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Young people's alcohol use in and around water: A scoping review of the literature

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Abstract

Issues: The surrounding social and commercial context, including alcohol advertising, heavily influences alcohol consumption. Alcohol use is a major risk factor for both fatal and non-fatal drowning, particularly for young people.

Approach: We conducted a scoping review to explore the peer-reviewed literature on the use of alcohol by young people (aged 15–34 years) in the context of aquatic environments. Five electronic academic databases were searched for English-language studies conducted in high-income countries and published in the last 15 years (since 2008). The MetaQAT framework was used to assess methodological quality of included studies.

Key Findings: The review included a total of 24 studies, including those addressing the prevalence of and/or risk factors for alcohol use in aquatic environments among young people ($n = 13$); the epidemiology of alcohol-related unintentional drowning in young people ($n = 9$); and interventions to reduce alcohol-related harm around water ($n = 3$). Findings suggest that young people commonly consume alcohol around water, particularly young men. We found multiple influences on this behaviour, including the perception of risk, location of aquatic activity and presence of others, particularly peers.

Implications: Understanding the literature addressing alcohol use around water among young people will assist in identifying and setting priorities for drowning prevention, including the need to mitigate the effects of alcohol advertising which promotes drinking in and around water.

Conclusion: There is a clear imperative to address the use of alcohol by young people in aquatic environments. These findings have key implications for public health policy, advocacy and practice.

KEYWORDS

drowning, policy, risk factors, water, young adult

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1 | INTRODUCTION

Alcohol use is heavily influenced by the social and commercial context in which it takes place [1]. Among young people in particular, social context has been identified as the strongest influence on alcohol initiation and consumption [2]. Research also increasingly recognises commercial interests as a major influence on alcohol consumption [1]. The alcohol industry has been shown to use many strategies to protect and enhance its commercial interests, shifting the blame from manufacturing and promoting alcohol products to those who consume them [3]. These strategies have enabled the alcohol industry to influence health policymaking, including the promotion of 'responsible drinking', and have contributed to a perception of the alcohol industry as less harmful than other industries [1]. In turn, fewer restrictions have been placed on the marketing and promotion of alcohol products than other harmful products such as tobacco.

Alcohol advertising and promotion shape social norms [4], and are associated with earlier initiation and higher consumption of alcohol, especially among young people [5]. One context in which this is particularly problematic is the use of alcohol in aquatic environments, with advertising frequently promoting alcohol use in and around water [6]. While this marketing may not specifically target young people [7], the evidence suggests that young adults are regularly exposed to this advertising [8] and find it engaging and attractive [9]. Recent literature has described the concept of 'aquatic alcogenic environments', whereby alcohol use in aquatic environments is normalised through various elements including advertising, social influences and peer behaviours [6, 10]. Aquatic alcogenic environments may be particularly influential among young people and have been linked to heavy and harmful alcohol consumption [11].

The use of alcohol in aquatic environments is a strong risk factor for injury, including fatal and non-fatal drowning [6, 10, 12]. Young males, in particular, are at increased risk, and are more likely to underestimate the risks of consuming alcohol around water [13]. In Australia from 2022 to 2023, 30 young people (aged 15–24 years) died by drowning, representing 11% of all drowning cases in Australia [14]. More than three-quarters of drowning deaths were in males, and 47% of fatal drownings occurred during swimming and recreational activities. Around one-quarter of fatal drownings per year are known to involve alcohol at levels above 0.05 g/100 mL or 0.05% blood alcohol concentration (BAC) [15].

Much of the cross-sectional and qualitative research in drowning prevention, particularly concerning alcohol use, has focused on individual risk perception and

behaviours. Risk-taking is complex and influenced by structural and cultural forces [16]. In the case of alcohol use around water, risk practices are influenced by the wider social environment, including normative assumptions around alcohol use [10], the social and peer context [2, 6], and commercial determinants such as marketing and advertising [1]. Gaining a better understanding of the factors that influence young people's alcohol use in aquatic environments, including the commercial activities that shape the alcogenic environment in which young people recreate [6], will have important consequences for future health promotion advocacy and policy efforts.

While previous research has investigated the role of alcohol in fatal and non-fatal drowning, to our knowledge there has not yet been any synthesis of this literature, particularly as it relates to young people. This scoping review aimed to summarise the literature on young people's use of alcohol in recreational aquatic environments, to inform further policy and advocacy efforts.

2 | METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses—Scoping Review (PRISMA-ScR) guidelines [17] and the Arksey and O'Malley methodological framework [18] guided this review. The scoping review was registered on the Open Science Framework (DOI: <http://10.17605/OSF.IO/QBZ2N>; URL: osf.io/qbz2n/).

2.1 | Search strategy

The Population, Exposure, Outcome framework aligned the search strategy with the research question. We defined the population as young people aged between 15 and 34 years, and the exposure as alcohol use in or around recreational aquatic environments (that is, those environments in which young people spend their leisure time and excluding employment and water transport-related environments). The outcome was defined as unintentional fatal or non-fatal drowning or studies aiming to understand alcohol use in aquatic environments or to evaluate interventions to reduce alcohol-related harm around water.

To identify relevant papers, we searched five electronic databases (Scopus, PubMed, Web of Science, SportDISCUS and CINAHL Ultimate). The final search strategies (i.e., keywords used) are presented in Table S1, Supporting Information. The reference lists of included articles were also hand-searched for potentially relevant studies. All searches were conducted in February and March 2023.

2.2 | Eligibility criteria

To be included, studies needed to provide information about any aspect of alcohol use by young people in recreational aquatic environments. In addition, all studies had to meet the following inclusion criteria: peer-reviewed; published in English between 2008 and 2023; conducted in a high-income country (as defined by the World Bank Atlas method [19]); with full-text available. Results were restricted to high-income countries in an attempt to minimise the differences in the context of drowning between high-income countries (where water use is typically recreational) and low-to-middle income countries (where water is mostly encountered occupationally or as part of daily life) [20, 21], as well as differences in the determinants of health between high- and low-to-middle income countries [22]. We recognise that inequities may still exist within and between high-income countries. All aquatic environments were included, such as rivers, lakes, coastal locations and swimming pools (public and private). To align with the age groupings used in relevant cross-sectional (e.g., [23, 24]) and epidemiological studies (e.g., [13, 25]), 'young people' were defined as those aged between 15 and 34 years; studies that investigated wider populations were included where results pertaining to this age group (or a portion thereof) were reported separately. Both original research and review articles were included.

Studies were excluded if they investigated intentional drowning (i.e., suicide, self-injury or homicide) or non-recreational (e.g., employment and water transport-related) environments.

2.3 | Study selection

The web-tool Rayyan.AI [26] was used to support the selection and screening process. After removing duplicates, all articles were screened by title and abstract by a research assistant. A second reviewer (author RNC) randomly reviewed 10% of the articles to identify inconsistencies. The full text of those studies which met inclusion criteria at this first stage was then screened by the same two researchers, with any conflicts resolved by discussion (Figure 1).

2.4 | Quality assessment

All included studies were appraised for study quality by one author (RNC) using a checklist created using the MetaQAT framework [27]. This checklist has been used in other reviews (e.g., [28]). The MetaQAT was designed specifically to assess public health studies across various study designs. A random sample of 20% of the studies

was reviewed by a second author (JL) to identify any inconsistencies, with conflicts resolved by discussion. The MetaQAT assesses study quality on nine criteria across four domains: relevancy (1 criteria); reliability (3 criteria); validity (4 criteria); and applicability (1 criteria) [27]. While the original MetaQAT does not use a numerical scoring system, instead using an overall judgement for each criterion and domain, we used a three-point scale for scoring each criterion ranging from 0 to 2, whereby 0 = criteria not met, 1 = unclear and 2 = criteria met, for a maximum score of 18. Studies scoring ≤ 9 were categorised as low quality, 10–14 medium quality and scores ≥ 15 high quality [28]. These scores and the appraisal process provide evidence for the applicability of included studies for public health policy and practice.

