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Contextual characteristics of adults' drinking occasions and their association with levels of alcohol consumption and acute alcohol-related harm: A mapping review

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ABSTRACT

Background and Aims

There is a growing literature using event-level methods to estimate associations between contextual characteristics of drinking occasions, consumption levels, and acute harms. This literature spans many research traditions and has not been brought together as a whole. This mapping review aims to identify and describe the theoretical approaches to conceptualising drinking occasions, study designs, predictors, and outcome measures used in existing research with a view to identifying dominant approaches, research gaps and areas for further synthesis.

Methods

Eligible papers studied adults' drinking occasions using quantitative event-level methods, considered one or more contextual characteristics (e.g. venue, timing, or company), and at least one event-level consumption or acute alcohol-related harm outcome. We systematically searched Ovid MEDLINE, PsycInfo, and the Web of Science Social Sciences Citation Index, extracting data on studies' theoretical approach, data collection methods, settings, populations, drinking occasion characteristics, and outcome measures.

Results

Searches identified 278 eligible papers (from 1975 to 2019), predominantly published after 2010 (n=181; 65.1%). Most papers reported research conducted in the United States (n=170; 61.2%) and half used student participants (n=133; 47.8%). Papers typically lacked a stated theoretical approach (n=203; 73.0%). Consistent with this, only 53 (19.1%) papers studied three or more occasion characteristics and most used methods that assume occasion characteristics do not change during an occasion (n=189; 68.0%). The most common outcome type considered was consumption (n=224; 80.6%) and only a few papers studied specific acute harm outcomes such as unprotected sex (n=24; 8.6%), drink driving (n=14; 5.0%) or sexual violence (n=9; 3.2%).

Conclusions

The reviewed literature is largely focused on students and consumption outcomes. Most papers considered a limited range of contextual characteristics. Future work should synthesise the findings on emerging and well-covered topics, such as venue type, and use theory-informed approaches to ensure more consistent analyses of contextual characteristics.

Key words: Drinking occasions, Contexts, Alcohol Drinking, Adverse Effects

INTRODUCTION

Globally, alcohol consumption was the seventh leading risk factor for death and disability in 2016 (1). Acute health conditions, such as injuries from violence and road traffic accidents, account for a large proportion of this burden, for example, they account for an estimated 54% of alcohol-related deaths and 65% of years of life lost in the United States (US) (2–4). Recent evidence suggests that both consumption levels and acute harmful outcomes are directly linked to the context of drinking occasions (5,6). There is less focus on the relationship between occasion characteristics and chronic harms as these are more related to long-term consumption patterns. Event-level methods, rather than measures of typical behaviour, are well suited and increasingly used to study the effects of contextual characteristics on consumption levels and acute harm (6,7). The range of characteristics studied to date is broad, including an occasion's timing, venue, situation, and participants. In the UK, drinking in pubs has been associated with violence (8). In the US college literature, themed parties were associated with increased blood alcohol concentration (9), and friends' high safety intentions for 21st birthday celebrations reduced the likelihood of negative alcohol-related consequences (10). Researchers in Switzerland and Australia also found that pre-drinking, drinking with a greater number of friends and drinking in a mixed gender group are all associated with increased alcohol consumption during an occasion (11–15). Other researchers have shown that drinking contexts and acute harm also vary across demographic groups; underage and legal drinkers differ in their drinking contexts and the alcohol-related harms that they experience (16,17).

In addition to measuring many contextual characteristics, the event-level literature linking contextual characteristics to acute consumption or harm is methodologically diverse. Researchers use experimental designs to determine how drinking behaviour is altered by factors manipulated by the researcher, such as the setting, who drinkers are with and the size or shape of the container which they are drinking from (18–20). There are also field studies in which researchers directly observe and collect data about drinking occasions (21). Intercept studies are a type of field study where participants are interviewed when entering or leaving drinking venues (22). Ecological momentary assessment is another commonly used survey approach involving eliciting reports from drinkers in real-time (or close to it), for example via smartphone apps (4,23,24). This is useful for identifying causal relationships as the temporal order of events is observed. Lastly, researchers use retrospective surveys to collect data on drinking occasions sometime after the event (25).

This large and diverse body of evidence is located in multiple research traditions, including epidemiology, experimental psychology, quantitative sociology, prevention research and anthropology. Thus, there is a need for a review to bring the published studies together and identify

the dominant theoretical and methodological approaches, any research gaps, and a set of specific topic areas for further detailed review and meta-analysis (26,27). Considering theoretical approaches is important as they influence the rationale, aims, objectives, methods and interpretation of studies (28,29). Understanding the theoretical approaches used can therefore assist in explaining other features of the literature. This mapping review aims to describe event-level research that quantifies the relationship between the context of adults' drinking occasions and consumption and/or acute alcohol-related harm. In order to achieve this, it maps studies in terms of their theoretical approach, data collection methods, settings, populations, characteristics of drinking occasions analysed, other outcome predictors such as individual characteristics, and the outcome measures of consumption and/or acute alcohol-related harm used (27).

METHODS

Mapping review

Grant *et al.,* in their typology of reviews, define mapping reviews as describing the topics covered and methods used by the existing literature to identify research gaps and areas for systematic review (27). Mapping reviews are particularly useful for a research area like event-level alcohol research, where the evidence base is large, methodologically and conceptually diverse, and distributed across a poorly connected set of research traditions.

Search strategy

A systematic search was conducted using Ovid MEDLINE, Ovid PsycInfo and the Web of Science Social Science Citation Index (SSCI). Databases were searched from the earliest dates available to the 8th January 2019. The main search strategy was developed iteratively, with a scoping search used to identify key terms relating to three concepts: alcohol consumption (e.g. alcohol-related or alcoholic beverage*), event-level research (e.g. ecological momentary assessment) and characteristics of drinking occasions (e.g. venue*, weekend). These were combined such that only records containing at least one term from each concept were identified (Table S1). This search strategy captured literature on alcohol-related harms since these papers mention the included alcohol terms and use Medical Subject Headings such as Alcohol Drinking.

Duplicates were removed using Ovid. Studies describing the effects of interventions or treatment were not of interest for this review. The search strategy therefore excluded papers using relevant database-specific subject headings and the terms 'brief intervention' present in the abstract or 'effectiveness' in the title.

Eligibility criteria

Population

Our review focuses on studies of the general population, or subsets thereof, defined by drinking level or age (including student populations). Research on clinical or other special subpopulations (e.g. pregnant women; homeless populations, young offenders, those diagnosed with specific health conditions) was excluded, as were studies with participants wholly under the legal drinking age (e.g. under 21s in the US) as underage drinkers are known to drink differently to adults and have a different harm profile (16,17).

Exposure

Eligible studies must quantitatively measure one or more contextual characteristics of individual drinking occasions other than alcohol consumption or harm. These were identified during search strategy development and are listed in the search strategy and results table (Table 1, Table S1). Contextual characteristics were organised into six categories developed using the results of the scoping search – meaning, timing, venue, company, situation (e.g. crowding) or drink type (30).

Outcome

Eligible studies examine the association between a relevant contextual characteristic and at least one event-level or aggregate consumption outcome and/or acute alcohol-related harm. Acute harms were identified using the 10th Revision of the International Classification of Diseases and a 2017 review of the burden of disease of alcohol use (31–33). The resultant list of 20 harms was lengthened to include condom use, criminal activity and aggregate measures of acute harm (which aggregate several different harms into one measure). Studies on these subjects were identified by the scoping search.

Study designs and reporting

Quantitative research published in English that used event-level methods including ecological momentary assessment, experimental, retrospective diary (up to one week) and recall of specific occasion/s methods was eligible for inclusion.

We excluded studies that did not identify drinking occasions of individuals or groups, such as bar-room studies measuring bar-level characteristics and outcomes only.

Existing reviews

Where recent (2014 – present) systematic reviews of an occasion characteristic, an outcome or the relationship between a characteristic and outcome were identified during database searching, we consider the literature on that topic to be adequately mapped and exclude it from the present review, irrespective of publication date. This decision was taken to manage the scope of an already wide-ranging review. It means we did not include search terms related to the topic of the earlier review in our search strategy and we did not include otherwise identified studies if they focused only on the reviewed characteristic, outcome or relationship. Below, we summarise the recent reviews identified by our search to give readers an overview of their content and guide them towards information that is excluded from the present study. Where older (pre-2014) systematic reviews were identified, we considered the literature to be potentially inadequately mapped, as recent studies would not be included. Therefore, we included all eligible studies within older reviews in our analysis and searched for more recent literature within our search strategy.

Four recent reviews were identified. Two of these focused on the relationship between illicit substance use and domestic violence (34,35) and the other two focused on combined use of alcohol with energy drinks (36,37). None of these reviews solely focused on event-level studies but included them alongside other literature. Choenni *et al*'s review on illicit substance use and domestic violence identified few event-level studies and most of the literature focused on clinical populations (34). Bruijn *et al*. include three event-level studies of non-clinical samples on the relationship between illicit substance use and same-day domestic violence based on the table of included literature (35). Similarly, Verster *et al*. and Peacock *et al's* systematic reviews on mixing alcohol with energy drinks included few event-level studies and none that predicted acute harm outcomes (36,37). Much of the literature in the reviews by Verster *et al.* and Peacock *et al.* studied student or bar drinking samples (36,37). Overall, there is limited event-level research in these areas especially in general population samples.

We identified a number of older systematic reviews that were potentially relevant. The most important was published in 2011 by Hughes *et al*. and examines physical, staffing and social factors in drinking occasions (38). We included the 53 papers in Hughes *et al's* review in our screening and searched for new literature in this area published after 2009 (38). Other reviews on pre-drinking, craving, smoking, motives and expectancies, bar characteristics, day of the week, time of day and student drinking and intimate partner violence were identified (2,4,6,39–47). These reviews were not recent, comprehensive, systematic and event-level and so did not justify excluding these characteristics from this review.

