A Novel framework for classifying alcohol intake and impact tools

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Keywords (MeSH): alcohol drinking; alcoholism; surveys & questionnaires; diagnosis; epidemiological monitoring

Abstract

Background

The focus of this review is on quantitative tools for estimating alcohol intake, the impact of alcohol intake for an individual, or population-level monitoring. Difficulties associated with comparing alcohol tools led the authors to develop a new framework, derived directly from the content of the tools, which aims to help researchers and clinicians select a tool appropriate for their intended purpose.

Methods

A scoping review identified alcohol tools from the published literature. This was followed by a thematic analysis of the content from the identified tools. Exclusion criteria were applied leaving 26 tools reviewed and mapped onto the framework. We also mapped the terminology which is found in the research literature onto our conceptual framework

Results

Thematic analysis identified 'context of use' and 'concept being measured' as the two overarching concepts that need to be considered when choosing a tool. Individual level treatment and epidemiological mapping were associated with context of use while consumption, consequences; and attitudes were identified as the three major concepts being measured.

Conclusions

A wide range of tools were identified. Consumption, sometimes to a very detailed level, was the most developed and contentious. Tools that measure consequences move beyond the impact on the individual and collect information on the broader social impact which is important for policy decisions around alcohol. Attitudes beliefs and norms has the fewest tools and is the least well developed but looks at the wider social determinants which are increasingly recognised as key determinants of behaviour. This new framework will be useful to guide alcohol researchers and clinicians select a tool that is appropriate for the intended purpose, and by considering the concepts identified in this review.

Keywords (MeSH): alcohol drinking; alcoholism; surveys & questionnaires; diagnosis; epidemiological monitoring

Introduction

Alcohol consumption has a long history in human societies and alcohol distillation was noted by Islamic chemists as early as the eighth century of the Common Era. Eurostat, the European Statistics Agency, reported that in 2014 one in every 11 people consumed alcohol daily, one in five had at least one heavy drinking session every month, but one in four did not drink any alcohol. Numbers like this vary enormously around the world with US researchers reporting that 70% of people over age 18 had drunk alcohol in 2017 (https://www.niaaa.nih.gov/publications/brochures-and-fact-sheets/alcohol-facts-and-statistics). An example of the role that alcohol plays, and the problems consumption generates, in modern society is the list of more than 50 pages on Wikipedia who also note that the list is incomplete (https://en.wikipedia.org/wiki/Index_of_alcohol-related_articles).

The focus of this review is on quantitative tools for estimating alcohol intake or impact of alcohol intake for an individual, or population-level monitoring. We use the term tools to encompass/include scales, measurements, and instruments. Along with smoking, exercise and diet, alcohol, is considered one of the 'modifiable' risk factors in promoting a healthy lifestyle. The framework was developed because it became clear, as the review progressed, that the emphasis of tools is evolving from a primary focus on individual assessment and intervention to the collection of social and individual impact data for healthcare policy and planning. In part, this shift mirrors the evolution in public health attitudes about alcohol from one of health promotion and individual responsibility to a more psychosocial model [1, 2]. This is why alcohol use, and its related behaviours, is now best viewed as a product of psychosocial influences and not just individual responsibility [3-5].

Older tools focused on the individual and, reasonably, often placed considerable emphasis on the accuracy of the reported alcohol intake (e.g. [6] [7]). In contrast, a policy focus tends to be more concerned with the consequences of excessive alcohol consumption to the individual and/or society.

We recognise that alcohol use is always a self-report and, until a validated biomarker is identified that is useful for population-level screening, there will always be the limitation inherent in self-reports. Wearable devices that monitor blood alcohol levels are entering the market, but concerns remain on their accuracy, and they can't account for previous intake as alcohol is quickly metabolised and removed from the blood [8]. The Greenfield et al review [8] explores the problems with alcohol biomarkers and devices which measure them. A useful biomarker would be specific to alcohol and provide an integrated measure of intake over the previous few months or indicate recent excessive consumption. Despite the advancement in the use of biomarkers, most clinicians and researchers still use paper or digital tools completed by a person.