2.5 | Data extraction and synthesis

One author (RNC) undertook data extraction using a form designed for this review. A sample of extracted data (20%) was counter-checked by a second author (JL). Extracted information included citation details, study aim, study design, study setting and population, sampling method and sample size, data collection methods, main findings, limitations and implications.

To aid the interpretation and synthesis of this extracted data, the main objective/s of each included study was identified and grouped into one (or more) of three broad categories for reporting. The results from the included studies were then summarised within these three broad objectives using narrative synthesis [29]. We also summarised the self-reported limitations and implications of the included studies.

3 | RESULTS

3.1 | Search results

A total of 842 articles were initially identified and 307 duplicates removed (Figure 1). After title and abstract screening, 454 irrelevant studies were excluded. Full-text review of the remaining 81 papers excluded 62 papers that did not meet inclusion criteria. An additional five studies were identified during manual reference list searches of the remaining studies, resulting in 24 included studies. MetaQAT scores for these studies ranged from 10 to 17; 11 studies were categorised as high quality and 13 as medium quality (see Table S2, Supporting Information). All studies addressed a topic which was relevant to the research question, and most had a clearly presented aim and/or rationale with clear implications for public health

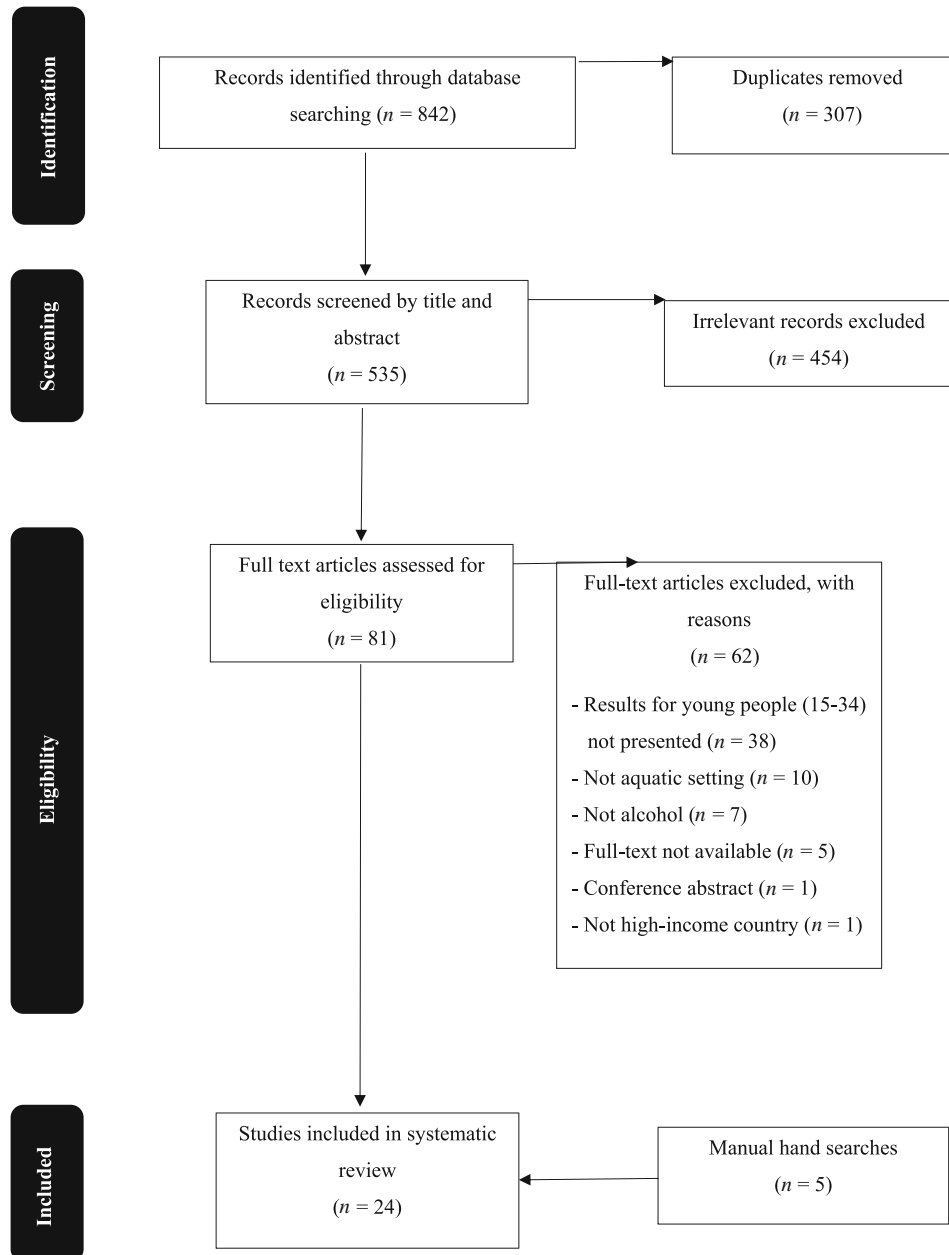


FIGURE 1 Flow chart of selection of papers included in the scoping review.

practice. The most common methodological flaws were the failure to control for confounding factors in analyses and unclear description of the research methodology.

3.2 | Study characteristics

The included studies addressed various aspects of young people's alcohol use in recreational aquatic environments. Thirteen studies investigated the prevalence and risk factors (e.g., gender, age, location) of alcohol use by young people in aquatic environments (Table 1); nine addressed the epidemiology of alcohol-related unintentional drowning (Table 2);

and three studies reviewed and/or evaluated interventions to reduce alcohol-related harm in aquatic environments (Table 3). The text below focuses on a synthesis of the findings under each of these objectives, with findings of individual studies detailed in Tables 1–3.

3.3 | Prevalence and risk factors of alcohol use by young people in aquatic environments

The studies addressing this objective explored young adults' knowledge, attitudes and behaviours about

TABLE 1 Studies investigating the prevalence and risk factors of alcohol use by young people in aquatic environments.

Author; year; aim; location	Study design; data collection method; ethical approval	Sample; sampling method	Main findings	Implications for intervention
<p><i>Author:</i> Abercromby [10] <i>Year:</i> 2021 <i>Aim:</i> To explore young people's knowledge, attitudes and behaviours regarding alcohol consumption and participation in aquatic activities. <i>Location:</i> Perth, WA, Australia.</p>	<p><i>Study design:</i> Qualitative. <i>Data collection method:</i> Semi-structured focus groups. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 41 participants aged 18–24 (mode = 20). Males 16; Females 25. 85.4% Australian-born. <i>Sampling method:</i> Purposive snowball sampling.</p>	<ul style="list-style-type: none"> • 24 participants had consumed alcohol while participating in water-based activities in last 12 months. Consuming alcohol around water was most common in pool and ocean activities. Mixing alcohol with water-based activities was also common on national holidays (e.g., Australia Day). • Some shared concerns about drowning and indicated that they made decisions to actively abstain from alcohol use around water, but others were less concerned. • Most believed they had sufficient water safety and swimming skills to prevent themselves from drowning. 	<ul style="list-style-type: none"> • Continued need for targeting potentially serious consequences of combining alcohol in and around water. • Peer-focused interventions that encourage young people to adopt supervisory or social support role may be effective strategy.
<p><i>Author:</i> Calverley [30] <i>Year:</i> 2021 <i>Aim:</i> To review awareness and understanding of current alcohol-focused drowning prevention campaigns among young adults, and identify strategies used by young people for personal safety if consuming alcohol in aquatic settings. <i>Location:</i> Regional Victoria, Australia.</p>	<p><i>Study design:</i> Qualitative. <i>Data collection method:</i> Semi-structured in-depth interviews. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 23 participants aged 18–24. 60% female. All identified as Australian. 48% studying or completed undergraduate degree. 17% with current aquatic qualification (e.g., pool lifeguard certificate). <i>Sampling method:</i> Convenience and snowball sampling.</p>	<ul style="list-style-type: none"> • 61% had previously participated in alcohol-influenced aquatic activity. • Female participants in particular expressed concern about consuming alcohol in aquatic environments with peers who were inexperienced with alcohol and/or unaware of the risks of drinking alcohol in aquatic contexts. 	<ul style="list-style-type: none"> • Campaigns to promote appropriate protective behavioural strategies in aquatic contexts.
<p><i>Author:</i> Calverley [31] <i>Year:</i> 2021 <i>Aim:</i> To ascertain young adults' perceptions around alcohol use in</p>	<p><i>Study design:</i> Qualitative. <i>Data collection method:</i> Semi-structured in-depth interviews. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 23 participants aged 18–24 (mean 20.65). Males 9; Females 14. All identified as Australian. 44%</p>	<ul style="list-style-type: none"> • Participants thought the risks associated with combining alcohol and aquatic activities were more strongly linked with 	<ul style="list-style-type: none"> • Design campaigns which address how drinking alcohol in aquatic environments can reduce young adults' control in the

