (2021) studied Australian men in the construction industry, to probe the relationships between heavy episodic drinking, barroom aggression, personality and male norms. They found that personality variables and heavy drinking were a predictor of barroom aggression. However, they questioned the utility of applying masculine norms derived in USA college student populations for predicting alcohol related aggression in Australian construction workers, reinforcing that understanding of masculinities is often a subcultural phenomenon. In an analysis of US data, Bush and Lipari report that the highest rates of heavy use of alcohol were in the mining and construction industries, both male dominated occupational settings [59].

### 3.2.5 Impacts of men's alcohol use on reproductive health

There are 8 domains of men’s reproductive health that impact health and well-being [95] including involvement in planned and wanted pregnancies, biologic, genetic and epigenetic contributions, men’s reproductive health practices and support for maternal health, their mental health, and overall social determinants. Alcohol use has an impact on all of these areas, from preconception to fathering practices, including the impact of sex and gender related factors on alcohol’s effect on semen quality to alcohol’s effect on fathering styles and intergenerational transmission of vulnerability to alcohol use disorder. The scope for extending research interest and health promotion messaging on alcohol, men and reproductive issues is vast.

Male fertility is affected by excessive alcohol use as ethanol consumption may induce cellular damage [96] linked to inflammation, oxidative stress, genotoxicity and apoptosis. Both animal and human studies on paternal alcohol consumption indicate effects similar to that of direct alcohol consumption such as low birth weight, altered hormonal regulation and nervous system anomalies, resulting from alcohol’s effects on reproductive hormonal regulation, semen quality and regulation of gene expression. Alcohol intake is associated with impairment of most semen characteristics and a hormonal shift towards higher estradiol/testosterone ratio [97]. Higher levels of habitual alcohol consumption are correlated with lower sperm concentration, reduced total sperm count, and a decreased percentage of sperm with normal morphology; and alcohol consumption is linked to changes in testosterone and SHBG levels [98].

Paternal alcohol consumption during preconception or during pregnancy also has an impact on maternal health and

alcohol consumption during pregnancy, and on fetal and infant health outcomes. The effects of paternal preconception alcohol consumption on several fetal/infant health indicators, include spontaneous abortion and acute lymphoblastic leukemia at high-level use (without maternal use); ventricle malformation with daily use; and low birth weight and low gestational age with low and moderate paternal preconception alcohol use [14]. Terracina *et al.* [99] (2022) identified the role of paternal preconception alcohol consumption (PPAC) in Fetal Alcohol Spectrum Disorder finding effects on sperm function, eliciting oxidative stress. In newborns, PPAC may induce changes in behavior, cognitive functions, and emotional responses. Neurobiological studies on PPAC have disclosed changes in brain function and structure by disrupting the growth factors pathways. In animal model studies, PPAC alters brain nerve growth factor and brain derived neurotrophic factor synthesis and release [99]. As the research evolves, it points to a toxic impact of paternal alcohol use on fetal/infant health.

Kotelchuck (2022) notes that: “Heavy paternal alcohol intake has long been known to impact reproductive and child’s health and developmental outcomes” [95, 100]. Various studies indicate the ongoing negative impact of paternal alcoholism on children’s emotional health [101], criminal behaviours and later AUD among sons [102], on academic achievement and subsequent substance use [103] and total and alcohol related mortality in adult sons [104, 105].

### 3.2.6 Sex, gender and intersecting factors

While it is crucial to separate sex and gender related factors in discovery research, various factors and characteristics intersect with sex + gender to create outcomes for men in real life, such as race/ethnicity, education, socioeconomic status (SES) and age, to create differential patterns and impacts of men’s alcohol use. For example, heavy episodic drinking among US young adults is moderated by race and gender, with White males more likely to engage in this form of alcohol use, and Black adults less so, with femininity norms moderating these behaviours [106]. Among alcohol-dependent male and female Black and White adults in the US, the moderating impact of education on health outcomes is more pronounced among Black adults [107].

Risks and impacts of alcohol use by men shift with age [108] with injuries making up a larger share of impact for men, than for women. Injuries account for the majority of alcohol related disability adjusted life years (DALYs) in 2020 for males in the 15-39 age group (transport related injuries 25.9%, self-harm 11.7%, and interpersonal violence injuries 12.4%). For 40–64-year-olds, health impacts shifted to chronic health conditions, including cardiovascular disease and cancer. Ischemic heart disease comprised 24.1% of alcohol related DALYs among males in that age group in addition to the burden of injuries. Among those over 65 the major causes of disease burden are cardiovascular diseases: indeed, in 2020, ischemic heart disease was responsible for 31.5% of all alcohol related DALYs among males.