It is difficult to compare tools because different tools are measuring different factors related to alcohol. This led us to develop this new framework to help researchers and clinicians select the appropriate tool. In part differences arise because developers come from different conceptual frameworks such as the difference between a psychosocial approach and a medical model of health. When reading any of this literature the reader needs to be aware that alcohol consumption and abuse is a contested human behaviour with tool developers bringing their disciplinary frameworks, and sometimes their personal biases into the research. The new framework we have developed is derived directly from the content of the tools and is informed by our clinical and public health practice. The project began with a scoping review, followed by thematic analysis of the question content and then a framework was developed and applied back onto the tools. This framework allows researchers and clinicians to quickly focus in on which aspects of alcohol they need for their work.

Methods

The research began with a scoping review followed by a thematic analysis [9] of the question content. Two of the authors then developed and refined a framework. Each identified tool was then mapped onto the framework which was further refined. See Figure 1.

Figure 1 – A framework for classifying alcohol intake and inpact tools

The literature search for tools was multifaceted. A Medline search using the terms "alcohol" and "questionnaire or scale" elicited more than 30,000 hits with very few relevant ones in the first few thousand screened. Online search engines produced more relevant hits. In the end, we identified tools from the published research that used them and then tracked down the tool information. We were restricted to English language as we had no resources for translation.

The initial searching produced 38 named tools. We excluded:

- Four generic health surveys that did not focus on alcohol intake or had only a few questions on alcohol intake (California Health Interview Survey, Health Survey for England, National Longitudinal Survey of Youth, US National Health Interview Survey) and the Alcohol Purchase Task which is used to inform the economics of alcohol pricing
- The content of two couldn't be found; Consumption Habits Questionnaire, and TARS-1/TARS-2
- Four were no longer available (NLAES, MAST, Form-90, STEPS)

- The CIDI and M.I.N.I. require training and certification for use and so the content was not available for review

One of the authors mapped the terminology which is found in the research literature onto our conceptual framework (see Table 1) and then all the authors discussed the mapping.

Table 1: Mapping of terms used in the literature onto the concepts in this paper

Terms	quantity	pattern	consequences	attitude
(alcohol) dependence			x	
(frequent) heavy drinking		x		
Abstinence	x			
alcohol abuse			x	
Alcohol attitudes & beliefs				x
alcohol intake	x			
alcohol intake pattern		x		
alcohol intake pattern		x		
alcohol misuse			x	
alcohol use	x			
Alcoholism			x	
Alcohol-Related Consequences			x	
Alcohol withdrawal			x	
Behavioural consequences			x	
Social and occupational consequences			x	
binge drinking		x		
categorisation of quantity and frequency measures	x			
chronic alcohol intake		x		
Consumption	x			
current drinking	x			
Dependence			x	
Drinking context				x
ever drunk alcohol	x			
few sips per year	x			
Frequency	x			
heavy alcohol consumption		x		
heavy alcohol use		x		
heavy episodic drinking		x		
heavy use		x		
intake in previous 30 days	x			
Intensity		x		
Intoxication		x		
non-fatal injuries			x	
Pattern		x		
pattern of use		x		
problem behaviour			x	
problem use			x	
Quantity	x			
Quantity & Frequency	x			

risky alcohol consumption	x	x		
sensible drinking	x			
standard drinks	x			
Units	x			

Results: Scoping Review and Framework Creation

Table 2 lists the 26 tools that were found and provides links or references to the question content.

For each concept, the content of tools which included it were reviewed and summaries created. Given the large amount of existing literature already discussing quantity, we focused on the other concepts.

Thematic analysis [9] identified two overarching concepts that need to be considered when choosing a measure. The first is the context and the second is the concept being measured. Concept is further broken down into consumption, consequences, and attitudes

Context of use

Context of use matters as a tool used for public health monitoring of the population for the impact of, for example, tax increases on alcohol, will be different than those used by a physician who is following an individual patient

Context 1: individual-level treatment. Tools are designed to:

- screen or triage people into different levels of treatment intensity. These tools may be designed to be self-administered by an individual and there is an increasing proportion appearing in web-based tools with algorithms that recommend a person approach a healthcare professional if they pass a certain threshold. It is helpful to recognise when an tool is intended to be a screening tool that identifies all people with a reasonable possibility of being at risk rather than a diagnostic tool that confirms a problem [10]. This can usually be distinguished by published validation studies on the measure which report on false positive rates and other screening effectiveness measures. Screening tools, by design, are intended to identify the greatest number of people with a potential problem who can then be further examined to confirm a diagnosis. When used alone, they will over-estimate the number of people at risk.
- measure an individual's response to treatment/intervention. These tools are specifically designed to be sensitive to changes in alcohol consumption and should have been validated and shown to also be reliable.