Screening for inclusion and data extraction

Titles and abstract screening was followed by full-text screening and data extraction by one reviewer (AS).

Identifying information extracted included title, first author, journal and year of publication. Key information was then extracted about each study including the theoretical approach, data collection method, setting, population and country, study outcome measures and the individual, contextual characteristics and other predictors included. We also assessed whether the design treated drinking occasions as static or allowed for characteristics to change during the drinking occasions (such as moving venue). The results reported in each paper were not extracted since the aim of this review was to map the topics and methods covered by existing literature (27).

Analysis and reporting

Descriptive summary statistics were used to first explore theoretical approaches, then study design, followed by individual and occasion characteristics used as predictors, and finally outcome measures. Summary statistics refer to numbers of papers as some papers reported multiple studies and vice versa.

Analysis was conducted using Microsoft Excel 2016 and Stata version 15. Figures were produced using OriginPro 2017. All searching, screening, data extraction and analysis was conducted by the first author with input from PM and JH.

RESULTS

A summary table of the included literature is available in the Appendix (Table S2).

Search results

Of the 5,590 non-duplicate titles and abstracts identified by the search, 4,429 (79.23%) were excluded after title and abstract screening. Full text screening subsequently excluded 883 papers leaving 278 eligible papers (Figure 1) (48).

[Insert Figure 1 here]

There has been a recent rapid increase in the number of papers being published – 65.1% of papers were published after 2010 (Figure 2).

[Insert Figure 2 here]

Theoretical approach

A minority of papers in this review had an explicit theoretical framework (n=75; 27.0%) (Table 1). Those that did typically used psychological theories such as the theory of planned behaviour and focused on specific contexts such as motivations (informed by motivational models) (49,50).

Study designs, locations and settings

Across all included papers, daily diary (n=70; 25.2%), single occasion recall (n=66; 23.7%) and experimental (n=43; 15.5%) designs were the most common. However, papers using ecological momentary assessment, such as by text messaging, were also used (n=39; 14.0%). The earliest ecological momentary assessment study identified was published in 2000 but most (n=27; 69.2%) were published after 2014 (Table S3). Most papers (n=189; 68.0%) used methods based on the assumption that occasion characteristics do not change across an occasion, for example, recording only one drinking venue or set of companions. Experimental (17 of 43 papers; 39.5%), daily diary (27 of 70 papers; 38.6%), and ecological momentary assessment (14 of 39 papers; 35.9%) designs were most likely to state an explicit theoretical framework.

Much of the identified literature was conducted in the US (n=170; 61.2%). Other common countries were Australia (n=21; 7.6%), Canada (n=17; 6.1%), and Switzerland (n=17; 6.1%). Most papers reported drinking occasions across a range of settings (n=198; 71.2%) but 45 (16.2%) focused on a single type of setting only – such as licensed premises (n=9; 3.2%), nightclubs (n=7; 2.5%) or bars (n=21; 7.6%). The remaining 35 (12.6%) papers used experimental settings.

Participant characteristics were frequently included in analyses as controls (n=230; 82.7%), including sex (n=195; 70.1%), age (n=109; 39.2%) and measures of usual drinking (n=67; 24.1%).

Study populations

Student populations were the most commonly studied (n=133; 47.8%), especially in the US literature (105 of 170 papers; 61.8%). Other papers recruited adult drinkers (n=98; 35.3%), non-student young adults (n=47; 16.9%), or risky drinkers (n=33; 11.9%). There were only three papers (1.1%) which focused on older adults although they are at higher risk of alcohol-related harm (51).

[Insert Table 1]

Contextual characteristics of drinking occasions

Contextual characteristics were organised into six categories: meaning, timing, venue, company, situation (e.g. crowding) or drink type, to facilitate interpretation (30) (Table 2). *Meaning* includes mood (e.g. feeling "sad" or "dejected" (52)), drinking motives (e.g. drinking to cope (6)), stated reason for the occasion such as being at a party (53), intentions (e.g. planned number of drinks (54)) and social support/interactions (e.g. positive or negative interpersonal events such as having an argument (55)). *Timing* is mostly operationalised as the day of the week and/or time of day at which the occasion occurs (56). Common *company* characteristics measured were the number of people in the drinking occasion and the type of people involved (e.g. family or friends (57)). *Venue* characteristics include the number of different venues (58); whether they are in the on-trade, off-trade or both (59); and the type of venue, such as in a pub versus at home (60). *Situation* relates to other features of the local environment, (e.g. crowding (61)), and a wide range of characteristics were studied. Lastly, *drink type* is the kind of alcoholic drink being consumed (e.g. liquor/spirits vs wine (62)).

The overall number of papers that studied each contextual characteristic, how many used student populations in the US, and how many used other young adult populations are shown in Table 2. There are several contextual characteristics that are well-studied in young adults but not covered by the literature on general adult populations – such as reasons, motives, number of venues and the availability of illicit drugs. Some contextual characteristics are largely studied in the US using student populations – such as the availability of food or number of drunk people in the local environment.

[Insert Table 2 here]

Few of the included papers measured a wide range of occasion characteristics, in line with the lack of theory-based conceptualisation of drinking occasions. A large proportion of included papers (n=117; 42.1%) measured just one type of characteristic. Few papers (n=53; 19.1%) measured three or more types of characteristics (Figure 3).

[Insert Figure 3 here]

Meaning characteristics were the most commonly studied (n=155; 55.8%), followed by timing (n=132; 47.5%), company (n=80; 28.8%), venue (n=75; 27.0%), situation (n=63; 22.7%) and drink type (n=18; 6.5%) (Table 3). This prominence of meaning is likely due to the dominance of psychological frameworks focused on particular aspects of drinking occasions. Of the 155 papers which measured meaning characteristics, 31.6% measured *only* meaning characteristics. This proportion was generally smaller for less commonly measured characteristics (e.g. timing 18.9%; company 16.3%; venue 12.0%; situation 15.9%; drink type 5.6%). There was variation in the overlaps between

contextual characteristic types studied; papers with company characteristics often included meaning characteristics (60.0%) and papers with drink type characteristics often included venue (61.1%) and timing (50.0%) characteristics (Table 3).

[Insert Table 3 here]

Alcohol consumption and harm outcome measures

The included papers primarily examined the relationship between occasion characteristics and alcohol consumption (n=224; 80.6%). Far fewer papers examined specific acute harms such as unprotected sex (n=24; 8.6%) and drink driving (n=14; 5.0%) (Table 4). There were no papers on drinking in pregnancy or drowning and just one paper on self-harm (63). Alcohol consumption was most commonly measured using the number of drinks or another measure of consumption volume (n=171; 61.5%). Smaller numbers of papers used dichotomous measures of heavy drinking (i.e. whether participants exceeded consumption thresholds) (n=42; 15.1%), estimated or measured blood alcohol concentration (n=59; 21.2%) and subjective measures of intoxication (n=12; 4.3%). The most common measures of acute harm were aggregate measures such as the Rutgers Alcohol Problem Index (RAPI) (n=30; 10.8%), which includes harms like drink driving and getting into fights (64).

[Insert Table 4 here]

DISCUSSION

This novel comprehensive review identified a large evidence base (278 papers) examining associations between contextual characteristics of drinking occasions, alcohol consumption and acute alcohol-related harm. Despite this, few papers included a comprehensive set of occasion characteristics and many used methods that assume drinking occasions do not evolve over their duration. This suggests the literature as a whole lacks a clear conception of drinking occasions - and therefore how to measure and analyse them. The available literature is also limited with regard to diversity of population studied. Almost half of the papers identified focused on students in the United States, which limits the generalisability of their findings.

Although most of the identified papers studied the relationship between contextual characteristics of drinking occasions and consumption, there is a growing literature studying acute harm outcomes. The included studies on specific alcohol-related harms largely focused on unprotected sex, drink driving and assault. Studying the links between these harms and occasion characteristics is

important, as alcohol consumption alone does not explain alcohol-related harm (5,6). For example, drink driving is more likely after heavy drinking occasions in on-trade venues than in off-trade venues (60). Narrative reviews or meta-analyses of sections of the identified literature are needed to identify further findings of this nature and to inform future studies of the contextual characteristics of drinking occasions and acute alcohol-related harms. Potential areas for meta-analysis include the influence on consumption or acute harms of characteristics such as day of the week, time of day or venue type, which are consistently defined and widely studied in the available literature. The authors are beginning this process by conducting a systematic review to narratively synthesise the results of studies examining the occasion-level predictors of acute alcohol-related harm (PROSPERO ID: CRD42018119701).

To gain a full and robust understanding of the relationship between contextual characteristics of drinking occasions, alcohol consumption and acute alcohol-related harm, we require studies that comprehensively capture relevant characteristics. This review identified six categories of contextual characteristics studied by the literature - meaning, timing, venue, company, situation and drink type. Most papers measured only one or two of these characteristic types and much of the literature focuses on psychological constructs (e.g. mood or stress), time of day and day of the week, with less attention paid to reasons for drinking, drinking motives, the drinking of others and the evolution of drinking occasions over their duration. This lack of comprehensiveness may reflect that the literature also lacks systematically applied occasion-focused theoretical frameworks. Future research across the disparate research traditions covered in this review could benefit from applying theoretical frameworks since theory structures our understanding of research topics, methods and interpretation (28,29). For example, in the absence of theory, researchers may overlook the complexity of drinking occasions and focus on their topic of interest – neglecting interaction with and confounding by other features of occasions.

One approach to addressing the lack of theoretical frameworks is to use insights from theories of practice (30,65,66). Ally et al. (67) and Meier et al. (30) have described how this might offer new ways to understand the contextual complexity of drinking behaviour. Their description of drinking occasions as comprising multiple intersecting elements is informed by Shove et al. (68) who propose three core types of elements - materials (e.g. glasses or a pub), competencies (e.g. round buying or managing appropriate intoxication levels), and meanings (e.g. relaxation) (68). Theories of practice therefore offer a holistic approach to conceptualising drinking occasions that can help researchers to identify key contextual characteristics to consider for inclusion in data collection and analyses. In contrast, the literature to date offers a much-reduced view of occasions, with only a small number of

occasion characteristics (or elements) included within each study and no clear rationale offered for decisions on which characteristics are or are not included.