SES and occupation are also important factors in evaluating the impact of alcohol on men. Probst *et al.* [109] (2015) investigated socioeconomic inequality and related gender differences in alcohol-attributable mortality finding that

such mortality disproportionately affects individuals with low SES. Significant gender disparities were observed based on occupation with male-dominated low SES occupations being more closely associated with risky drinking cultures compared to female-dominated occupations within the same SES [104]. Matheson *et al.* [110] (2012) also investigated the association between gender, neighbourhood deprivation and weekly drinking in a sample of 93,457 Canadians from the Canadian Community Health Survey. Findings from multilevel analysis showed a U-shaped curve between neighbourhood deprivation and drinking, but only for men. Men living in the poorest neighbourhoods drank more weekly (8.5 drinks) than men living in neighbourhoods of wealthy (4.5 drinks) and mid-range deprivation (3.7 drinks). In a 2017 report analyzing Canadian data, Canadian Institute for Health Information (CIHI) reported that alcohol use is responsible for more hospital visits than heart attacks on an annual basis, with men having higher rates of hospitalization for alcohol compared to women. However, these results are neighbourhood dependent, with lowincome neighborhoods being the context for more alcohol related hospitalizations [111].

Sex/gender intersects in other ways. The connection between intimate partner violence (IPV) and men’s alcohol use illustrates another intersection as most survivors of IPV are women and most perpetrators men, and IPV is often first experienced during pregnancy [112]. In this example, gender relations have an impact on reproductive processes, with health impacts on women’s and fetal health.

Clearly, multiple factors of disadvantage and/or negative social processes intersect and amplify the risk for alcohol use, and its negative health effects among men and boys, along with impacts on women and children.

## 4. Discussion

Evidence suggests that sex and gender related information is pertinent in assessing the impact of alcohol on males and men, and specific sex/gender related information could improve knowledge mobilization with respect to men’s alcohol use.

Much of the evidence indicates that men and males experience sex/gender related health issues suggesting the need for a gendered focus on policies and services related to men’s health. One area of importance is health promotion messages and initiatives. The challenge for public health and primary care is to collaborate in addressing risk-taking behaviours among men through targeted prevention efforts and culturally geared educational messages designed to promote healthy lifestyles.

Intersectional and context-specific evidence affirms a need, and provides an opportunity, to tailor messaging and interventions to specific sub populations of men and boys and sexual and gender minority groups. Alcohol preventive measures for groups such as men with low SES, college age, or have that familial risk for alcohol-attributable mortality are needed. Occupation-specific or context specific drinking cultures are a strong starting point for effective measures and messaging to reduce alcohol attributable mortality in men. Health services for reproductive health care and preconception health knowledge are a key source of information on the impacts of alcohol use, but men are often overlooked in this context. An

ongoing preoccupation with women's role in pregnancy and alcohol has masked the need for health promotion and research on men's alcohol and reproduction, ignoring of the impact of men's alcohol use on their roles as partners and parents, and leaving the emphasis (and stigma associated with alcohol use during pregnancy and parenting), on women. Services and messages that address gender and alcohol use, couple dynamics, help-seeking, and gender equity are often scarce during this period. However, they are crucial for advancing knowledge and understanding about alcohol use.

There are health promotion initiatives directed to men in related areas that are useful guides. These programs have integrated a gender-sensitive focus (*e.g.*, considering masculinities, masculine roles, *etc.*) in their design and delivery to enhance acceptability to men. Botttorff, Oliffe *et al.* [113] (2019) report on the implementation of community-based, gender-sensitized smoking cessation programming directed to fathers (Dads in Gear), attributing its success to the integration of smoking cessation with building competencies in fathering and physical activity [113]. They further tailored the Dads in Gear approach for Indigenous fathers, including activities that enabled discussion about Indigenous men's aspirations as fathers, along with cultural expectations of Indigenous men in the current context [114]. Gender specific mental health promotion programming for men has used sports and team-based activities to foster receptivity to mental health messages and have created safe spaces in community (with male facilitators) to normalize discussions of health and illness [115]. Goodyear *et al.* [116] (2023) discuss the importance of dual focused approaches regarding messaging on alcohol: inviting conversation about how alcohol and other substances are used when having sex, and making such conversations sex-positive and promoting of safe sex. Overall, Oliffe *et al.* [117] (2020) describe a rapid growth in community-based men's health promotion programming and offer lessons learned, including the importance of addressing the social determinants of health, including activity-based programming and integrating content to advance men's health literacy.