- produce a medical diagnosis of problems with alcohol intake. These tools are designed to diagnose that a person has a problem with alcohol. This group of tools often follow structured interview techniques or require a health professional to determine that a person meets specific diagnostic criteria. The two major versions of diagnostic criteria, by which people are labelled as having a problem with alcohol, are the American standard classification of mental disorders (DSM) and the World Health Organisation International Classification of Diseases (ICD). The DSM, as a psychiatric tool, is mental health only while the ICD covers all aspects of health.

Context 2: epidemiologic mapping of the population for healthcare planning such as a resource needs assessment, population-level interventions such as an alcohol pricing intervention, or population monitoring as seen with national health surveys. As data is always used in the aggregate, less emphasis is placed on the accuracy of individual alcohol intake measures and more is placed on designing an tool that will be interpreted and completed by all respondents in a similar fashion so that changes at the population level can be monitored over time. The background literature for this use will focus on the acceptability of the measure for the target audience and obtaining high completion rates. This groups of tools:

- quantify the prevalence of "unsafe" alcohol intake or specific behaviours from consumption which may be determined by crossing a defined threshold score(s).
- will produce/estimate the burden of treatment provision required based on assigning respondents to a "risk" level. This is very similar to the triage screening at the individual-level but less precision in the estimate of alcohol intake is usually tolerated.
- assesses changes in alcohol intake and or impact over time. The same tool must be used to collect the data at each time point.

Concepts Being Measured

The thematic analysis identified three major concepts being measured: consumption, consequences, and attitudes.

Concept 1: consumption is also known as 'intake'. There is a high level of debate around consumption measures. With this paper we want to emphasise that there are three overlapping constructs, within the concept of consumption: quantity, pattern, and variability. All are contested and overlap, and the terminology used in this paper is selected to highlight the conceptual differences in what is being measured

Quantity is measured by volume of alcohol intake. Some authors combine volume and frequency (see [11]) but, because acute alcohol consumption is considered more risky, we have separated quantity from pattern and variability. For a more nuanced discussion on the frequency, volume, quantity debate see Greenfield et al [12], Leeman et al [13] and Del Boca and Darkes [14].

Some of the measures are derived from diet surveys which were designed to collect the frequency and volume of specific foodstuffs. To provide a memory aide many measures ask respondents to report in 'standard drinks' or 'units'. The amount of pure alcohol in a standard drink is different in different countries and the relationship with serving size can be confusing for consumers. For a more detailed analysis see the review by Greenfield and Kerr [12].

As the impact of alcohol intake does not increase in a linear manner with increasing intake (see [15]), consumption is generally operationalised with 'cut-off drinking thresholds'. The categories are designed to assist in triaging people into different intensities of intervention and the underlying framework for these categories may be a medical or addiction model.

This construct includes the concept of abstinence which is used to label both people who have never consumed alcohol, and those who have stopped (generally described as remission). These two groups are rarely distinguished with further questions but may represent people with very different risks from alcohol consumption. Some people who are abstinent may have experienced previous problems with alcohol consumption while others have religious or cultural reasons for abstinence. In addition, some measures label people as abstinent as long as they consume no more than a few sips per year while others include those same people in the 'drinker' category.

The time frame over which the question(s) apply (also known as retrospective recall") has been shown to affect responses and should be stated clearly, for example, over the previous 30 days, rather than less precise terms such as "current". More detail on the importance of this issue can be found in Greenfield and Kerr [12]).

Pattern is recurring or repeated consumption while variability is a lack of consistency or a fixed pattern. We have separated pattern from consumption as a construct as there is considerable debate about both jargon and measurement. Crudely consumption has been thought of as 'acute' vs. 'chronic' with acute' intake generally referred to as 'binge' drinking. But the term "heavy" may be used as part of the terminology which needs to be further considered as there is a long history of debate about whether the term is describing the overall intake over a specified period of time or the consumption of high volumes in a short period of time which is also described as intoxication. Li et al [15] describe the debate as "too much too fast" versus "too much too often" which is a helpful distinction as the health and social impacts differ substantially between the two patterns of intake.