The types of contextual characteristics studied in the literature identified in the present review do not reflect a particular theoretical approach to understanding drinking occasions but can be mapped to Shove *et al's* elements of social practice (68). The contextual characteristics in the meaning category of our typology are also meanings as conceptualised by Shove *et al.* while venue, company, situation and drink type are measured as material elements, since respondents are asked to describe where, with whom and what they are drinking. The literature could further address meanings associated with these material factors. For example, most papers used material elements (such as drinking in a loud environment (9)) as predictors for their outcome of interest. However, they did not explore the meanings the respondent associated with these materials (such as associating 'time out' from typical social restrictions with drinking in bars (69,70)) which could mediate or moderate the observed associations with outcome measures. Of the three types of elements theorised by Shove, the literature particularly lacks studies of competencies. Just two papers studied competencies of round buying and none considered other relevant competencies, such as toasting, downing drinks or managing intoxication levels, which are routinely cited within the qualitative literature (71–73).

Another theoretical framework rooted in theories of practice is Southerton's five understandings of time – how frequently and when activities take place (periodicity), how long they take (duration), how fast they happen (tempo), what order they happen in (sequence) and what other activities are happening simultaneously (synchronisation) (30,74). Although occasion timing was often studied by the reviewed literature, it was mostly operationalised as time of day or day of the week (i.e. periodicity). These studies are more limited in considering duration, tempo, sequence or synchronisation of specific drinking occasions (74,75). Furthermore, most studies used methods that assumed that drinking occasions are static, such that they cannot assess change within drinking occasions (e.g. sequencing of venues).

This study is the first comprehensive review mapping the literature on contextual characteristics of drinking occasions. This is timely as there is increasing interest in using event-level methods to develop understanding of how context is associated with levels of consumption and acute alcohol-related harm (30,65,66). We have used a detailed, systematic search strategy to identify relevant papers and reviews of subsections of this literature. A comprehensive list of acute-alcohol related harms were used to identify papers on harm outcomes (31,32). The main limitations of this review are that a single reviewer considered the studies, there was no validation of data extraction, and the

construction of the search strategy was challenging since the concepts are ill defined and the literature heterogeneous. The first two limitations are less problematic for a mapping review than for a systematic review (76) and allowed the paper to provide an overview of a large volume of literature efficiently. The final limitation may reduce the comprehensiveness of our findings but the strengths listed above and the breadth of studies identified suggest we have minimised this problem.

Overall, the study of contextual characteristics of adults' drinking occasions and their association with levels of alcohol consumption and alcohol-related harm would benefit from the application of an event-level theoretical framework such as theories of practice. Particular characteristics of occasions that require further study in general population samples include people's reasons and motives for drinking and the presence of others who are drinking heavily. There is also a need for more research to focus on comprehensive sets of occasion characteristics and specific acute harm outcomes. Future research should conduct reviews and meta-analyses of well-studied areas (e.g. mood, drinking venue, time of the week and time of day) and develop theory-based primary evidence in under-researched areas, particularly competencies, temporalities and acute alcohol-related harm.

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FIGURES AND TABLES

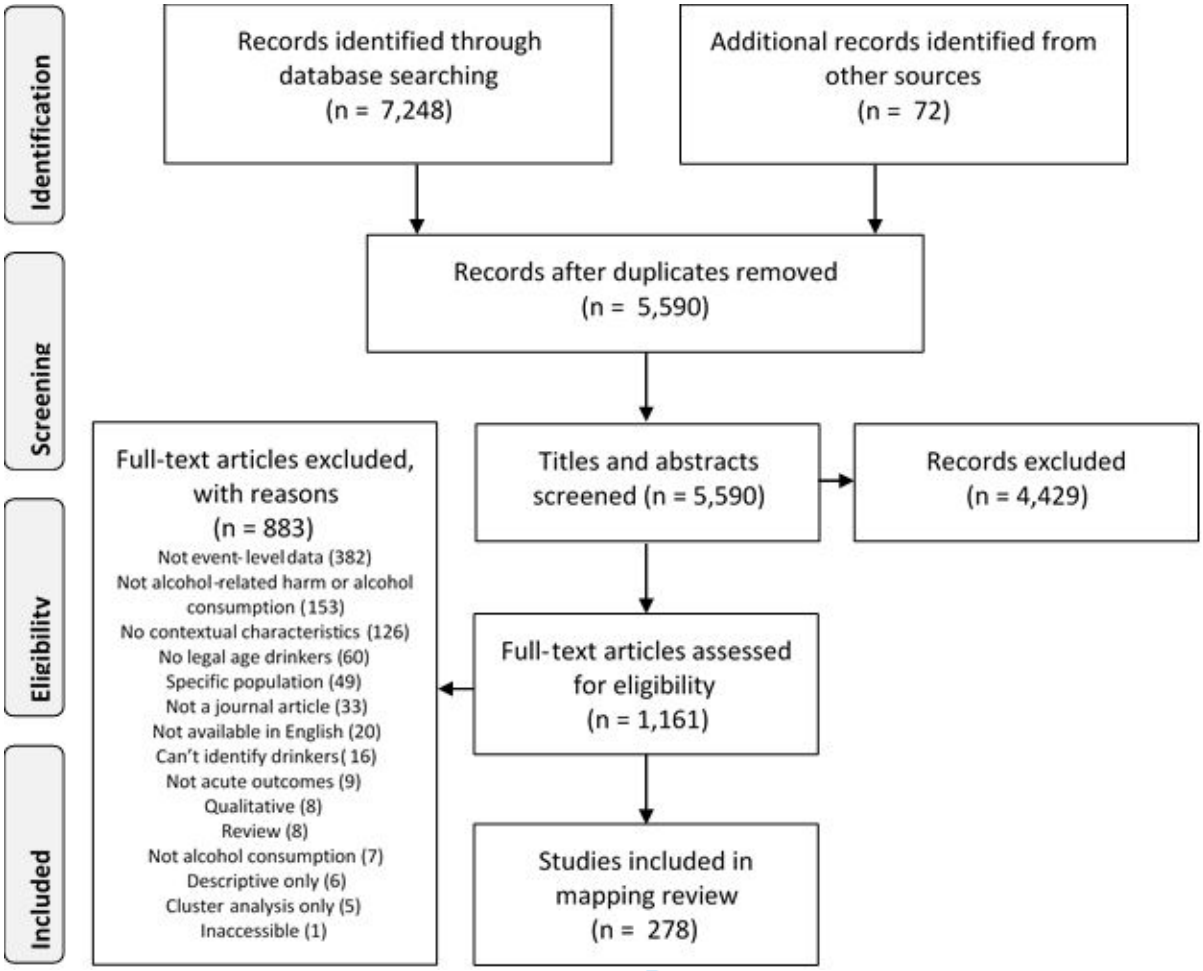

Figure 1. PRISMA diagram

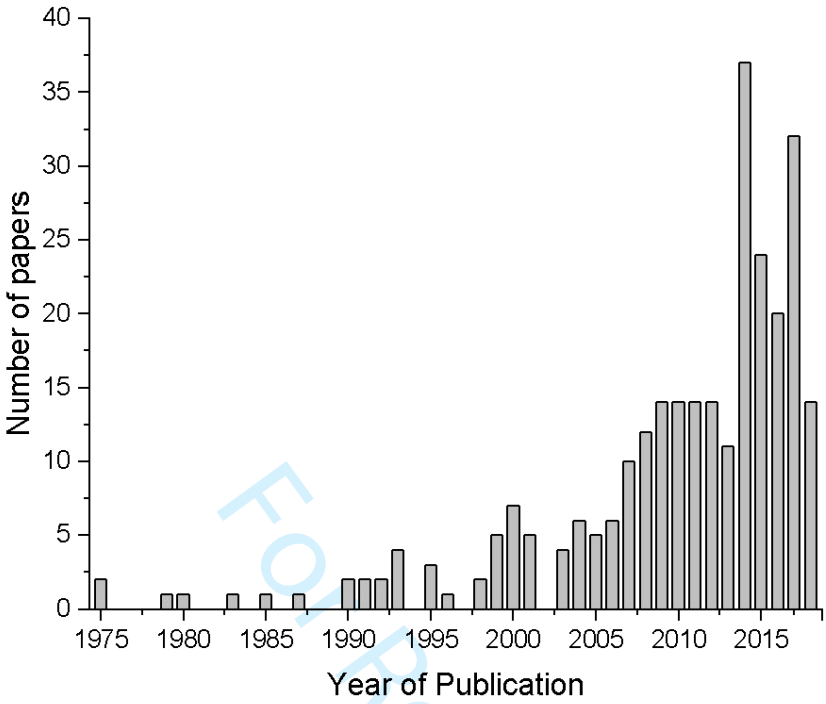

Figure 2. Year of publication for included studies

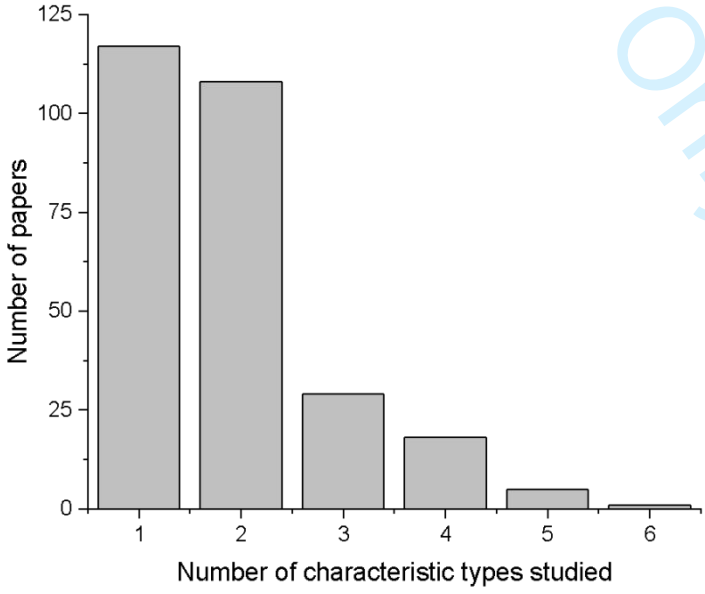

Figure 3. The number of characteristic types studied by included papers

Table 1. Study characteristics which applied to at least five papers [1]