TABLE 1 (Continued)

Author; year; aim; location	Study design; data collection method; ethical approval	Sample; sampling method	Main findings	Implications for intervention
<p>aquatic contexts, and determine influences on related behaviours. <i>Location:</i> Regional Victoria, Australia.</p>		<p>currently studying. 96% had received water safety education. <i>Sampling method:</i> Purposive sampling.</p>	<p>the amount of alcohol consumed, rather than drinking while recreating.</p> <ul style="list-style-type: none"> Alcohol consumption was considered a typical behaviour in aquatic contexts, particularly during summer and on public holidays. Larger groups with fewer external onlookers were associated with more dangerous behaviours than smaller groups and activities in more populated aquatic locations. 	<p>situation, and how this could affect autonomy and independence.</p>
<p><i>Author:</i> Calverley [32] <i>Year:</i> 2021 <i>Aim:</i> To identify predictors of young adults' intentions to participate and past participation in alcohol-influenced aquatic activity. <i>Location:</i> Australia and UK.</p>	<p><i>Study design:</i> Cross-sectional. <i>Data collection method:</i> Online survey. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 182 participants aged 18–24 (mean 20.66). 59.2% female. 79.3% educated in Australia. <i>Sampling method:</i> Convenience sampling.</p>	<ul style="list-style-type: none"> 49.2% of participants had previously participated in alcohol-influenced aquatic activity, and 28.4% described this activity as high risk. 21.4% expressed a high intention and 29.7% a moderate intention to participate in alcohol-influenced aquatic activity in next 12 months. Intention was significantly predicted by previous participation, subjective norms and cognitive attitudes. Intention and influence of friends predicted past behaviour. 	<ul style="list-style-type: none"> Separately target those who have and have not previously participated in alcohol-influenced aquatic activity because intentions and approach may be different. Encourage non-alcohol-related behaviours, citing the potential for disapproval from the social group if alcohol was consumed.
<p><i>Author:</i> Calverley [33] <i>Year:</i> 2021 <i>Aim:</i> To establish young adults' level of knowledge about alcohol consumption, and to investigate the</p>	<p><i>Study design:</i> Mixed methods. <i>Data collection method:</i> Self-report survey and interviews. <i>Ethical approval:</i> N/R.</p>	<p><i>Sample:</i> 182 participants aged 18–24 surveyed (mean 20.66); 58.2% female; 97.8% had previous aquatic safety education. PLUS</p>	<ul style="list-style-type: none"> 48.9% of those surveyed and 60.9% of those interviewed had previously participated in alcohol-influenced aquatic activity. 	<ul style="list-style-type: none"> Incorporate alcohol-specific education into water safety education programs to enhance knowledge of alcohol and its effects in aquatic contexts.

(Continues)

TABLE 1 (Continued)

Author; year; aim; location	Study design; data collection method; ethical approval	Sample; sampling method	Main findings	Implications for intervention
<p>factors impacting their attitudes towards participation in alcohol-influenced aquatic activity.</p> <p><i>Location:</i> Australia and UK.</p>		<p>23 interviews. Mean age 20.65; 60.9% female; 95.7% with previous water safety education.</p> <p><i>Sampling method:</i> Purposive sampling</p>	<ul style="list-style-type: none"> • Overall participants had poor knowledge skills but perceived their knowledge as adequate. • Survey participants who had previously participated in alcohol-influenced aquatic activities had a more accepting attitude of the behaviour. • Interviewees felt that the more alcohol was consumed, the riskier the behaviour, and associated alcohol consumption with fun, particularly when combined with aquatic activities. 	
<p><i>Author:</i> Enkel [34] <i>Year:</i> 2018 <i>Aim:</i> To determine intended and actual alcohol consumption among school leavers, and to evaluate their knowledge of the risks associated with alcohol use around water.</p> <p><i>Location:</i> South-west (regional) WA, Australia.</p>	<p><i>Study design:</i> Cross-sectional. <i>Data collection method:</i> Intercept survey. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 549 participants aged 17–18. Males 255; Females 294. 70.5% resided in metropolitan Perth. 47% had spent less than 1 day at end of high school celebrations ('Leavers').</p> <p><i>Sampling method:</i> Convenience sampling.</p>	<ul style="list-style-type: none"> • 94.9% had previously consumed alcohol, and 33.4% had consumed alcohol around water. Males (43.5%) and those who resided in regional areas (41.4%) were more likely to have consumed alcohol in an aquatic environment compared with females (24.6%) and metropolitan participants (30.1%). 29% had consumed alcohol around a waterway while at Leavers; again, males were more likely to have done so (43%) than females (17.8%). • Of those who consumed alcohol around water, 16.7% identified the activity as risky. Activities while consuming alcohol included land-based activities (62%), 	<ul style="list-style-type: none"> • Sustained health promotion messages to be delivered to the target audience before and during Leavers' celebrations to facilitate further awareness of the risks.

TABLE 1 (Continued)

Author; year; aim; location	Study design; data collection method; ethical approval	Sample; sampling method	Main findings	Implications for intervention
<p><i>Author:</i> Hamilton [23] <i>Year:</i> 2013 <i>Aim:</i> To investigate critical beliefs that underlie males' intentions to drink and swim. <i>Location:</i> Australia.</p>	<p><i>Study design:</i> Cross-sectional. <i>Data collection method:</i> Online or paper-based survey. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 211 males aged 18–34 (mean 23.93) 95.3% lived in Queensland. 90.5% from an English-speaking background. 94.8% consumed alcohol at hazardous levels <i>Sampling method:</i> Convenience sampling</p>	<p>swimming (46.7%), surfing (12.2%), operating watercraft (8.7%), and water sports (9.3%). Participants' knowledge of risks of combining alcohol and aquatic activities was high (92.5%).</p> <ul style="list-style-type: none"> 45% engaged in drinking and swimming at a 'greater than small' extent. Five critical beliefs: 'feel more relaxed', 'having fun', 'friends/mates', 'parents' and 'presence of other people' were identified as significant independent predictors of the intention to drink and swim. 54% fully or strongly endorsed the belief that drinking and swimming would be fun, and 28.2% that it would increase relaxation. 	<ul style="list-style-type: none"> Target beliefs associated with young males' drinking and swimming behavioural intentions and promote the 'not so fun' side of drinking and swimming.
<p><i>Author:</i> Hamilton [24] <i>Year:</i> 2014 <i>Aim:</i> To provide an understanding of the motivational determinants guiding the intentions of young Australian men to drink and swim. <i>Location:</i> Australia.</p>	<p><i>Study design:</i> Cross-sectional. <i>Data collection method:</i> Online or paper-based survey. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 211 males aged 18–34 (mean 23.93). 95.3% lived in Queensland. 90.5% from an English-speaking background. 94.8% consumed alcohol at hazardous levels. <i>Sampling method:</i> Convenience sampling.</p>	<ul style="list-style-type: none"> Males intended to drink and swim to a 'moderate' degree, and 25% had engaged in the behaviour to a moderate or large degree in the last 6 months. Controlling for other influences in a regression, intentions to drink and swim were predicted by anticipated regret and objective risk. Males who have positive attitudes towards drinking and swimming, and who perceive that people 	<ul style="list-style-type: none"> Increase the salience of negative affective consequences of the behaviour and consider others' disapproval in strategies to reduce drinking and swimming.