The time frame over which the binge occurs is crucial here in two contexts: 1) for binge drinking it is important to define an 'occasion'; 2) authors typically use terms like 'current' or 'usual' or 'history' which should be clarified in the instructions.

Concept 2: Consequences of alcohol consumption moves beyond measures of intake and is largely concerned with unsafe behaviours or social consequences. Conceptually, the information produced from the tool is moving beyond the impact on the individual and collecting information on the broader social impact which is important for policy decisions around alcohol.

Within this concept there is a strong influence from the addictions literature where one of the key concepts is dependence [16]. Dependence as a concept has changed considerably through the successive versions of the DSM clinical diagnostic criteria. The term alcohol abuse was initially considered as a residual category for those persons who did not meet dependence criteria but who drink despite obvious social and psychological repercussions [17]. The two terms have now since been integrated into a single disorder called alcohol use disorder (AUD), with mild, moderate and severe risk categories [18].

When the patient is classified as at 'risk', just what is the risk? Which particular constellation of factors constitute increased risk or dependence and what is the research foundation for this? Dependence or physical health problems or something else? Typically, a measure includes a list of behaviours that are considered unsafe and asks the respondent to indicate if they have experienced them within a specified time frame, for example drinking and driving. There are likely to be considerable cultural and social differences in the impact and relevance of these alcohol-associated behaviours.

Concept 3: Attitudes and beliefs is a broader concept than consequences as it includes the respondents, and possibly the developers, attitudes towards alcohol consumption. Measures that include this concept examine the circumstances in which alcohol consumption occurs.

Not only is a measure of attitudes and beliefs important in helping the respondent identify the circumstances which influence their drinking as part of a treatment process, it also helps policy makers devise evidence-based intervention programs that aim to address risky alcohol consumption.

More recently there has been use of the term "sensible drinking" which is grounded in a health promotion approach which believes there are safe or even beneficial consumption levels. A 2016 review [19] concluded that there was no protective effect from low levels of alcohol consumption nor were abstainers at increased risk. The mortality by intake plots suggest a threshold intake above which increasing alcohol intake is associated with increasing risk of mortality. But guidelines identify specific groups which should not drink, including people who are: pregnant or breast feeding, stroke

patients, cancer patients, drivers, or recovering alcoholics (CDC and IARC). In practice, when selecting a tool, it is important to examine the developers underlying attitude towards alcohol as some appear to believe there are no safe consumption levels while others believe there are safe levels, and this may be reflected in their tool.

We mapped the terminology which is found in the research literature onto our conceptual framework (see Table 1)

Results: mapping the Framework Concepts onto the Tools

Below we describe and summarize each of the concepts listing which of the tools include some aspect of that concept. The acronyms for each tool are listed in Table 2.

[Insert Table 2 about here]

The Individual Context

Tools in this context produce an individual risk score, a list of diagnoses, or are used for screening people into intervention levels. Four tools are screens (AUDIT, CAGE, CIWA-Ar, FAST, RAPS4) and the number of questions is limited. The slightly longer AUDIT tool adds an additional set of questions if the score in the first section is above a threshold.

More than half of the tools covered in this review are intended for individual evaluation (AUDIT, B-YAACQ, CAGE, CAPS, CARET, CIWA, CNLab_A, CRAFFT, DrinC, FAST, QFI, RAPI, RAPS4, SCID, SIP-R, TLFB, YAAPST. The AUQ was designed to survey populations but has been used for individual assessment and intervention.

The Population Context

Some tools, possibly most that aren't screens, could be used for estimating the level of alcohol problems within the population. But many (AUQ, BRFSS, CLASS, GENACIS, ICD-9, NESARC, NHIS, NSDUH, OSDUHS) are specifically designed for population monitoring specifically around alcohol consumption. AUDIT was designed to identify at risk individuals but has been used in population screening. The ICD-9 list of alcohol-related health conditions is used to classify patients from their healthcare records as having problems likely to be related to alcohol consumption. It, of course, requires that healthcare records be coded to the ICD-9 system.