Some general areas for the development of lower risk drinking guidance might include (a) Sex-specific health information, (b) Alcohol's impact on men's reproductive processes, including fathering, (c) Gendered messaging, addressing links between alcohol and masculinities, (d) Real world messaging, reflecting the experiences of men in occupational contexts, and bar/pub contexts, social settings, and family life and (e) Gender transformative messaging addressing masculinities, fathering, couple dynamics and gender equality.

#### 4.1 Sex-specific information and messages

Males and men need to be aware of the impacts of drinking alcohol when deciding on the amount and frequency of alcohol use. Sex and gender interact to create more risk of higher volume and more frequent drinking among boys and men, particularly in contexts where drinking is encouraged or normalized. Information is needed that clearly spells out the sex related risks for males, as distinguished from gender related information applicable to men's health. The messages that need to be disseminated include how males process alcohol ef-

ficiently due to active gastric enzymes (ADH), male hormones, higher average body weight and larger organ size, resulting in propensity and tolerance for higher volume and frequent drinking and potential for AUD among men. In addition, males and men need to know that cancer is an alcohol related risk as such awareness may be key to alcohol decision making, and that alcohol use increases the risk of a range of numerous cancers including possible linkages to prostate cancer, and that risky drinking increases injuries and accidents, and alcohol use is implicated in violence, aggression and assault.

#### 4.2 Alcohol's impact on male reproductive processes, including fathering

Messaging about the role of alcohol in male reproduction should be made more prominent in the interests of men's health, child health and gender equity. It would be useful to routinely include men in preconception and reproductive planning as individuals or as part of couples, to communicate better to males (and females) about the impact of alcohol use in men on all aspects of the reproductive cycle. There has been exploration of appeals to fathers in tobacco reduction that could be applied to alcohol use reduction [113, 118, 119], as well as in gender transformative international work focusing on equality in caring work by men [120]. Key messages include explicating how alcohol use affects sperm quality and may affect male fertility, how fathers' alcohol use has a direct impact on fathering, child development and adolescent substance use patterns and how such impacts of men's alcohol use may be intergenerational, including genetic transmission of vulnerability to alcohol use disorder.

#### 4.3 Gendered messaging addressing links between alcohol and masculinities

Messaging to address alcohol use and masculine identities, male gender norms and behaviours could foster awareness on the impacts of gender norms on men's drinking and undermine prevailing understandings of masculinities with respect to alcohol use. For example, links between frequent, high volume or binge drinking and masculine social relations, and between alcohol industry advertising and men's drinking choices, products, styles and behaviour, and between men's drinking practices and attitudes toward women and gay men could all be explored in health promotion. Also worth exploring are the potential for male socialization without alcohol, developing skills for intervening in impaired driving or aggression among peers influenced by alcohol, a critical analysis of and resistance to alcohol advertising, and the links between violence against women and men's drinking.

#### 4.4 Real world messaging

Messages could link more positive drinking patterns for men to social locations, age groups, social class and culturally specific settings, by exploiting values such as caring and friendship. These could be tailored to male dominated contexts, such as fraternities, occupational settings, pubs and bars. For example, it is important to create messages to reduce vulnerability to risky drinking in subcultures such as fraternities, parties,

military or college settings, and to resist or replace alcohol use in male oriented occupations such as construction or mining.

As men enter into family relationships or fathering roles, messages to reduce alcohol use could focus on caring and fathering, and as men age, messages could be developed about the impact of alcohol use on chronic diseases, to encourage alcohol reduction.

#### 4.5 Gender transformative messaging

Gender transformative approaches to health and health promotion seek to redress gender inequities and improve health by transforming harmful gender norms, roles and relationships while working towards redistributing power and resources [121]. Gender transformative messaging would attempt to generate both gender equity and reduce alcohol use at the same time. It is clearly warranted in responding to men's alcohol use to address and change understandings of masculine identities to reduce or mitigate alcohol use among men, along with reducing misogyny and homophobia. Such messaging would change the positioning of masculinity as hypermasculine based on being "not feminine" or "gay" and integrate notions of gender equity into alcohol messaging, such as awareness of the impact of men's alcohol use on women. Addressing alcohol use and its impacts on sexual assault and IPV would also enhance gender equity. Similarly, improving men's media literacy in order to critique alcohol advertising aimed at men and boys may shift boys' and men's relationship to drinking norms and provide another opportunity for improving gender equity. For example, some messages could include how being a good father involves reducing alcohol use and sharing care, how men's alcohol abstinence can improve fertility, sperm health and conception, and how men can join pregnant women in alcohol reduction as a key way to share responsibility for family health. Overall, messages that delink heavy drinking and masculinity, or as a differentiation from femininity are warranted, as are messages that encourage men to intervene to reduce women's risk of sexual assault and IPV in drinking settings.