	Study characteristics [2]	Total number of papers (percentage of included studies)
Theoretical approach	None	203 (73.0)
	Motivational models	17 (6.1)
	Tension-reduction models	6 (2.2)
	Social learning theory	5 (1.8)
Design	Daily drinking diary/ 24 hour recall	70 (25.2)
	Single occasion recall	66 (23.7)
	Experimental	43 (15.5)
	Ecological momentary assessment	39 (14.0)
	Portal/ intercept survey	29 (10.4)
	Retrospective drinking diary	24 (8.6)
	Field studies	20 (7.2)
Country	United States	170 (61.2)
	Australia	21 (7.6)
	Canada	17 (6.1)
	Switzerland	17 (6.1)
	England	14 (5.0)
	The Netherlands	10 (3.6)
	New Zealand	5 (1.8)
Population	Students	133 (47.8)
	Adults	98 (35.3)
	Non-student young adults	47 (16.9)
	Risky drinkers	33 (11.9)
	Experienced a specific harm [3]	16 (5.8)

[1] These findings are shown by year of publication in Table S3. [2] Some studies fit into multiple categories (e.g. they were conducted in two countries or they used both daily diary and single occasion recall methods). In such instances, we used both characteristics to define the paper. [3] For example, recruiting injured patients in accident and emergency departments.

Table 2. Contextual characteristics measured by at least five papers [1]

	Contextual characteristics [2]	Number of papers with United States student populations	Number of papers with young adult populations [3]	Total number of papers (percentage of included studies)
Meaning	Affect/ mood	22	33	50 (18.0)
	Anxiety/ stress	7	7	19 (6.8)
	Intentions	5	9	18 (6.5)
	Subjective intoxication	7	14	18 (6.5)
	Social support/ interactions	9	9	16 (5.8)
	Reasons	10	14	15 (5.4)
	Craving	1	9	14 (5.0)
	Motives	5	11	13 (4.7)
	Alcohol cue exposure	1	5	8 (2.9)
Timing	Day of the week	31	51	81 (29.1)
	Time of day	7	21	38 (13.7)
	Duration	6	17	24 (8.6)
	Other timing (e.g. year)	10	16	23 (8.3)
	Specific/special occasions	8	14	21 (7.6)
	Sport-related	5	5	8 (2.9)
Company	Number of people	9	25	36 (13.0)
	Type of people	14	25	35 (12.6)
	Drunk people	9	17	20 (7.2)
	Gender composition	1	11	15 (5.4)
	Length of relationship	5	6	8 (2.9)
Venue	Venue type	13	25	44 (15.8)
	Pre-drinking	11	21	30 (10.8)
	On-trade versus off-trade premises	4	9	17 (6.1)
	Number of venues	3	8	8 (2.9)
Situation	Illicit drugs used	8	13	23 (8.3)
	On-trade venue features (e.g. loud music)	6	12	21 (7.6)
	Off-trade occasion features (e.g. drinking games)	14	14	16 (5.8)
	Commercial factors (e.g. discounting)	7	7	12 (4.3)
	Illicit drugs available	7	7	8 (2.9)
	Crowding	1	4	8 (2.9)
	Food available	6	6	8 (2.9)
	Ate food	0	4	7 (2.5)
	Number of drunk people	5	5	5 (1.8)

[1] These findings are shown by year of publication in Table S4. [2] Some studies fit into multiple categories (e.g. they were conducted in two countries or they used both daily diary and single occasion recall methods). In such instances, we used both characteristics to define the paper. [3] The number of papers using student and other young adult populations.

Table 3. Proportion of papers in each category of contextual characteristics (rows) which also studied other types of contextual characteristics (columns)

	Meaning	Timing	Company	Venue	Situation	Drink type	Total papers
Meaning	31.6%	38.7%	31.0%	22.6%	18.1%	2.6%	155
Timing	45.5%	18.9%	19.7%	25.0%	18.9%	6.8%	132
Company	60.0%	32.5%	16.3%	35.0%	28.8%	3.8%	80
Venue	46.7%	44.0%	37.3%	12.0%	38.7%	14.7%	75
Situation	44.4%	39.7%	36.5%	46.0%	15.9%	9.5%	63
Drink type	22.2%	50.0%	16.7%	61.1%	33.3%	5.6%	18

The percentages show how many papers in the contextual characteristics category indicated by the row heading also measured characteristics in the category indicated by the column heading. For example, the top left cell shows that 31.6% of the papers which studied meaning characteristics only studied meaning characteristics. The next cell to the right shows that 38.7% of the papers which studied meaning characteristics also studied timing characteristics.

Table 4. Number of papers studying each consumption and alcohol-related acute harm outcome measure

Alcohol-related acute harm[1]	Number of papers with United States student populations	Number of papers with young adult populations [2]	Total number of papers (percentage of included studies)
Alcohol consumption	83	145	224 (80.6%)
Aggregate acute harm [3]	22	27	30 (10.8)
Condom use	10	19	24 (8.6)
Accidental injuries (fall injuries and other unintentional injuries) [4]	2	4	16 (5.8)
Drink driving and transport injuries	5	6	14 (5.0)
Victim of assault	5	10	13 (4.7)
Perpetrating assault	4	10	11 (4.0)
Sexual violence	5	6	9 (3.2)
Mental and behavioural disorders (acute intoxication, dependence syndrome, withdrawal, withdrawal with delirium, psychotic episode)	4	5	5 (1.8)
Criminal activity	2	3	3 (1.1)
Intimate partner violence	2	2	2 (0.7)
Intentional self-harm	0	0	1 (0.4)
Mechanical forces	0	0	0
Drinking in pregnancy	0	0	0
Drowning	0	0	0
Intentional self-poisoning with alcohol	0	0	0
Other intentional injury	0	0	0
Alcohol poisoning, undetermined intent	0	0	0
Accidental exposure to noxious substances	0	0	0

[1] Some studies fit into multiple categories (e.g. they studied two types of harm). In such instances, we used both characteristics to define the paper. [2] The number of papers using student and other young adult populations.[3] Aggregate measures of acute harm create a single measure of harm from several different harms. For example, a score for the number of harms experienced from a list might be used. [4] The total for this category includes papers on emergency department attendance and hospitalisation.

Table S1. Systematic search strategy

Concept	Search terms			
Alcohol consumption (.mp.) (TS & TI)	bing* adj3 (drink* or consum* or intoxicat*)	alcohol* adj3 (drink* or consum* or intoxicat* or related)	heavy adj3 drink* alcoholic beverage* alcohol-related	
Alcohol consumption MEDLINE	exp Alcohol Drinking/			
Alcohol consumption PsycInfo	exp Alcohol drinking attitudes/	exp Alcohol drinking patterns/ exp binge drinking/	exp drinking behavior/ exp social drinking/	
Event-level research (.af.) (TS & TI)	ema ecological momentary assessment experience sampling diary diaries event level event level drink* adj2 event* event-specific event specific event-contingent event contingent	referral event occasion-based occasion based drink* practi?e* practi?e theor* theor* of practi?e* element* adj2 practi?e* recent* adj2 occasion recent* adj2 occasions recent* adj2 event last adj2 occasion	last adj2 occasions last adj2 event barroom bar-room bar room experimental setting experimental condition icat phone adj assessment text message*	portal survey rhdo ivr interactive voice response daily survey* handheld assessment tool* daily retrospective daily process realtime real time real-time daily account*
Contextual characteristics (.mp.) (TS & TI)	cocaine crack cocaine cannabis hashish marijuana cannabinoids (tetrahydrocannabinol) heroin ecstasy XTC amphetamines speed GHB MDMA venue* location* barroom bar-room bar* home pub restaurant* street drink* nightclub	parent* beverage choice* beverage preference* beverage type* beverage-type* drink choice* drink type* drink-type wine* spirits beer* cider* alcopop* premixed pre-mixed pre mixed rtd* ready-to-drink* ready to drink* (flavoured alcoholic beverage*) (flavored alcoholic beverage*)	Tuesday* Wednesday* Thursday* Friday* Saturday* Sunday* weekend* week-end* week end start-time start time duration night-time night time day-time day time daytime meal time* meal-time* mealtime* drink* adj3 mood alcohol adj3 mood stress affect	social support (subjective intoxication) subjective effect* (subjective experience*) (perceived intoxication) occasion adj3 type (occasion adj3 reason) party adj3 type party adj3 reason social purpose (purpose adj3 occasion) year* holiday* birthday* semester* gender composition gender ratio sex composition

Concept	Search terms			
	club hotel tavern* bottle store* wine shop* shebeen* company companion* peer* friend* colleague* family partner wife husband spouse	drink* adj3 (motive* or motivation* or meaning* or expect?nc* or reason*) alcohol* adj3 (motive* or motivation* or meaning* or expect?nc* or reason*) day of the week Monday*	anxiety craving urge desire (pre-loading and alcohol) (pre-loading and drinking) (front-loading and alcohol) (front-loading and drinking) (drinking before drinking) intention* social interaction*	sex ratio male only female only mixed sex mixed gender football rugby rowing match day* sport* patron age patron sex patron ethnicity patron race drinking game*
Contextual characteristics – situation (.mp.) (TS & TI)	dancing crowd* buy* adj3 round* facilities lighting	atmosphere music volume loud	discount* offer* promotion* marketing	advertising BOGOF drink* adj3 free alcohol* adj3 free
Exclusions for: MEDLINE	Therapeutics/ Psychotherapy/	Intervention.ti.	Brief intervention.ab.	Effectiveness.ti.
PsycInfo	Treatment/ Psychotherapy/	Intervention.ti.	Brief intervention.ab.	Effectiveness.ti.
SSCI (TS & TI)	Intervention effectiveness			