(Continues)

TABLE 1 (Continued)

Author; year; aim; location	Study design; data collection method; ethical approval	Sample; sampling method	Main findings	Implications for intervention
<p><i>Author:</i> Leavy [6] <i>Year:</i> 2022 <i>Aim:</i> To examine the relationship between behaviour in and around water and (a) alcohol consumption, (b) resistance to peer influence, (c) sensation seeking, and (d) perceptions of risk. <i>Location:</i> WA, Australia.</p>	<p><i>Study design:</i> Cross-sectional. <i>Data collection method:</i> Online survey. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 730 participants aged 15–24 (mean 19.9). 74.5% female. 84.4% lived in metropolitan Perth. 56.9% current university students. <i>Sampling method:</i> Convenience sampling.</p>	<p>important to them approve of the behaviour, are more likely to intend to drink and swim.</p> <ul style="list-style-type: none"> 40.3% had swum after drinking alcohol. This was more common in males (47.8%) than females (38.2%) and among those who lived in regional (47.4%) rather than metropolitan areas (39.0%). Participants were more likely to swim after drinking alcohol with every year they got older, and with increasing sensation seeking and peer influence scores. Those who more strongly considered the seriousness of an adverse event were less likely to swim after consuming alcohol. 	<ul style="list-style-type: none"> Target peer group norms, skills, and self-efficacy as part of a suite of strategies delivered to young adults. Strategies that focus only on the awareness of risks are unlikely to resonate with the target audience Need for comprehensive interventions that not only encourage young people to consider the risks but also provide environmental supports.
<p><i>Author:</i> Miller [36] <i>Year:</i> 2008 <i>Aim:</i> To explore the relationship between consuming alcohol on boating trip and demographic and boating characteristics. <i>Location:</i> WA, Australia.</p>	<p><i>Study design:</i> Cross-sectional. <i>Data collection method:</i> Telephone survey. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 500 registered boat owners aged 18+. 7.5% aged 18–34. 79.4% male. 27.4% had completed boating education course. <i>Sampling method:</i> Random sample of all registered boat owners in WA (response rate 46.6%).</p>	<ul style="list-style-type: none"> Those aged 18–34 were more likely to have consumed alcohol on their last boating trip compared to older adults in the sample (although this difference was not significant). Approximately 10% of 18- to 24-year-olds, and 28% of 25- to 34-year-olds, had consumed alcohol on their last trip. 	<ul style="list-style-type: none"> Information regarding dangers of consuming alcohol while boating should be included in boating education courses.
<p><i>Author:</i> Moran [38] <i>Year:</i> 2011 <i>Aim:</i> To use the notion of ‘dangerous masculinities’ to help explain the heightened risk of drowning by young</p>	<p><i>Study design:</i> Narrative review. <i>Data collection method:</i> N/A. <i>Ethical approval:</i> Not reported</p>	<p><i>Sample:</i> N/A. <i>Sampling method:</i> N/A.</p>	<ul style="list-style-type: none"> Males (36.3%) are more likely than females (19.9%) to have performed at-risk swimming behaviours, including swimming after alcohol or drugs. Most 	<ul style="list-style-type: none"> Address the ‘masculinised hegemonies’ evident in such practices as mixing alcohol with aquatic recreation.

TABLE 1 (Continued)

Author; year; aim; location	Study design; data collection method; ethical approval	Sample; sampling method	Main findings	Implications for intervention
men during aquatic leisure activity. <i>Location:</i> New Zealand.			<p>males who reported alcohol consumption during swimming activity also reported having swum unsupervised (86%), outside patrol flags (77%), in a prohibited place (77%) or alone (57%).</p> <ul style="list-style-type: none"> • More males (33.0%) than females (24.2%) reported observing peers swimming after using alcohol or drugs, and 35% of males identified their friends as the dominant influence on their water safety. 	
<p><i>Author:</i> Peden [35] Year: 2018 <i>Aim:</i> To describe the demographic profile of river users, explore their attitudes towards river safety and alcohol use, and measure their blood alcohol concentration. <i>Location:</i> Australia.</p>	<p><i>Study design:</i> Cross-sectional. <i>Data collection method:</i> Paper-based survey. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 684 participants aged 18+; 335 aged 18–34. Males 331; Females 353. 57.2% lived in inner regional areas. 84.4% born in Australia. <i>Sampling method:</i> Convenience sampling.</p>	<ul style="list-style-type: none"> • Those aged 18–34 were significantly more likely to record a positive BAC and to record a BAC of greater than 0.05%. 20.6% of those aged 18–34 recorded a positive BAC. 	<ul style="list-style-type: none"> • Link between hot weather and alcohol consumption may be used to guide the timing of prevention messages.
<p><i>Author:</i> Sinkinson [37] Year: 2014 <i>Aim:</i> To examine the aquatic activities participated in by young people, their experiences of social activities involving alcohol in and around water, their perceptions of low- and high-risk situations, and the actions taken to ensure their own and others' safety. <i>Location:</i> New Zealand.</p>	<p><i>Study design:</i> Qualitative. <i>Data collection method:</i> Semi-structured focus groups. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 17 participants aged 17–24 (16 aged 17–21; 1 aged 24). Males 10; Females 7. 9 New Zealand European, 3 Maori, 3 Pacific Islander, 2 other. <i>Sampling method:</i> Convenience sampling.</p>	<ul style="list-style-type: none"> • Most participants agreed it was not uncommon for alcohol to be consumed during social activities around water, and this was more common when socialising with friends/peers than families. • Many recognised that alcohol use added a potential risk for injury or death, attributable to an increased sense of confidence, impaired judgement and 	<ul style="list-style-type: none"> • Dilemma between fun, excitement, and voluntary risk taking and possible health hazards.

(Continues)

TABLE 1 (Continued)

Author; year; aim; location	Study design; data collection method; ethical approval	Sample; sampling method	Main findings	Implications for intervention
			<p>impaired physical ability. The quantity of alcohol consumed and the environment in which activities were taking place were key factors influencing the level of risk.</p>	
			<ul style="list-style-type: none"> • Participants also had a well-developed awareness of suitable 'safety nets' including limiting alcohol intake and being more careful. 	

Abbreviations: BAC, blood alcohol concentration; N/A, not applicable; N/R, not reported.

alcohol use around water, and the predictors of these (Table 1). The studies were conducted in Australia ($n = 11$) [6, 10, 23, 24, 30–36] or New Zealand (NZ; $n = 2$) [37, 38], with two studies including participants from both Australia and the United Kingdom (UK) [32, 33]. Eight studies were published in the last 5 years (since 2018) [6, 10, 30–35]. Seven studies used a cross-sectional survey design [6, 23, 24, 32, 34–36], four used qualitative methods [10, 30, 31, 37], and one was a mixed methods study using interviews and a cross-sectional survey [33]. The remaining study was a narrative review of literature investigating the notion of 'dangerous masculinities' concerning drowning risk among young men [38].

3.3.1 | Prevalence of alcohol use by young people in aquatic environments

Nine studies described the self-reported prevalence of alcohol use around water in young people, with rates ranging from 25% to 61% [6, 10, 23, 24, 30–34]. In general, the prevalence of self-reported alcohol use around water was greater in qualitative studies [10, 30, 33] than in those with a cross-sectional design [6, 23, 24, 32–34]. A further study by Peden and colleagues collected objective measurements of alcohol use around water by breathalysing river users [35]. Of those who were breathalysed, one in five young adults (aged 18–34 years) had a positive breath test for alcohol, and this age group was significantly more likely to have consumed alcohol than not while recreating at the river.