### 5. Conclusions

It is important that health promotion and advice on lower risk drinking consider sex and gender, and tailor advice for males and diverse groups of men, based on available evidence that reports on sex and gender related factors and sex-gender interactions. While much of the research reviewed here often focuses on sex differences, it is but one form of sex and gender science (and a somewhat limited paradigm) [15], that while important in signaling issues for further research, does not typically seek to understand underlying processes and mechanisms. It is important to generate research that identifies the aspects of sex/gender under study and their underlying mechanisms to underpin specific messaging and advice regarding men's alcohol consumption.

Nevertheless, the review indicates numerous opportunities for communicating alcohol-related risk to men, boys and males that include gender-specific and sex-specific themes and information designed for various subpopulations, cultural contexts,

and settings. A key issue for men's health is the de-linking of alcohol use from masculine gender identities and undermining gendered messages about the links between masculinity and alcohol use (especially high use, binge drinking and drinking to intoxication). It is also important to address male health and the detrimental impacts of alcohol on cancers and reproductive health, both largely ignored to date in health promotion.

Ultimately, it is time to generate gender transformative messages that link safer drinking practices to changing gender norms and expectations, and link improving men's health to attitudes and practices that support gender equity. For example, creating opportunities for preconception interventions where discussions about alcohol guidelines are routinely incorporated, and providing support to enhance understanding and confidence in making changes in alcohol consumption, while clearly important for women [122, 123] is also important for men and all gender groups. Despite the impacts of paternal alcohol use on children and families through IPV, child maltreatment and intergenerational impact, especially when strong patriarchal norms are at play, there have been relatively few programmatic interventions [30]. The over concentration and stigmatization of pregnant women and mothers who use alcohol distracts us from paying attention to men who are expectant fathers, parents or in relationships with women [124].

Gendered relations can be actively addressed in prevention efforts by eroding rigid masculine roles and predominant views of masculinity, and introducing gender transformative ideas that aim to reduce gender inequality. Key areas of focus include examining masculine behaviours and gender roles regarding managing conflicts, distributing responsibilities, parenting, communication, offering emotional support, fostering emotional closeness, ensuring sexual fulfillment, addressing alcohol and drug use, promoting self-care, cultivating acceptance, and help-seeking [125].

While males/men have historically been the standard research subjects (constituting the "male norm") to whom women have been compared, there is a large need for understanding the sex/gender related processes underpinning alcohol's impacts on men and male health, and tailoring health promotion accordingly. But males/men have not been scrutinized as often with a SGBA+ as have females/women, resulting in the many gaps in both evidence and health promotion regarding alcohol use as reflected in this review.

### 6. Limitations

While we employed a systematic approach to conducting the search, our coverage of included articles may not have been exhaustive. We did not evaluate the quality of the included studies, as our primary objective in this review was to provide an overview of the evidence on sex and gender related factors influencing alcohol use and its effects in men.

In addition, this review does not cover the impact of COVID-19 on shifts in alcohol use among males and men. Increases in use during the pandemic may surface different aspects of the impact on health and well-being and may merit different messaging [126].

Further, the research evidence we reviewed was commonly based on a sex differences paradigm, typically noting where

males/men differ from females/women, and therefore does not always illuminate the dynamics or mechanisms at play within male bodies or among men. The overall lack of reporting of SGBA+ in published journal articles, despite the SAGER guidance [127] continues to inhibit our understanding of overall health, gaps and omissions science, and specific impacts on men (or women or gender diverse individuals). Finally, the lack of focus on men and men's health, particularly on the impacts of men's alcohol use on reproductive health and parenting, perpetuate an ongoing gap in health promotion and care.

Overall, this review has identified numerous sex and/or gender related factors that affect alcohol use and its impacts on males and men. In the short term, we suggest linking these factors to risk communications and health promotion messaging designed for men and males to support lower-risk drinking among men. In the mid and long term, incorporating a sex and gender differentiated approach to research and reporting is essential, to advance our collective understanding of how alcohol use affects men, women and all gender groups. Such efforts will assist in tailoring further guidance for men and boys and contribute to better health for all.

## AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article.

## AUTHOR CONTRIBUTIONS

LG and NP—conceptualized the article, funding acquisition. LG, ACB and NP—methodology, writing; data analysis, curation and summary. All authors have read and agreed to the published version of the manuscript.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at <https://oss.jomh.org/>

[files/article/1851499811110305792/attachment/Supplementary%20material.docx](https://oss.jomh.org/files/article/1851499811110305792/attachment/Supplementary%20material.docx).

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