Table S2. Summary of included papers

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Abbey, 2001 (1)	Recall specific past event/s	Male students	United States	Not occasion consumption Sexual violence	Yes		Yes	Yes		
Aberg, 1993 (2)	Recall specific past event/s	Adult male	Sweden	Not occasion consumption Drink driving	Yes		Yes			
Ahmed, 2014 (3)	Recall specific past event/s	Students	United States	Not occasion consumption Requiring medical attention	Yes			Yes		
Aldridge-Gerry, 2011 (4)	Retrospective daily diary/ 24hr recall	Students	United States		Yes	Yes				
Andreuccetti, 2014 (5)	Recall specific past event/s	Alcohol-related A&E injured patients vs non-alcohol related controls	Latin American and Caribbean	Not occasion consumption Requiring medical attention				Yes		Yes
Armeli, 2000 (6)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States		Yes					
Armeli, 2005 (7)	Retrospective daily diary/ 24hr recall	Students	United States		Yes	Yes				
Armeli, 2007 (8)	EMA	Risky drinkers	United States		Yes	Yes				
Armeli, 2010 (9)	Retrospective daily diary/ 24hr recall	Students	United States		Yes					
Babor, 1980 (10)	Experimental	General/healthy adult	United States			Yes			Yes	
Bacon, 2015 (11)	Experimental	Students	United States		Yes					
Bacon, 2018 (12)	Experimental	Students	United States		Yes		Yes			
Bae, 2017 (13)	EMA	Young adult heavy drinkers	United States			Yes			Yes	

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Barry, 2013 (14)	Portal/ intercept survey[4]	Students	United States			Yes		Yes		
Barry, 2014 (15)	Portal/ intercept survey	General/healthy adult	United States			Yes				
Beech, 2014 (16)	Experimental	General/healthy adult	United States		Yes					
Bellis MA, 2010 (17)	Portal/ intercept survey	General/healthy adult	England			Yes		Yes	Yes	
Borsari, 2007 (18)	Recall specific past event/s	Mandated college students	United States		Yes			Yes	Yes	
Bourdeau, 2015 (19)	Portal/ intercept survey	General/healthy adult	United States		Yes		Yes		Yes	
Bourdeau, 2017 (20)	Portal/ intercept survey	General/healthy adult	United States	Sexual violence Victim of assault		Yes	Yes			
Boynton, 2014 (21)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States		Yes	Yes				
Braitman, 2017 (22)	Diary	Students	United States	Aggregate measure of acute harm[3]	Yes		Yes	Yes		
Brister, 2011 (23)	Recall specific past event/s	Students	United States	Aggregate measure of acute harm		Yes	Yes	Yes	Yes	
Brown, 2007 (24)	Recall specific past event/s	Students	United States	Unprotected sex			Yes			
Brown, 2016 (25)	Recall specific past event/s	Young women	United States	Not occasion consumption Unprotected sex	Yes		Yes			
Bryan, 2017 (26)	Diary	Adult female	United States	Not occasion consumption Unprotected sex	Yes		Yes			
Buettner CK, 2011 (27)	Diary	Students	United States	Aggregate measure of acute harm	Yes			Yes		
Butler, 2010 (28)	Retrospective daily diary/ 24hr recall	Students	United States		Yes	Yes				
Byrnes, 2014 (29)	Field studies Portal/ intercept survey	General/healthy adult	United States			Yes			Yes	

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Callaghan, 2014 (30)	Routine data	Young adults	Canada	Not occasion consumption Dependence syndrome		Yes				
Callinan, 2014 (31)	Recall specific past event/s	General/healthy adult	Australia					Yes		Yes
Carlini, 2014 (32)	Portal/ intercept survey Field studies	General/healthy adult	Brazil					Yes	Yes	
Carney, 2000 (33)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States		Yes					
Caudill, 1975 (34)	Experimental	Male students who are risky drinkers	United States		Yes		Yes			
Caudill, 2001 (35)	Experimental	Risky drinkers	United States		Yes		Yes			
Champion, 2009 (36)	Diary	Students	United States	Aggregate measure of acute harm		Yes				
Cherpitel, 1998 (37)	Retrospective daily diary/ 24hr recall	Experienced a skiing injury vs controls	United States	Not occasion consumption Other unintentional injuries (skiing injuries)		Yes				
Cherpitel, 1999 (38)	Recall specific past event/s	A&E patients	Canada	Not occasion consumption Requiring medical attention	Yes	Yes			Yes	
Cherpitel, 2012 (39)	Recall specific past event/s	A&E patients	Canada	Not occasion consumption Requiring medical attention					Yes	
Clapp, 2000 (40)	Recall specific past event/s	Students	United States	Not occasion consumption Aggregate measure of acute harm	Yes		Yes	Yes	Yes	
Clapp, 2001 (41)	Recall specific past event/s	Students	United States		Yes		Yes	Yes	Yes	Yes
Clapp, 2003 (42)	Recall specific past event/s	Students	United States		Yes			Yes	Yes	
Clapp, 2006 (43)	Recall specific past event/s	Students	United States					Yes	Yes	
Clapp, 2008 (44)	Recall specific past event/s Field studies	Students	United States	Injuries Aggregate measure of acute harm Aggression	Yes				Yes	

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
				Rode with a drunk driver						
Clapp, 2008 (45)	Field studies	Students	United States		Yes	Yes	Yes	Yes	Yes	Yes
Clapp, 2009 (46)	Portal/ intercept survey Field studies	General/healthy adult	United States		Yes	Yes	Yes	Yes	Yes	
Clapp, 2014 (47)	Field studies	Students	United States	Not occasion consumption Aggregate measure of acute harm		Yes		Yes	Yes	
Clapp, 2017 (48)	EMA	Students	United States		Yes	Yes				
Colby, 2004 (49)	Experimental	Young smokers and risky drinkers	United States		Yes					
Collins, 1985 (50)	Experimental	Male students who are risky drinkers	United States		Yes		Yes			
Collins, 2007 (51)	Recall specific past event/s	Young women who were involved in an aggressive incident in a bar	United States	Not occasion consumption Perpetrating assault Victim of assault	Yes		Yes		Yes	
Collins, 2018 (52)	Experimental	Students	Canada		Yes					
Connor, 2014 (53)	Diary	Students	New Zealand	Not occasion consumption Aggregate measure of acute harm	Yes	Yes	Yes	Yes		
Corbin, 2008 (54)	Experimental	Students	United States		Yes					
Cotti, 2014 (55)	Recall specific past event/s	Risky drinkers	United States	Not occasion consumption Drink driving				Yes		Yes
Cousins, 2010 (56)	Recall specific past event/s	Young adults	Ireland	Not occasion consumption Unprotected sex	Yes		Yes			
Croff, 2017 (57)	Field studies	Students	United States		Yes	Yes			Yes	Yes
Cullum, 2010 (58)	Retrospective daily diary/ 24hr recall	Students	United States				Yes			

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Cullum, 2012 (59)	Retrospective daily diary/ 24hr recall	Students	United States		Yes		Yes			
de Castro, 1990 (60)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States		Yes	Yes	Yes		Yes	
de Castro, 2004 (61)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States			Yes				
Dehart, 2008 (62)	Retrospective daily diary/ 24hr recall	Risky drinkers	United States		Yes					
DeHart, 2009 (63)	Retrospective daily diary/ 24hr recall	Students	United States		Yes	Yes	Yes			
Diep, 2016 (64)	Recall specific past event/s	Students	Vietnam		Yes	Yes	Yes	Yes	Yes	
Dietze, 2017 (65)	Recall specific past event/s	Young adult heavy drinkers	Australia			Yes		Yes		Yes
Dinc, 2015 (66)	Experimental	Students	England		Yes					
Dodd, 2012 (67)	Portal/ intercept survey	General/healthy adult	United States		Yes	Yes		Yes		
Dumas, 2014 (68)	Portal/ intercept survey	Young adults	Canada				Yes			
Durbeej, 2017 (69)	Portal/ intercept survey	General/healthy adult	Sweden		Yes	Yes		Yes		
Dvorak, 2014 (70)	EMA	Students	United States	Dependence syndrome	Yes	Yes				
Dvorak, 2014 (71)	EMA	Student risky drinkers	United States		Yes					
Dvorak, 2016 (72)	EMA	Students	United States	Dependence syndrome	Yes					
Engels, 2012 (73)	Experimental	Young adults	The Netherlands						Yes	
Fairbairn, 2018 (74)	EMA Experimental	Risky drinkers	United States		Yes	Yes	Yes	Yes		