3.3.2 | Risk factors of alcohol use by young people in aquatic environments

Alcohol consumption in aquatic environments was found to be most common among males [6, 31, 34, 38], on public holidays [10, 31], and among those living in regional areas [6, 34], as well as when in larger groups with few onlookers (as compared with small groups in populated areas) [31]. In addition, among WA young people (aged 18–24 years) consumption of alcohol around water increased in prevalence with each year of age [6], and WA boat-owners aged 18–34 years were more likely to have consumed alcohol on their last boating trip than older respondents, although this was not statistically significant [36]. The use of alcohol around water was associated with other risky behaviours, particularly in young males, including swimming unsupervised, outside of patrolled areas, in a prohibited place and/or while alone [38].

3.3.3 | Intention to drink alcohol in aquatic environments

Two studies investigated Australian young adults' intentions to consume alcohol in aquatic environments through cross-sectional surveys [24, 32]. These studies found that many young adults expressed a moderate-to-high intention to participate in alcohol-influenced activity around water, and that this intention was predicted by previous behaviour, subjective norms, anticipated regret and objective risk. Those who felt they were

TABLE 2 Studies investigating the epidemiology of alcohol-related unintentional drowning in young adults.

Author; year; aim; location	Study design; data collection method	Sample; sampling method	Main findings	Implications for intervention
<p><i>Author:</i> Ahlm [44] <i>Year:</i> 2013 <i>Aim:</i> To analyse the epidemiology and current trends of unintentional, intentional, and undetermined drowning deaths in Sweden with an emphasis on alcohol and other drugs. <i>Location:</i> Sweden.</p>	<p><i>Study design:</i> Retrospective. <i>Data collection method:</i> Records from Forensic Medicine Database.</p>	<p><i>Sample:</i> 5125 drownings; 2585 unintentional (Males 2180; Females 405); 221 aged 20–29. <i>Sampling method:</i> All deaths from drowning from January 1992 to December 2009.</p>	<ul style="list-style-type: none"> The presence of alcohol was more frequent in unintentional than suicide drowning deaths, and in males compared to females. Alcohol was found in 997 of the 2255 tested individuals in the unintentional drowning group. 99 of 221 (45%) drowning deaths in those aged 20–29 involved alcohol. 	<ul style="list-style-type: none"> Counteract the use of alcohol and other drugs during water activities.
<p><i>Author:</i> Clemens [42] <i>Year:</i> 2016 <i>Aim:</i> To examine the epidemiology of drowning in Canada, and describe the characteristics of drowning incidents by age group. <i>Location:</i> Canada.</p>	<p><i>Study design:</i> Retrospective. <i>Data collection method:</i> Coronial records, collected using structured questionnaire.</p>	<p><i>Sample:</i> 2391 cases of unintentional water-related fatality. 82% male. 5.9% aged 15–19; 24.8% aged 20–34. <i>Sampling method:</i> All water-related fatalities in Canada from January 2008 to December 2012</p>	<ul style="list-style-type: none"> 51.4% of all victims aged 20–34, and 40.8% of those aged 15–19, had consumed alcohol prior to the incident. Rates of unintentional water-related fatality with alcohol involvement were 0.52 per 100,000 Canadians per year among 15- to 19-year-olds, and 0.87 per 100,000 per year among 20- to 34-year-olds. 	<ul style="list-style-type: none"> Need for drowning prevention strategies tailored to specific age groups.
<p><i>Author:</i> Croft [43] <i>Year:</i> 2015 <i>Aim:</i> To examine the relative role of factors that contribute to male drowning risk in New Zealand. <i>Location:</i> New Zealand.</p>	<p><i>Study design:</i> Retrospective. <i>Data collection method:</i> Coronial records.</p>	<p><i>Sample:</i> 2134 cases. All males. 716 aged 15–34. <i>Sampling method:</i> All male drownings from 1983 to 2012.</p>	<ul style="list-style-type: none"> The most prevalent age group for drowning involving alcohol in males was 20- to 24-year-olds. Among 15- to 19-year-olds, 30 of 96 freshwater and 16 of 92 saltwater drownings involved alcohol. Among 20- to 24-year-olds, 48 of 125 freshwater and 22 of 107 saltwater drownings involved alcohol. Among 25- to 29-year-olds, 14 of 78 freshwater and 28 of 124 saltwater drownings involved alcohol. Among 30- to 34-year-olds, 14 of 47 	<ul style="list-style-type: none"> Targeted intervention strategies, rather than a blanket approach, are needed.

(Continues)

TABLE 2 (Continued)

Author; year; aim; location	Study design; data collection method	Sample; sampling method	Main findings	Implications for intervention
<p><i>Author:</i> Franklin [39] <i>Year:</i> 2010 <i>Aim:</i> To examine drowning patterns in Australia and assess the feasibility of achieving a 50% reduction in drowning deaths by 2020. <i>Location:</i> Australia.</p>	<p><i>Study design:</i> Retrospective. <i>Data collection method:</i> Coronial data matched with information from Royal Life Saving drowning reports.</p>	<p><i>Sample:</i> 1452 drownings; 76.4% male; 376 aged 15–34. <i>Sampling method:</i> All open and closed drowning cases from July 2002 to June 2007.</p>	<p>freshwater and 26 of 129 saltwater drownings involved alcohol.</p> <ul style="list-style-type: none"> • 20.9% of drownings (48 of 230) in 18- to 29-year-olds involved alcohol, and 5.2% ($n = 12$) involved alcohol and drugs. 	<ul style="list-style-type: none"> • Drowning prevention strategies must be maintained.
<p><i>Author:</i> Lawes [13] <i>Year:</i> 2021 <i>Aim:</i> To describe the epidemiology of coastal drowning deaths involving young males compared with other adults, and to explore the prevalence of potential risk factors. <i>Location:</i> Australia.</p>	<p><i>Study design:</i> Retrospective. <i>Data collection method:</i> Coronial data.</p>	<p><i>Sample:</i> 476 deaths in young males (aged 15–34 years); 1172 in other adults. <i>Sampling method:</i> All coastal water drowning deaths in those aged 15+ from July 2004 to June 2019.</p>	<ul style="list-style-type: none"> • Young males were more likely than other adults to drown following a jump, while swimming or wading, from a rock or cliff, on a public holiday, and in the afternoon; and less likely to drown while boating or scuba diving, offshore, or in the morning. • The average BAC for young males who drowned was 0.17%, significantly lower than the mean BAC (0.2%) for other adults. • 64 drownings in young males (13.1%) involved alcohol, compared with 137 (11.3%) in other adults. Young males were 1.17 times more likely to drown after consuming alcohol than other adults, although this difference was not significant. 	<ul style="list-style-type: none"> • Greater establishment and enforcement of alcohol-free areas at coastal locations may decrease the combination of aquatic activities with alcohol.
<p><i>Author:</i> Pajunen [45] <i>Year:</i> 2017. <i>Aim:</i> To evaluate the potential</p>	<p><i>Study design:</i> Retrospective. <i>Data collection method:</i> Records from</p>	<p><i>Sample:</i> 1697 fatal drowning victims aged 15+. Males 1487; Females 210.</p>	<ul style="list-style-type: none"> • The highest percentage of alcohol-positive cases was in the 20- to 54-year-old 	<ul style="list-style-type: none"> • None stated.