Concepts: Tools which measure consumption - quantity

In spite of the amount of scholarship and research about consumptions, quantity is not a component of all tools, and this is not surprising given the consistent findings of under reporting by respondents.

Quantity is not included in half of the four screening tools (CAGE, SIP-R). And generally not included in tools intended to measure consequences (CAPS, CARET, CLASS, DrinC, RAPI, RAPS4, SCID, SIP-R, YAAPST). Tools intended to identify psychiatric or physical health conditions associated with alcohol do not always measure quantity either (ICD-9, SCID).

Concepts: Tools which measure consumption - pattern & variability

This section includes some of the longest tools, all of which include extremely detailed questions with long logic threads that take a person through a detailed recall of their drinking over some specified time period. NSDUH shows the complex programming required to set up a survey of this type for the interviewers. As such these tools elicit considerably more detail such as asking at what age people started drinking, on which days of the week, and the type of alcohol.

Acute intake is addressed by most tools that address pattern and variability. Most do not include the word "binge" in the question wording, but the word is used in the NSDUH as the description of the section. The definition of a binge is quite variable ranging from 4 to 8 drinks on a single occasion (see Table 3) and differs between jurisdictions. FAST is unique in defining a different cut-off for men and women. While the mechanism of how men metabolise alcohol differently from women is still being debated, the enhanced vulnerability of women to developing alcohol related diseases is clear [31, 32]. There are also significant differences by age as geriatrics metabolize alcohol differently from young people [33]; Meier and Seitz, 2008) but shorter tools have to trade-off against brevity.

Table 3 - Tools which measure binging

Acronym	Full Name	Binge cutoff *
AUDIT and AUDIT- C	Alcohol use disorders Identification Test (AUDIT)	6+ on one occasion
BRFSS (ASBI)	Behavioral Risk Factor Surveillance System - Alcohol Screening & Brief Intervention subsection	5+ for men 4+ for women
CNLAB_A	CNLAB-A mobile app	4+ on one occasion
FAST	FAST	8+ for men 6+ for women On one occasion
NESARC	National Epidemiologic Survey on Alcohol and Related Conditions	Extremely detailed
NHIS	National Health Interview Survey	Extremely detailed
NSDUH	National Survey on Drug Use and Health	Extremely detailed 4+
OSDUHS	Ontario Student Drug Use and Health Survey	5+

QFI	Quantity / Frequency Index	Starts with 12 then steps down through 8-11, 5-7, 4, and then 3 in a single occasion

- Note – cut-offs may not match current local recommendations

Concepts: Tools which measure consequences (social, biological, and legal)

The majority of the tools measure consequences with two major differences: 1) the nature of these consequences varies depending upon the target audience; 2) the level of detail within any one consequences category. As could be expected, given their brevity, the screening instruments contain very few consequences, although it is worth noting that most screening instruments are largely or completely about consequences (e.g., FAST, CAGE, CIWA-Ar). Much longer instruments more fully identify consequences (e.g., GENACIS). Selection of an instrument will need to incorporate the amount of time and resources available, but we caution against selecting the shortest instrument as the nature of the impacts included, particularly in the screening instruments, needs to be suitable for the target population. For example, asking about engaging in drink driving in a society where driving is uncommon is not useful.

It is also clear after reviewing the instruments how much they have been derived from each other: YAAPST and SIP-R are derived from DrinC, and the OSUDHS from AUDIT

Read et al., [30] used statistical analysis on the 67-item YAAPST to statistically derive categories for consequences which are useful for this review in identifying the relevant domains within this concept. They are: social interpersonal consequences (SIC); impaired control (IC); self-perception (SP); self-care (SC); risk behaviours (RB); academic/occupational consequences (AOC); physical dependence (PD); blackout drinking (BD). We relabelled blackout drinking as severe health (SH) consequences. The tools have been mapped onto these categories in Table 4. Engaging in risky behaviours is the most commonly included consequence followed by academic/occupational consequences, physical dependence, social interpersonal consequences, and self-perception. Impaired control and severe health impacts are the least often included. The choice of consequences is, to some extent, based on the target audience for the instrument.