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Fairlie, 2015 (75)	Retrospective daily diary/ 24hr recall	Students	United States					Yes	Yes	
Fairlie, 2018 (76)	Recall specific past event/s	Young adults	United States	Not occasion consumption Unprotected sex					Yes	
Fazzino, 2013 (77)	Retrospective daily diary/ 24hr recall	Risky drinkers	United States		Yes	Yes				
Fiala, 2017 (78)	Diary	General/healthy adult	Czech Republic			Yes				Yes
Field, 2017 (79)	Experimental	Risky drinkers	England		Yes					
Fillo, 2017 (80)	Recall specific past event/s	Students	United States	Not occasion consumption Aggregate measure of acute harm			Yes			
Ford, 2017 (81)	Recall specific past event/s	Female students	United States	Not occasion consumption Sexual violence	Yes		Yes			
Foster, 2011 (82)	Recall specific past event/s	Students	United States	Consuming more than on a typical Saturday night	Yes	Yes				
Foster, 2015 (83)	Diary Routine data	Young men	Switzerland	Transport injuries (inc RTA)		Yes				
Fromme, 2010 (84)	Retrospective daily diary/ 24hr recall	Students	United States	Drink driving		Yes				
Geisner, 2017 (85)	Recall specific past event/s	Students	United States	Aggregate measure of acute harm	Yes	Yes				
Giraldo, 2017 (86)	Field studies	General/healthy adult	United States		Yes					
Giraldo, 2017 (87)	Field studies	General/healthy adult	United States		Yes				Yes	
Gmel, 2005 (88)	EMA Routine data	General/healthy adult	Switzerland	Not occasion consumption Transport injuries (inc RTA)		Yes		Yes		
Goldstein, 2014 (89)	EMA	Young adults	Canada		Yes					
Goodman, 2017 (90)	EMA	Students	United States		Yes	Yes				
Graham, 2014 (91)	Portal/ intercept survey	Young women	Canada	Not occasion consumption Sexual violence	Yes		Yes	Yes		

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Grant, 2009 (92)	Retrospective daily diary/ 24hr recall	Students	Canada	Depressed and anxious drinking	Yes					
Greene, 2018 (93)	Retrospective daily diary/ 24hr recall	Students	United States	Aggregate measure of acute harm		Yes				
Griffin, 1987 (94)	Retrospective daily diary/ 24hr recall	Female marijuana users	United States		Yes					
Griffin, 2017 (95)	Routine data	General/healthy adult	Ireland	Not occasion consumption Intentional self harm		Yes				
Groefsema, 2016 (96)	EMA	Young adults	The Netherlands			Yes	Yes			
Groefsema, 2018 (97)	EMA	Young adults	The Netherlands			Yes				
Gruenewald, 1999 (98)	Recall specific past event/s	Drivers who experienced crashes	Australia	Not occasion consumption Drink driving				Yes		
Grzywacz, 2008 (99)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States		Yes					
Gullo, 2017 (100)	Experimental	Young adults	Australia		Yes		Yes			
Gunn, 2018 (101)	Diary	Students	United States	Aggregate measure of acute harm		Yes			Yes	
Guéguen, 2004 (102)	Experimental Field studies	General/healthy adult	France						Yes	
Guéguen, 2008 (103)	Experimental Field studies	Adult male	France						Yes	
Hamilton, 2017 (104)	Experimental Retrospective daily diary/ 24hr recall	Students	United States		Yes		Yes			
Harford, 1983 (105)	Recall specific past event/s	General/healthy adult	United States				Yes	Yes		
Heeb, 2008 (106)	Diary	General/healthy adult	Switzerland			Yes				

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Helzer, 2006 (107)	Retrospective daily diary/ 24hr recall	At risk male drinkers	United States		Yes	Yes				
Higgins, 1975 (108)	Experimental	Male students who are risky drinkers	United States		Yes					
Howard, 2015 (109)	Retrospective daily diary/ 24hr recall	Students	United States		Yes	Yes				
Howells, 2014 (110)	Recall specific past event/s	Female students	United States	Not occasion consumption Unprotected sex	Yes					
Huh, 2015 (111)	Retrospective daily diary/ 24hr recall	Female students	United States			Yes				
Hummer, 2013 (112)	Recall specific past event/s	Student risky drinkers	United States	Aggregate measure of acute harm			Yes	Yes	Yes	
Jih CS, 1995 (113)	Recall specific past event/s	Students	United States			Yes				
Jones, 2007 (114)	Retrospective daily diary/ 24hr recall	General/healthy adult	England		Yes					
Jones, 2013 (115)	Experimental	Risky drinkers	England		Yes			Yes		
Jones, 2016 (116)	Experimental	Students	England		Yes	Yes				
Jones, 2018 (117)	EMA	Risky drinkers	England		Yes					
Joyce, 2017 (118)	Retrospective daily diary/ 24hr recall EMA	Adult female	Canada		Yes	Yes				
Jula, 1999 (119)	Retrospective daily diary/ 24hr recall	General/healthy adult	Finland			Yes				
Kenney, 2014 (120)	Recall specific past event/s	Students	United States	Not occasion consumption Aggregate measure of acute harm					Yes	

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Kerr, 2015 (121)	Retrospective daily diary/ 24hr recall	Students	United States	Not occasion consumption Unprotected sex	Yes	Yes	Yes		Yes	
Khurana, 2015 (122)	Recall specific past event/s	Students	United States	Aggregate measure of acute harm		Yes	Yes			
Kidorf, 1999 (123)	Experimental	Students	United States		Yes					
Kiene, 2009 (124)	Retrospective daily diary/ 24hr recall	Students	United States	Not occasion consumption Unprotected sex	Yes		Yes			
Kiene, 2013 (125)	Recall specific past event/s	General/healthy adult	sub-Saharan Africa	Not occasion consumption Unprotected sex	Yes		Yes			
Kilwein, 2018 (126)	Diary	Students	United States	Not occasion consumption Unprotected sex Sexual violence	Yes					
Knibbe, 1993 (127)	Field studies	Young adults	The Netherlands		Yes		Yes	Yes	Yes	
Kraft, 1991 (128)	Recall specific past event/s	Young adults	Norway	Not occasion consumption Unprotected sex			Yes			
Kuendig, 2011 (129)	Experimental	Students	Switzerland			Yes	Yes			
Kuendig, 2013 (130)	Experimental	Young adults	Switzerland				Yes			
Kuntsche, 2010 (131)	Retrospective daily diary/ 24hr recall	Young adults	Switzerland			Yes				
Kuntsche, 2012 (132)	EMA	Students	Switzerland			Yes				
Kuntsche, 2012 (133)	Experimental	Young adults	Switzerland				Yes			
Kuntsche, 2013 (134)	EMA	Students	Switzerland	Aggregate measure of acute harm				Yes		
Kuntsche, 2015 (135)	EMA	Students	Switzerland	Aggregate measure of acute harm		Yes	Yes	Yes		
Kushnir, 2014 (136)	Diary	General/healthy adult	Canada			Yes				

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Kypri, 2007 (137)	Diary	Students	New Zealand					Yes		
Kypri, 2010 (138)	Diary	Students	New Zealand			Yes		Yes		
LaBrie, 2008 (139)	Recall specific past event/s	Students	United States	Aggregate measure of acute harm				Yes		
Labhart, 2013 (140)	EMA	Young adults	Switzerland	Aggregate measure of acute harm		Yes		Yes		
Labhart, 2014 (141)	EMA	Students	Switzerland			Yes				
Labhart, 2014 (142)	EMA	Students	Switzerland			Yes	Yes	Yes		Yes
Labhart, 2017 (143)	EMA	Young adults	Switzerland, Lausanne and Zurich			Yes	Yes	Yes		
Lam, 2014 (144)	Recall specific past event/s	Young adults	Australia	Unprotected sex Injuries Perpetrating assault Criminal activity (e.g. theft, vandalism)	Yes	Yes				
Lam, 2017 (145)	Recall specific past event/s	Young adult heavy drinkers	Australia			Yes			Yes	
Lang, 1995 (146)	Recall specific past event/s	General/healthy adult	Australia	Aggregate measure of acute harm	Yes		Yes	Yes	Yes	
Larsen, 2009 (147)	Experimental	Young adults	The Netherlands		Yes		Yes			
Larsen, 2010 (148)	Experimental	Young adults	The Netherlands				Yes			
Larsen, 2012 (149)	Experimental	Students	The Netherlands				Yes			
Lau-Barraco, 2018 (150)	Retrospective daily diary/ 24hr recall	Young adults	United States	Aggregate measure of acute harm	Yes					
Laws, 2017 (151)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States		Yes	Yes				

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Leigh, 2008 (152)	Retrospective daily diary/ 24hr recall	Students	United States	Not occasion consumption Unprotected sex	Yes		Yes			
Leonard, 2003 (153)	Recall specific past event/s	Young men who were involved in an aggressive incident in a bar	United States	Perpetrating assault Victim of assault Aggression severity Injury to opponent	Yes		Yes		Yes	
Lewis, 2009 (154)	Diary	Students	United States	Aggregate measure of acute harm		Yes				
Lewis, 2010 (155)	Recall specific past event/s	Students	United States	Not occasion consumption Unprotected sex			Yes			
Liang, 2015 (156)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States			Yes				
Linden-Carmichael, 2018 (157)	Retrospective daily diary/ 24hr recall	Students	United States	Not occasion consumption Acute intoxication	Yes	Yes				
Lopes, 2008 (158)	Diary	Over 40s	Portugal			Yes				
Lubman, 2014 (159)	Portal/ intercept survey	Young adults	Australia	Aggression Unprotected sex Injuries	Yes	Yes			Yes	
MacKillop, 2006 (160)	Experimental	Student risky drinkers	United States		Yes					
Madden, 2019 (161)	Recall specific past event/s	Students	United States	Aggregate measure of acute harm				Yes		
Makela, 2005 (162)	Diary Routine data	General/healthy adult	Finland	Not occasion consumption Intoxication-related death		Yes				
Mallett, 2017 (163)	Diary	Students	United States	Not occasion consumption Aggregate measure of acute harm		Yes			Yes	
Martel, 2017 (164)	Retrospective daily diary/ 24hr recall	Female students	United States		Yes	Yes				