TABLE 2 (Continued)

Author; year; aim; location	Study design; data collection method	Sample; sampling method	Main findings	Implications for intervention
contributing role of psychotropic drugs, alone or in combination with alcohol, in events leading to fatal unintentional drowning in Finland. <i>Location:</i> Finland	Forensic Toxicology Database.	<i>Sampling method:</i> Victims aged 15+ with medicolegal autopsy and toxicology screen from 2000 to 2009.	age group. Approximately 50% of 15- to 19-year-old victims, 70% of 20- to 24-year-olds, 72% of 25- to 29-year-olds, and 70% of 30- to 34-year-olds had a BAC over 50 mg/dL.	
<i>Author:</i> Peden [40] <i>Year:</i> 2017 <i>Aim:</i> To identify the burden of alcohol-related unintentional fatal drowning in Australian rivers. <i>Location:</i> Australia.	<i>Study design:</i> Retrospective. <i>Data collection method:</i> Coronial records.	<i>Sample:</i> 770 drownings; Males 619; Females 151. <i>Sampling method:</i> All records of unintentional fatal drowning in Australian rivers, creeks, and streams from 2002 to 2012.	<ul style="list-style-type: none"> • 50% of drownings in the 25- to 34-year-old age group had positive BAC readings. • 32 drownings in 18- to 24-year-olds had an available BAC. 88.1% of these were male, the BAC ranged from 0.006 to 0.259 (average 0.163), and most drownings occurred in the early morning, followed by afternoon and evening. Most victims jumped into the water, followed by watercraft, fall in, and non-aquatic vehicle. • 38 drownings in 25- to 34-year-olds had an available BAC. 87.8% of these were male, the BAC ranged from 0.009 to 0.430 (average 0.210), and most drownings occurred in the afternoon, followed by evening and early morning. Most victims had been swimming or recreating when they drowned. 	<ul style="list-style-type: none"> • Education and awareness of the risks of combining aquatic activity and alcohol to be well-entrenched prior to adolescents leaving high school. • Population-level strategies to curb drinking on and around rivers need to be developed.
<i>Author:</i> Peden [25] <i>Year:</i> 2019 <i>Aim:</i> To examine how river drowning deaths vary when adjusted for exposure. <i>Location:</i> Australia.	<i>Study design:</i> Mixed methods. <i>Data collection method:</i> Coronial records plus cross-sectional survey.	<i>Sample:</i> 151 drowning deaths; 86.4% male; 39.7% aged 18–34 years; 1318 survey responses. Males 602; Females 716. 253 aged 18–34. 16% had	<ul style="list-style-type: none"> • Among males aged 18–34, 18 deaths involved alcohol (32%). The drowning rate was 0.20 per 100,000 population, which increased to 0.97 per 100,000 	<ul style="list-style-type: none"> • Differences in drowning between males and females narrow after adjusting for exposure, which has implications for targeted prevention campaigns.

(Continues)

TABLE 2 (Continued)

Author; year; aim; location	Study design; data collection method	Sample; sampling method	Main findings	Implications for intervention
		consumed alcohol at last river visit. <i>Sampling method:</i> All records of unintentional fatal drowning in Australian rivers, creeks and streams among those aged 18+ from 2014 to 2016; survey sampling method not stated.	population exposed (those who consume alcohol at rivers). • Among females aged 18–34, 1 death involved alcohol (25%). The drowning rate was 0.01 per 100,000 population, which increased to 0.08 per 100,000 population exposed.	
<i>Author:</i> Strasiotto [41] <i>Year:</i> 2022 <i>Aim:</i> To investigate alcohol and drugs as contributing factors in Australian coastal deaths. <i>Location:</i> Australia.	<i>Study design:</i> Retrospective. <i>Data collection method:</i> Coronial records.	<i>Sample:</i> 2884 deaths; 2324 with toxicology results. <i>Sampling method:</i> Any unintentional coastal drowning death or non-drowning fatality between July 2004 and June 2020 occurring less than 12 nautical miles from shore.	• Young adults aged 15–34 were 1.4 times more likely to die under the influence of alcohol, and 1.75 times more likely to die under the influence of alcohol and drugs, compared with other adults. • 24 of 208 deaths and 45 of 573 drownings in 15- to 34-year-olds involved alcohol.	• Young adults are a clear target group for future intervention strategies around intoxicant usage in coastal environments.

Abbreviation: BAC, blood alcohol concentration.

less likely to regret the behaviour and those who rated their swimming ability as stronger (and therefore the behaviour as less risky) were more likely to express an intention to drink alcohol while swimming [24]. Similarly, Hamilton and colleagues identified five ‘critical beliefs’ as significant predictors of the intention to drink and swim among 18- to 34-year-olds in Australia [23]. These comprised the beliefs that drinking and swimming would lead to them ‘feeling more relaxed’ and ‘having fun’, that ‘friends/mates’ and ‘parents’ would approve of the activity, and that the ‘presence of other people’ would prevent them consuming alcohol in aquatic environments.

3.3.4 | Perceptions of risk

Perceptions of the risks involved in consuming alcohol around water varied between studies and participants. Many of the young adults (aged 17–24 years) interviewed in a NZ study recognised that alcohol use around water increased risk [37]; however only 28% of 18- to 24-year-

olds in an Australian study identified the behaviour as high risk, and 52% thought it carried no or low risk [32]. A study of ‘Leavers’ celebrations in WA found that while most participants (92%) were aware of the risks of combining alcohol and aquatic activities, only 17% of those who had consumed alcohol around water identified the activity as risky [34].

Some activities were associated with an increased risk, including activities in open (e.g., ocean) rather than closed water (e.g., pools), proposed by the authors as likely due to the perceived predictability [37], control, and familiarity of the latter [31]. Further, activities involving greater alcohol consumption were seen as higher risk [31].

Risk perception was an important determinant of behaviour, with those more concerned about the risks involved being less likely to swim after consuming alcohol [6]. However, it was also suggested that participants believed they had sufficient swimming ability to avoid risks [10] and that they were able to use ‘safety nets’ when consuming alcohol around water, including limiting alcohol intake, being more careful and appointing ‘sober minders’ [37].

TABLE 3 Studies investigating interventions to reduce alcohol-related harm in aquatic environments.

Author; year; aim; location	Study design; data collection method; ethical approval	Sample; sampling method	Main findings	Implications for intervention
<p><i>Author:</i> Calverley [48] <i>Year:</i> 2020 <i>Aim:</i> To identify available information about alcohol-themed drowning prevention campaigns, and identify whether those campaigns had undergone evaluation. <i>Location:</i> High-income countries.</p>	<p><i>Study design:</i> Literature review. <i>Data collection method:</i> Webpages of drowning prevention organisations plus academic databases. <i>Ethical approval:</i> N/R.</p>	<p><i>Sample:</i> 12 campaigns from 5 countries (Australia, Canada, Ireland, New Zealand, UK); 5 campaigns relevant to young adults <i>Sampling method:</i> Campaigns with direct focus of preventing death by drowning, with a specific focus on alcohol.</p>	<ul style="list-style-type: none"> Evidence of program evaluation was available for only 2 campaigns. Five campaigns were targeted at young adults, including: Sinkers #Don'tDrinkandSink (Australia, Royal Life Saving Society); Don't let your mates drink and swim (Australia, Royal Life Saving Society); Swim Safe Swim Sober (Australia, Royal Life Saving Society NSW); The Swim Reaper (Water Safety New Zealand); and Don't Drink and Drown (UK, Royal Life Saving Society). 	<ul style="list-style-type: none"> Need for further evaluation of programs to determine the effectiveness of strategies.
<p><i>Author:</i> Calverley [30] <i>Year:</i> 2021 <i>Aim:</i> To review the awareness and understanding of current drowning prevention campaigns among young adults, and identify strategies used by young people for personal safety if consuming alcohol in aquatic settings. <i>Location:</i> Victoria, Australia.</p>	<p><i>Study design:</i> Qualitative. <i>Data collection method:</i> Semi-structured in-depth interviews. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 23 participants aged 18–24; 60% female. All identified as Australian. 48% studying or completed undergraduate degree. 17% with current aquatic qualification. <i>Sampling method:</i> Convenience and snowball sampling.</p>	<ul style="list-style-type: none"> Most participants were unable to recall the purpose or message of prevention campaigns they recalled, and instead interpreted the meaning from the campaign logo or name. Participants emphasised the importance of delivering aquatic-themed alcohol education in schools and thought that such education was currently lacking. Participants suggested a wide range of intervention delivery methods including social media; streaming services; media outlets; shops; aquatic-based signage; in classrooms; and 	<ul style="list-style-type: none"> Campaigns to promote appropriate protective behavioural strategies in aquatic contexts.