Table 4 - Tools which measure consequences and their categories

Acronym	SIC*	IC	SP	SC	RB	AOC	PD	SH
AUDIT and AUDIT- C			X		x	x	x	X
B-YAACQ	X	X			X	X	X	
CAGE			X				x	
CAPS					x			
CARET			x		x			x

CIWA-Ar							X	X
CRAFFT					x			
DrInC	x		X	x	x	x		
FAST						x		X
GENACIS	x	x	X		x	x	x	X
NESARC	x	x	X		x	x	x	X
NSDUH	x	x			x	x	x	
OSDUHS			X		x		x	
RAPI	x	x	X		x	x	x	
RAPS4	x		X				x	X
SCID		x					x	x
SIP-R	x		X	x	x	x	x	
YAAPST	x				x	x	x	

*social and interpersonal consequences (SIC); impaired control (IC); self-perception (SP); self-care (SC); risk behaviours (RB); academic/occupational consequences (AOC); physical dependence (PD); severe health (SH)

Concepts: Tools which measure attitudes, beliefs and norms

This concept has the least amount of quantitative research literature. Attitudes and beliefs are not often included in the tools although more lengthy tools investigate the circumstances in which people drink. This is reflected in the UK guidelines around managing alcohol dependence and harmful alcohol use [34] which include a few references to being sensitive to social pressure to drink or religious, and culturally-related, attitudes towards alcohol but UK guidelines provide no further guidance or evidence on this area

The tools measuring people's attitudes towards alcohol seem to be largely focused on young people, in particular college students (see [22, 35]). CLASS consists of a list of attitude-towards-alcohol statements generated by U.S, higher education students about the role of alcohol in college life in which most relate alcohol intake as "normal" party behaviour. Drinking age varies greatly between countries and users should be aware of legal issues around disclosure when using tools for young people.

Fossey [36] showed school children images of adults drinking or engaging in other health-adverse behaviours and compared their response to images with the same adults eating, reading or drinking non-alcoholic beverages. The children reported distinct differences in their responses to the images, depending upon the gender of the adult in the image demonstrating that attitudes may embed early in life.

Some tools ask about who people drink with (GENACIS, NESARC, NHIS) and those more focused on psychiatric diagnosis probe into the social circumstances in which people drink. DrinC offers two statements in which respondents are asked to say how much they agree with: "enjoy the taste of beer, wine or liquor" and "drinking has helped me to relax". Two researcher groups [37, 38] have added questions about attitudes, and intentions to the AUDIT instrument expanding its content to include attitudes towards alcohol.

The GENACIS instrument, developed in an international collaboration, asks about the circumstances in which people drink such as during a meal, at a celebration, friend's home, etc. The instrument continues with questions about whether the consumption occurred with family or friends and is one of the few tools in this concept not to focus on young people.

Discussion

Main findings

The tools we have identified may not be an exhaustive list, but we feel they provide an important representation of both what is readily available and the proportion covering each of the themes. Biomonitoring [8] is the 'holy grail' of alcohol consumption but no effective biomarker, equivalent to cotinine in smoking, has yet been identified. In a recent review Niemelä and Alatalo [39] recommend a panel of biomarkers, but these relate to a quite advanced level of physiological damage and do not address the need for identifying health-adverse consumption early enough to save people from the consequences. Sales data has also often been used to estimate alcohol intake within specific geographical areas, but the self-report methods continue to remain the only viable option for measuring retrospective alcohol intake, particularly so in large population-based surveys.

We note that in the alcohol literature, there is a wide array of terms used: intake, consumption, heavy drinking, intoxicated etc. We strongly feel that it is high time both researchers and clinicians start working on internationalizing these terms. As a community of alcohol researchers, we also feel that it is now the right time to start devising rules, or at least a set of system that aims to standardise the way we use these terms to make our research more comparable.

Overall, attitudes, beliefs and norms are the most poorly investigated component of alcohol 'intake' measurement. Perhaps because it is looking at the wider social determinants and not individual behaviours. From a policy perspective this is a serious failing as it is now widely understood that people's health behaviours occur within a wider social context. This means that it is often more effective to change all of society rather than try to change one person at a time.