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Marzell, 2015 (165)	Recall specific past event/s	Students	United States		Yes	Yes		Yes	Yes	
McCabe, 2013 (166)	Retrospective daily diary/ 24hr recall	Students	United States		Yes	Yes				
McClatchley, 2014 (167)	Portal/ intercept survey	General/healthy adult	England		Yes		Yes	Yes	Yes	
McGrath, 2016 (168)	Experimental	Uni students and staff	England		Yes					
McKetin, 2014 (169)	Recall specific past event/s	Young adults	Australia					Yes		
McKetin, 2014 (170)	Recall specific past event/s	Young adults	Australia						Yes	
McLean, 2009 (171)	Recall specific past event/s	Alcohol-related A&E injured patients vs non-alcohol related controls	New Zealand	Requiring medical attention	Yes			Yes		
Merrill, 2017 (172)	Diary	Students	United States	Not occasion consumption Aggregate measure of acute harm		Yes				
Mihic, 2009 (173)	Recall specific past event/s	Students	Canada	Not occasion consumption Aggression	Yes		Yes	Yes	Yes	
Miller, 2015 (174)	Portal/ intercept survey	Alcohol-related A&E injured patients	Australia	Not occasion consumption Requiring medical attention		Yes		Yes		
Miller, 2016 (175)	Recall specific past event/s	Mandated college students	United States					Yes		
Mohr, 2001 (176)	EMA Retrospective daily diary/ 24hr recall	Risky drinkers	United States		Yes	Yes				

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Mohr, 2005 (177)	Retrospective daily diary/ 24hr recall	Students	United States		Yes		Yes			
Mohr, 2015 (178)	EMA	Risky drinkers	United States		Yes	Yes				
Mustonen, 2016 (179)	Diary	General/healthy adult	Finland		Yes	Yes	Yes	Yes		
Naimi, 2007 (180)	Recall specific past event/s	Risky drinkers	United States	Drink driving				Yes		Yes
Neal, 2005 (181)	Retrospective daily diary/ 24hr recall	Students	United States			Yes				
Neighbors, 2014 (182)	Recall specific past event/s	Students	United States	Aggregate measure of acute harm Unprotected sex Sexual violence Drink driving Aggression Criminal activity (e.g. theft, vandalism)			Yes		Yes	
Nesic, 2006 (183)	Experimental	Risky drinkers	England		Yes					
O'Callaghan, 1992 (184)	Retrospective daily diary/ 24hr recall	Students	Australia		Yes					
O'Grady, 2011 (185)	Retrospective daily diary/ 24hr recall	Students	United States		Yes	Yes	Yes			
O'Grady, 2011 (186)	Retrospective daily diary/ 24hr recall	Students	United States		Yes					
O'Grady, 2012 (187)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States		Yes	Yes	Yes			
O'Hara, 2014 (188)	Retrospective daily diary/ 24hr recall	Students	United States		Yes	Yes				

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
O'Hara, 2014 (189)	Retrospective daily diary/ 24hr recall	African american students	United States		Yes	Yes				
O'Hara, 2015 (190)	Retrospective daily diary/ 24hr recall	African american students	United States		Yes	Yes				
Ogeil, 2016 (191)	Recall specific past event/s	Young adult heavy drinkers	Australia		Yes			Yes	Yes	
Ostergaard, 2014 (192)	Field studies	Young adults	United Kingdom		Yes	Yes		Yes		
Ostergaard, 2014 (193)	Field studies Retrospective daily diary/ 24hr recall	Young adults	England and Denmark			Yes		Yes		
Otten, 2014 (194)	Experimental	Students	The Netherlands		Yes					
Palfai, 2000 (195)	Experimental	Smoking risky drinkers	United States		Yes					
Palfai, 2001 (196)	Experimental	Young adult heavy drinkers	United States		Yes					
Palfai, 2006 (197)	Experimental	Young adult heavy drinkers	United States		Yes					
Park, 2004 (198)	Retrospective daily diary/ 24hr recall	Students	United States		Yes					
Parks, 2000 (199)	Retrospective daily diary/ 24hr recall	Adult female	United States	Not occasion consumption Victim of assault Sexual violence	Yes	Yes	Yes	Yes	Yes	
Parks, 2011 (200)	Retrospective daily diary/ 24hr recall	Young women	United States	Not occasion consumption Unprotected sex		Yes				
Parks, 2012 (201)	Retrospective daily diary/ 24hr recall	Young women	United States	Not occasion consumption Unprotected sex			Yes		Yes	
Paschall MJ, 2007 (202)	Recall specific past event/s	Students	United States		Yes	Yes		Yes		

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Patrick, 2016 (203)	EMA	Students	United States	Aggregate measure of acute harm	Yes	Yes	Yes	Yes		
Peacock, 2015 (204)	EMA	Young adults	Australia		Yes					
Peltz, 2017 (205)	Retrospective daily diary/ 24hr recall	Young adults	United States		Yes	Yes				
Pennay, 2015 (206)	Portal/ intercept survey	General/healthy adult	Australia			Yes		Yes	Yes	Yes
Perrine, 2004 (207)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States		Yes	Yes				
Piasecki, 2014 (208)	EMA	General/healthy adult	United States			Yes				
Quigg Z, 2013 (209)	Portal/ intercept survey	Students	United Kingdom		Yes	Yes		Yes	Yes	
Quinn, 2011 (210)	Retrospective daily diary/ 24hr recall	Students	United States	Not occasion consumption Unprotected sex Aggregate measure of acute harm Aggression Criminal activity (e.g. theft, vandalism)	Yes	Yes				
Quinn, 2012 (211)	Retrospective daily diary/ 24hr recall	Students	United States	Not occasion consumption Drink driving	Yes	Yes				
Ragsdale, 2012 (212)	Field studies	Female students	United States	Rode with a drunk driver		Yes				
Ray, 2010 (213)	EMA	Risky drinkers	United States		Yes					
Reed, 2011 (214)	Portal/ intercept survey	General/healthy adult	United States		Yes	Yes		Yes		
Riley, 2018 (215)	Retrospective daily diary/ 24hr recall	Students	United States		Yes					
Riordan, 2015 (216)	Retrospective daily diary/ 24hr recall	Students	New Zealand			Yes				

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
	Diary									
Robinson, 2016 (217)	Experimental	Students	England		Yes		Yes			
Rodriguez, 2016 (218)	Recall specific past event/s	Students	United States				Yes	Yes		
Rossheim, 2011 (219)	Portal/ intercept survey	General/healthy adult	United States			Yes				Yes
Rowland, 2012 (220)	Diary	General/healthy adult	Australia			Yes				
Russell, 2017 (221)	Retrospective daily diary/ 24hr recall	Students	United States		Yes	Yes				
Sacco, 2015 (222)	Retrospective daily diary/ 24hr recall	Older adults	United States		Yes					
Samoluk, 1996 (223)	Experimental	General/healthy adult	Canada		Yes					
Santos, 2015 (224)	Portal/ intercept survey	General/healthy adult	Brazil	Sexual violence Perpetrating assault Victim of assault				Yes		
Santos, 2015 (225)	Portal/ intercept survey	General/healthy adult	Brazil					Yes		
Schroder, 2007 (226)	Retrospective daily diary/ 24hr recall	General/healthy adult	United States		Yes	Yes				
Schroder, 2009 (227)	EMA	Students	United States	Not occasion consumption Unprotected sex	Yes					
Searles, 1995 (228)	Retrospective daily diary/ 24hr recall	Adult male	United States	Aggregate measure of acute harm Drink driving		Yes		Yes		
Shorey, 2014 (229)	Retrospective daily diary/ 24hr recall	Female students	United States	Not occasion consumption Intimate partner violence	Yes				Yes	
Shorey, 2016 (230)	Retrospective daily diary/ 24hr recall	Female students	United States	Not occasion consumption Intimate partner violence Sexual violence			Yes		Yes	

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Simons, 2010 (231)	EMA	Students	United States	Dependence syndrome	Yes	Yes				
Simons, 2014 (232)	EMA	Students	United States	Dependence syndrome	Yes	Yes				
Simons, 2016 (233)	EMA	Students	United States	Not occasion consumption Perpetrating assault	Yes	Yes				
Simons, 2018 (234)	EMA	Young adults	United States	Not occasion consumption Unprotected sex			Yes			
Smit, 2015 (235)	EMA Retrospective daily diary/ 24hr recall	Young adults	The Netherlands				Yes			
Steptoe, 1999 (236)	Retrospective daily diary/ 24hr recall	General/healthy adult	England		Yes					
Stevens, 2017 (237)	Retrospective daily diary/ 24hr recall	Young adult heavy drinkers	United States		Yes	Yes				
Stockwell, 1993 (238)	Recall specific past event/s	General/healthy adult	Australia	Aggregate measure of acute harm				Yes	Yes	
Strickler, 1979 (239)	Experimental Field studies	Male students who are risky drinkers	United States					Yes	Yes	
Swendsen, 2000 (240)	EMA	General/healthy adult	United States		Yes					
Temple, 1992 (241)	Recall specific past event/s	General/healthy adult	United States	Not occasion consumption Unprotected sex	Yes		Yes			
Temple, 1993 (242)	Recall specific past event/s	General/healthy adult	United States	Unprotected sex	Yes		Yes			
Thomas, 2014 (243)	Experimental	General/healthy adult	United States		Yes					
Thombs, 2008 (244)	Portal/ intercept survey	Students	United States			Yes			Yes	
Thombs, 2009 (245)	Field studies	Students	United States			Yes				
Thombs, 2009 (246)	Portal/ intercept survey	Students	United States						Yes	