(Continues)

TABLE 3 (Continued)

Author; year; aim; location	Study design; data collection method; ethical approval	Sample; sampling method	Main findings	Implications for intervention
<p><i>Author:</i> Hamilton [47] <i>Year:</i> 2022 <i>Aim:</i> To evaluate the impact of a video intervention depicting a male discouraging his mates from mixing alcohol and aquatic activities on intentions and social cognitions. <i>Location:</i> Australia.</p>	<p><i>Study design:</i> Experimental (three wave non-controlled pre-test post-test). <i>Data collection method:</i> Online survey with intervention embedded at T1; T2 directly after intervention; T3 one month later. <i>Ethical approval:</i> Yes.</p>	<p><i>Sample:</i> 97 young males at T1/T2; 47 at T3 Aged 18–34 (mean 22.09). All current drinkers. All engage in water activities. <i>Sampling method:</i> Convenience sampling.</p>	<p>warning labels on alcohol.</p> <ul style="list-style-type: none"> • Education was the preferred intervention strategy. • Video intervention influenced intentions to discourage mates from swimming and drinking and attitudes around discouraging mates immediately post-intervention, but effects had started to diminish at follow-up. • Effects on subjective norms regarding discouraging mates was maintained at follow up. • Exposure to the video did not influence intentions of own behaviour or subjective norms around own behaviour immediately post-intervention, but effect had started to emerge at follow-up. • Effects on attitudes towards one's own behaviour was maintained at follow-up. 	<ul style="list-style-type: none"> • Positive appeals are more persuasive over time (while negative appeals are more persuasive directly after exposure). • The lack of sustained effects may suggest a need for sustained communication of messages to the target group.

3.4 | Epidemiology of alcohol-related unintentional drowning in young adults

All epidemiological studies ($n = 9$) used retrospective data collected mainly from coronial records to investigate patterns and trends in unintentional drowning, including the role of alcohol (Table 2). One Australian study supplemented retrospective data with a cross-sectional survey to allow for adjustment by exposure [25]. The studies were conducted in Australia ($n = 5$) [13, 25, 39–41], Canada ($n = 1$) [42], NZ ($n = 1$) [43], Sweden ($n = 1$) [44] and Finland ($n = 1$) [45]. Three studies were published in the last 5 years (since 2018) [13, 25, 41]. All studies investigated population-level drowning

(i.e., across all age groups) and presented results for young adults separately. Two studies restricted their analysis to unintentional drowning in coastal locations [13, 41], and two more to drowning in rivers, creeks or streams [25, 40]. All studies focused on fatal unintentional drowning.

The definition of alcohol involvement varied between studies, with five studies considering alcohol as contributory to drowning when the BAC was 0.05% (or 0.05 g/100 mL) or greater (the legal limit for driving in Australia and a level at which concentration, reaction times and risk-taking behaviour have been shown to be impacted [40]) [13, 25, 40, 41, 45], one study a BAC of 0.02% or greater (to account for the possibility of alcohol

level to be artificially inflated by decomposition to a level of 0.02 g/100 mL [44], and three studies using the presence of any alcohol to signify alcohol involvement [39, 42, 43]. This reflects the challenges in determining the level of BAC where alcohol can be assumed to have contributed to the drowning event [40] as well as the known artificial inflation of BAC by post-mortem decomposition [46].

The prevalence of alcohol involvement in drowning deaths ranged from 8% of coastal drownings in 15- to 34-year-olds in Australia [41] up to 72% of deaths in 25- to 29-year-olds in Finland (where toxicological results were available) [45]. Two studies provided rates of unintentional drowning involving alcohol per 100,000 population, both finding a higher rate of fatality with alcohol involvement [25, 42].

Rates of alcohol involvement were generally higher in countries other than Australia, ranging from 41% to 72% of unintentional drowning deaths [42, 44, 45]. The rates of alcohol involvement in unintentional drowning were broadly similar across Australian and NZ studies, with around 21% to 30% of drownings involving alcohol [43]. In general, the rates of alcohol involvement were substantially higher in river than coastal drowning deaths in Australia and NZ, ranging from 25% to 50% in young adults in river drownings [25, 40, 43] and 8% to 20% in coastal drownings [13, 41, 43].

The age group with the highest rate of alcohol involvement in unintentional drowning differed across studies. Four studies found that younger adults (aged 15–34 years) had a higher rate of alcohol involvement than those in older age groups [13, 41–43], although this difference was only found to be statistically significant in one study investigating Australian coastal drowning [41]. Three studies found that middle-aged adults (aged 40–59 years) had higher rates of alcohol involvement [39, 44, 45], and one Australian study found that the average BAC for young male drowning decedents (aged 15–34 years; 0.17%) was significantly lower than the average for older adults (0.2%) [13]. Two studies conducted in Australia found relatively similar rates across all age groups [25, 40]. Where sex was considered, the presence of alcohol among drowning decedents was found to be more common in males compared to females [25, 40, 44].

3.5 | Interventions to reduce alcohol-related harm in aquatic environments

The intervention studies used different study designs to address the prevention of alcohol-related harm around water (Table 3). Two original studies were conducted in Australia [30, 47], and the third was a literature review identifying alcohol-related drowning prevention campaigns conducted in high-income countries [48]. These studies

were all published in the last 3 years (2020 [48], 2021 [30], and 2022 [47]). All interventions explored utilised group and population strategies, predominantly examining the impact of education and communication.

Taken together, these intervention studies suggest that continued communication of messages, perhaps through education campaigns, is necessary, and that the development of those campaigns should consider the perspectives of the target audience. Findings also suggest that drowning prevention program evaluation and dissemination should be a key focus of future research.

3.6 | Self-reported study limitations

Twenty-three studies explicitly listed limitations, while one study did not report any limitations [37].

The most frequently self-reported study limitations included a lack of generalisability due to the homogeneity and/or size of the sample [6, 10, 13, 23, 24, 30–33, 35, 36, 47], the possibility of social desirability bias [6, 10, 23, 24, 30, 32–36, 47], and the self-report nature of data collection [6, 24, 25, 32, 35, 36, 38]. Other limitations relating to sampling included convenience sampling [31, 34, 47] and the possibility of participation bias, whereby only those who thought the study was relevant to them (e.g., those who drink alcohol) may have chosen to participate [35]. Study design limitations mentioned included the correlational or cross-sectional study design [25], the heterogeneity of focus group membership [10], high attrition rate and short follow-up [47] and the fact that only some parts of an intervention were evaluated [30, 47].

Studies using retrospective data noted the possibility of information bias [42] and poor data quality [44], as well as the potential for alcohol levels to be inflated due to post-mortem decomposition [40, 41, 44, 45]. Missing data, particularly relating to alcohol involvement, was mentioned as a limitation [34, 39, 40, 42, 43], as well as that some information was either not collected or unavailable for analysis [25, 44, 48]. Limitations relating to data analysis included the lack of multivariate analysis [42], the operationalisation of alcohol involvement [23, 40, 45], and the inability to account for complex alcohol-drug interactions [41] or to disentangle the effects of age and gender [13].