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
Thombs, 2009 (247)	Portal/ intercept survey	Students	United States			Yes			Yes	
Thombs, 2011 (248)	Portal/ intercept survey	General/healthy adult	United States			Yes				Yes
Thombs, 2011 (249)	Portal/ intercept survey	Students	United States			Yes			Yes	
Thrul, 2015 (250)	EMA	Students	Switzerland			Yes	Yes			
Thrul, 2016 (251)	EMA	Students	Switzerland			Yes	Yes			
Thrul, 2017 (252)	EMA	Students	Switzerland			Yes	Yes			
Todd, 2003 (253)	EMA	General/healthy adult	United States		Yes					
Todkill, 2016 (254)	Routine data	General/healthy adult	England	Not occasion consumption Emergency department attendance		Yes				
Torronen, 2016 (255)	Recall specific past event/s	General/healthy adult	Finland		Yes					
Treaeen, 2003 (256)	Recall specific past event/s	General/healthy adult	European countries	Not occasion consumption Unprotected sex			Yes			
Tremblay, 2010 (257)	Diary	Students	Canada			Yes				
Vallance, 2016 (258)	Recall specific past event/s	Drug using population	Canada						Yes	
van de Goor, 1990 (259)	Field studies	Young adults	The Netherlands		Yes		Yes	Yes	Yes	
Wagner, 2017 (260)	Portal/ intercept survey	People who drove to the nightclub	Brazil	Drink driving					Yes	
Walmsley, 1998 (261)	Retrospective daily diary/ 24hr recall	Older adults	Britain							Yes
Wardell, 2012 (262)	Experimental	Students	United States		Yes					
Watt, 2004 (263)	Recall specific past event/s	Alcohol-related A&E	Australia	Requiring medical attention					Yes	Yes

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
		injured patients vs population controls								
Watt, 2006 (264)	Portal/ intercept survey	Alcohol-related A&E injured patients vs non-alcohol related controls	Australia	Not occasion consumption Injury severity				Yes	Yes	Yes
Wei, 2010 (265)	Recall specific past event/s	Students	United States		Yes					
Wells, 2008 (266)	Recall specific past event/s	Students	Canada	Not occasion consumption Aggression	Yes	Yes	Yes	Yes	Yes	
Wells, 2015 (267)	Portal/ intercept survey	Young adults	Canada			Yes	Yes	Yes		
Wetherill, 2009 (268)	Recall specific past event/s	Students	United States		Yes	Yes				
Wigmore, 1991 (269)	Experimental Field studies	Male students who are risky drinkers	Canada		Yes			Yes		Yes
Williams, 2011 (270)	Recall specific past event/s Diary	Alcohol-related A&E injured patients	Australia	Not occasion consumption Requiring medical attention			Yes	Yes	Yes	
Witkiewitz, 2012 (271)	EMA	Student smokers	United States			Yes				
Wolfe, 2000 (272)	Experimental	Students	United States		Yes					
Wood, 2007 (273)	Diary Routine data	Students	United States			Yes				
Wymond, 2016 (274)	Retrospective daily diary/ 24hr recall	General/healthy adult	Australia			Yes				Yes
Yao, 2018 (275)	Field studies	Drivers who experienced	United States	Transport injuries (inc RTA) Drink driving		Yes				

First author, year	Design	Population	Country[1]	Outcomes[2]	Meaning	Timing	Company	Venue	Situation	Drink type
		crashes vs control drivers								
Yurasek, 2016 (276)	Recall specific past event/s	Mandated college students	United States			Yes		Yes		
Zamboanga, 2013 (277)	Recall specific past event/s	Students	United States		Yes			Yes		
Zaso, 2017 (278)	Experimental	Young adult heavy drinkers	United States		Yes		Yes			

[1] Not all papers report national-level studies. Sub-national information on the location of participants was not extracted. [2] Papers which do not include a measure of consumption in the occasion as an outcome have the text "Not occasion consumption" in the outcome column as most papers include a measure of this. [3] Aggregate measures of acute harm create a single measure of harm from several different harms. For example, a score for the number of harms experienced from a list might be used. [4] Portal/ intercept surveys recruit participants as they enter or leave drinking venues, or intercept them on the street.

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Table S3. Study characteristics which applied to at least five papers by year of publication

	Study characteristics [1]	Total number of papers (percentage[2]) 1975 - 1989	Total number of papers (percentage) 1990 - 1999	Total number of papers (percentage) 2000 - 2009	Total number of papers (percentage) 2010 - 2019
Theoretical approach	None	5 (71.4)	17 (81.0)	49 (71.0)	132 (72.9)
	Motivational models	0	0	5 (7.2)	12 (6.6)
	Tension-reduction models	1 (14.3)	2 (9.5)	0	3 (1.7)
	Social learning theory	1 (14.3)	0	1 (1.4)	3 (1.7)
Design	Daily drinking diary/ 24 hour recall	1 (14.3)	7 (33.3)	19 (27.5)	43 (23.8)
	Single occasion recall	1 (14.3)	9 (42.9)	19 (27.5)	37 (20.4)
	Experimental	5 (71.4)	3 (14.3)	12 (17.4)	23 (12.7)
	Ecological momentary assessment	0	0	6 (8.7)	33 (18.2)
	Portal/ intercept survey	0	0	5 (7.2)	24 (13.3)
	Retrospective drinking diary	0	0	7 (10.1)	17 (9.4)
	Field studies	1 (14.3)	3 (14.3)	6 (8.7)	10 (5.5)
Country	United States	7 (100.0)	7 (33.3)	52 (75.4)	104 (57.5)
	Australia	0	4 (19.0)	2 (2.9)	15 (8.3)
	Canada	0	3 (14.3)	3 (4.3)	11 (6.1)
	Switzerland	0	0	2 (2.9)	15 (8.3)
	England	0	1 (4.8)	2 (2.9)	11 (6.1)
	The Netherlands	0	2 (9.5)	1 (1.4)	7 (3.9)
	New Zealand	0	0	2 (2.9)	3 (1.7)
Population	Students	4 (57.1)	4 (19.0)	34 (49.3)	91 (50.3)
	Adults	3 (42.9)	14 (66.7)	29 (42.0)	52 (28.7)
	Non-student young adults	0	3 (14.3)	6 (8.7)	38 (21.0)
	Risky drinkers	4 (57.1)	1 (4.8)	12 (17.4)	16 (8.8)
	Experienced a specific harm [3]	0	3 (14.3)	6 (8.7)	7 (3.9)

[1] Some studies fit into multiple categories (e.g. they were conducted in two countries or they used both daily diary and single occasion recall methods). In such instances, we used both characteristics to define the paper. [2] Percentage of the papers published in the relevant years. This is 7 papers from 1975 – 1989, 21 from 1990 – 1995, 69 from 2000 – 2009 and 181 from 2010 – 2019. [3] For example, recruiting injured patients in accident and emergency departments.

Table S4. Contextual characteristics measured by at least five papers by year of publication

	Contextual characteristics [1]	Total number of papers (percentage[2]) 1975 - 1989	Total number of papers (percentage) 1990 - 1999	Total number of papers (percentage) 2000 - 2009	Total number of papers (percentage) 2010 - 2019
Meaning	Affect/ mood	1 (14.3)	2 (9.5)	18 (26.1)	29 (16.0)
	Anxiety/ stress	1 (14.3)	2 (9.5)	9 (13.0)	7 (3.9)
	Intentions	0	0	2 (2.9)	16 (8.8)
	Subjective intoxication	0	1 (4.8)	4 (5.8)	13 (7.2)
	Social support/interactions	2 (28.6)	0	7 (10.1)	7 (3.9)
	Reasons	0	0	8 (11.6)	7 (3.9)
	Craving	0	0	6 (8.7)	8 (4.4)
	Motives	0	1 (4.8)	1 (1.4)	11 (6.1)
	Alcohol cue exposure	0	0	5 (7.2)	3 (1.7)
Timing	Day of the week	0	3 (14.3)	16 (23.2)	62 (34.3)
	Time of day	0	2 (9.5)	4 (5.8)	32 (17.7)
	Duration	0	0	6 (8.7)	18 (9.9)
	Other timing (e.g. year)	0	1 (4.8)	2 (2.9)	20 (11.0)
	Specific/special occasions	0	1 (4.8)	4 (5.8)	16 (8.8)
	Sport-related	1 (14.3)	0	3 (4.3)	4 (2.2)
Company	Number of people	2 (28.6)	5 (23.8)	4 (5.8)	25 (13.8)
	Type of people	1 (14.3)	4 (19.0)	11 (15.9)	19 (10.5)
	Drunk people	2 (28.6)	1 (4.8)	4 (5.8)	13 (7.2)
	Gender composition	0	3 (14.3)	1 (1.4)	11 (6.1)
	Length of relationship	0	1 (4.8)	4 (5.8)	3 (1.7)
Venue	Venue type	2 (28.6)	7 (33.3)	12 (17.4)	23 (12.7)
	Pre-drinking	0	0	4 (5.8)	26 (14.4)
	On-trade versus off-trade premises	0	0	5 (7.2)	12 (6.6)
	Number of venues	0	0	2 (2.9)	6 (3.3)
Situation	Illicit drugs used	0	1 (4.8)	6 (8.7)	16 (8.8)
	Other on-trade venue factors	1 (14.3)	3 (14.3)	8 (11.6)	9 (5.0)

	Off-trade occasion features (e.g. drinking games)	0	0	8 (11.6)	8 (4.4)
	Commercial factors (e.g. discounting)	1 (14.3)	1 (4.8)	4 (5.8)	6 (3.3)
	Illicit drugs available	0	0	5 (7.2)	3 (1.7)
	Crowding	0	2 (9.5)	2 (2.9)	4 (2.2)
	Food available	0	0	6 (8.7)	2 (1.1)
	Ate food	0	2 (9.5)	2 (2.9)	3 (1.7)
	Number of drunk people	0	0	5 (7.2)	0
Drink type	What drink types	0	1 (4.8)	5 (7.2)	10 (5.5)

[1] Some studies fit into multiple categories (e.g. they were conducted in two countries or they used both daily diary and single occasion recall methods). In such instances, we used both characteristics to define the paper. [2] Percentage of the papers published in the relevant years. This is 7 papers from 1975 – 1989, 21 from 1990 – 1995, 69 from 2000 – 2009 and 181 from 2010 – 2019.

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	N/A (Mapping review)
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4 - 5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	N/A
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	6 - 7
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Table S1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6 - 8
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	8
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	8
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	8
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	8

PRISMA 2009 Checklist

Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	8

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	8
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Table S2
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	N/A
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	N/A
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	N/A
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11 – 14
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	13 - 14
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	11 - 14
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	14

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PRISMA 2009 Checklist

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