3.7 | Self-reported implications of findings

All but one study reported that their findings had implications for drowning prevention interventions, and noted specific target populations or messages that might be

effective. Many studies mentioned the need for targeted rather than generalised interventions [6, 23, 25, 32, 41–43], although one study concluded that population-level strategies may be most effective [40]. Specific target messages included the risks and potentially serious consequences of alcohol use around aquatic environments [10, 23, 30, 37, 38, 47]; the effect of alcohol use on control, autonomy, and independence [31]; and the potential disapproval of peers when drinking and swimming [6, 24, 32]. Two studies mentioned the need for environmental supports such as establishing and enforcing alcohol-free areas in aquatic environments [6, 13]. Finally, the need for sustained communication of messages over time, and the evaluation of those messages, was noted by four studies [34, 39, 47, 48].

4 | DISCUSSION

This scoping review aimed to explore the peer-reviewed literature on alcohol use by young people (aged 15–34 years) in the context of recreational aquatic environments. This is an emerging field of research, evidenced by the fact that most identified studies were published in the last 5 years and were conducted in a handful of countries (predominantly Australia and NZ). All included studies were assessed as being of medium to high quality, providing some confidence in the robustness of the findings of this review.

Three broad objectives of included studies were identified: those investigating the prevalence and risk factors of alcohol use by young people in aquatic environments; those addressing the epidemiology of alcohol-related unintentional drowning; and those reviewing or evaluating interventions to reduce alcohol-related harm around water. The findings of this review provide insights for addressing the complex social, environmental, and increasingly commercial factors posed by the pervasive aquatic alcogenic environments experienced by young people.

4.1 | Prevalence and epidemiology of alcohol use in aquatic environments

Overall, findings highlight that young people, particularly males, commonly use alcohol in and around water. Alcohol use in aquatic environments was associated with other risks, including swimming unsupervised and while alone [38]. The retrospective and epidemiological studies showed that the risk of unintentional drowning increased with alcohol use, and the rates of alcohol involvement were generally higher in river compared with coastal drowning and among males (e.g., [25, 42]). However,

many jurisdictions do not require toxicology reporting for drowning cases [49], and so the true extent of alcohol involvement may be underestimated. Finally, only a few studies looked specifically at interventions to reduce alcohol-related harm around water [30, 47, 48].

4.2 | Risk factors for alcohol use around water

Risk perception was an important determinant of behaviour, with those more concerned about the risks involved being less likely to swim after drinking alcohol [6]. However, studies also showed that while many young adults were aware of the risks of combining alcohol with aquatic activities [34, 37], this awareness did not always translate into behaviour to reduce risks [31, 34]. This highlights multiple influences on young adults' alcohol use around water, with risk perception being just one. The context around alcohol use may also be important, with studies reporting that alcohol use around water was more common in regional and rural areas [6, 34, 35] and on public holidays [10, 31]. This is consistent with other research showing that those living in regional and remote areas are more likely to drink at risky levels [50], as well as that emergency department presentations due to alcohol intoxication increase around public holidays [51]. These findings have implications for the timing and setting of interventions including media campaigns.

Further, peer influence may be an important factor to consider. One study found that young adults who believed their friends would approve of them drinking and swimming were more likely to intend to use alcohol around water [23], while another found that alcohol use around water was considered a 'typical' behaviour among young adults [31]. Thus, an intervention such as that conducted by Hamilton and colleagues [47], whereby young people were encouraged to 'help their mates' avoid drinking and swimming, may be an effective soft entry to educating young people.

4.3 | Implications for interventions to reduce alcohol use around water

The findings of this review suggest that interventions to reduce alcohol-related harm around water among young people need to be comprehensive and consider environmental influences and supports to minimise the effect of the aquatic alcogenic environment. The use of alcohol around water is influenced by the wider environment, including social norms [10], peer influence [2, 6] and

commercial determinants such as alcohol marketing [1]. One potential strategy may involve peer-focused interventions to target peer group norms, improve social negotiation skills [6] and encourage young adults to consider the disapproval of others [24]. However, interpersonal interventions, while necessary, may not be sufficient to combat the pervasive influence of the alcohol industry. Recent research highlights the need for increased advocacy and policy efforts to mitigate the effects of alcohol advertising which promotes drinking in and around water [6]. Strategies should include safety messaging at the point of purchase and/or consumption, in an attempt to counteract young people's intentions to consume alcohol around water, and restricting alcohol advertising, sales and consumption in aquatic locations [6, 13]. There is also a need for routine surveillance around the burden of alcohol-related aquatic injuries, and the reporting of these findings, to inform ongoing policy and practice.

4.4 | Gaps in the literature

While we identified many studies addressing the prevalence of and risk factors for alcohol use around water, no studies investigated the wider cultural and commercial determinants of this behaviour. There is a need for future research to explore the wider context around alcohol use in aquatic environments, and in particular commercial interests including alcohol advertising and promotion. While the extant literature suggests that young people are frequently exposed to alcohol advertising [8], including that which features aquatic locations and activities, and that this exposure influences their use of alcohol [5], there has to date been little attention paid to how this advertising might impact upon alcohol-related harms in aquatic environments. A recent call to action has emphasised the need for increased advocacy and policy efforts to counteract the effects of the alcohol industry that uses its considerable influence through media, product placement, sponsorship, and corporate social responsibility activities to legitimise practices that can harm the health of young people [52].

In addition, very few studies looked at interventions to reduce alcohol use around water and the related harms. While drowning prevention campaigns focussing on alcohol use have been developed in various countries, many of these have not undergone any formal evaluation and the details of these campaigns are not available in the peer-reviewed literature. There is therefore a need for further evaluation of existing prevention campaigns, and the reporting of these findings in the literature, in order to inform future intervention strategies.

4.5 | Strengths and limitations of this review

This review used the MetaQAT tool to appraise the quality of included studies. This is a strength of the present study, as this tool has been developed explicitly for quality appraisal in public health studies. However, some limitations need to be noted. We included only those studies with full-text available and published in English and did not include grey literature. We acknowledge that the exclusion of grey literature may have omitted potentially relevant and valuable information, particularly concerning interventions, which may be less likely to be published in peer-reviewed journals. Despite these limitations, this review provides an overview of the contemporary literature addressing alcohol use in young people in aquatic environments.

The majority of studies were conducted in Australia. Alcohol consumption is widely accepted in Australian culture and considered a normal part of Australian life [10]. These social norms may be particularly influential among young people, with social context found to be the strongest predictor of alcohol initiation and consumption among Australians aged 18–30 years [2]. Recent survey results show that those aged 18–24 years were the most likely of all age groups to drink at levels that exceed the Australian single-occasion risk guidelines, with 41% drinking more than four standard drinks per episode at least monthly [53]. A national survey of adolescents found that 46% of Australians aged 12–17 years had consumed alcohol in the previous year, with 11% drinking in excess of the guidelines [54]. These high rates of alcohol consumption, combined with many coalescing factors including the extensive Australian coastline, warm climate, popularity of water-based activities, high per-capita boat ownership [10, 13, 36] and associated risk practices [35, 55], mean that young Australians are particularly at risk of unintentional fatal and non-fatal drowning. Thus, the findings of this review may be particularly relevant to public health action directed towards young people in Australia and may be less generalisable to other countries and contexts.

5 | CONCLUSIONS

With up to three-quarters of unintentional drowning deaths involving alcohol and many young people reporting the use of alcohol in and around water, there is a clear imperative to address the use of alcohol by young people in aquatic environments. Understanding the literature addressing alcohol use around water among young people has key implications for public health practice and policy. The findings of this review will assist in

identifying and setting priorities for drowning prevention and will be a vital resource to inform health promotion practice, advocacy and policy.

AUTHOR CONTRIBUTIONS

Each author certifies that their contribution to this work meets the standards of the International Committee of Medical Journal Editors.

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CONFLICT OF INTEREST STATEMENT

In the past 5 years, Tina Lam has been an investigator on untied education grants from CSL Seqirus to investigate prescription opioid related harms (unrelated to the current work). All other authors have no interests to declare.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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