We note that gender differences are not considered sufficiently given that we know men and women metabolise alcohol at different rates (sex differences) the social/cultural aspects are very influential as demonstrated in Fossey's work[36]. This should be considered when using these tools and tests for gender differences should be considered when designing any questionnaire that seeks respondents' opinions about alcohol consumption. There is an extensive body of qualitative research on attitudes (e.g., see [40]) which could form the basis of tool development. As important as gender, is position in the social hierarchy which also shapes attitudes (see [41]). The impact of social norms and expectations is increasingly being recognised as a strong driver of health behaviours [42, 43].

We recognise that alcohol use is always a self-report and, until a validated biomarker is identified that is useful for population-level screening, there will always be the limitation inherent in self-reports. This may be heresy, but we feel it is time to stop attempting to measure precise levels of alcohol consumption as, despite the considerable effort and expertise expended on this, there remains a consistent misreporting of intake. There are a multitude of reasons behind this misreporting: social and cultural expectations, the effects of alcohol on memory, the social situations in which alcohol is consumed, etc.

One limitation of this review is that, unlike other fields such as psychology, there is no central repository of scales used in public health, meaning that we had to find these by screening a vast amount of literature to establish what is used in practice. Although scoping reviews have become an increasingly popular approach for synthesizing research evidence and mapping broad topics, there are no definitive procedures for using scoping reviews. It is therefore possible that we may have also missed some relevant studies. We encourage readers to apply the framework to tools we may have missed and review the content in the broader context provided by this paper.

Conclusion

We hope the typology we have developed will help researchers and clinicians choose the best instrument for their purposes rather than just using the first one they can find. We also hope that the typology we have developed will also lessen the time required to search for the appropriate instrument to use, which would either be for diagnostic, screening, alcohol policy formulation or epidemiologic purposes. It is likely that this typology will make international comparisons of alcohol research findings more objective, because unless a consensus is reached in applying consistent typology, a lack of clarity regarding which instrument is best suited for which purpose, and under what circumstances, is likely to continue bringing conflicting evidence on alcohol consumption research.

In conclusion we identified a wide arrange of tools with many passionate advocates and entrenched opinions. Tool selection needs to be appropriate for the intended use and include the concepts relevant for this use.

List of Abbreviations

AUDIT and AUDIT- C Alcohol use disorders Identification Test (AUDIT)

AUQ Alcohol Use Questionnaire – US NIH

B-YAACQ and YAACQ Brief Young Adults Alcohol Consequences Questionnaire and Young Adults Alcohol Consequences Questionnnaire

BRFSS (ASBI) Behavioral Risk Factor Surveillance System - Alcohol Screening & Brief Intervention subsection

CAGE (Modified version)

CAPS College Alcohol Problems Scale

CARET Comorbidity-alcohol risk evaluation tool

CIWA-Ar Clinical Institute Wirhgdrawal Assessment

CLASS College Life Alcohol Salience Scale

CNLab_A CNLab-A (Mobile App)

CRAFFT Car, Relax, Alone, Forget, Friends, Trouble

DrInC Drinker Inventory of Consequences

FAST FAST

GENACIS Gender, alcohol and culture: an international study

ICD-9 ICD-9

NESARC National Epidemiologic Survey on Alcohol and Related Conditions

NHIS National Health Interview Survey

NSDUH National Survey on Drug Use and Health

OSDUHS Ontario Student Drug Use and Health Survey

QFI Quantity / Frequency Index

RAPI Rutgers Alcohol Problems Index (RAPI

RAPS4 Rapid Alcohol Problems Screen

SCID Structured Clinical Interview for DSM Disorders I research /non patient edition

SIP-R Short Inventory of Problems Revised

TLFB Timeline Followback Interview

YAAPST Young Adult Alcohol Problem Screening Test

Declarations

Ethics approval and consent to participate

not applicable

Consent for publication

Availability of data and materials

There is no data to share as all data used in this research is open source

Conflict of Interest

The authors declare that they have no competing interests

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Authors Contributions

WT and SK developed the project. WT conducted the literature review. SK generated the first draft of themes which were honed by all authors. All authors wrote the paper.

Key Points

- quantitative tools for estimating alcohol intake or impact of alcohol intake
- alcohol, is considered one of the 'modifiable' risk factors in promoting a healthy lifestyle
- tools should be assessed for their 'context of use' and 'concept being measured'
- the 'concept being measured' in the tool should be further evaluated for consumption, consequences; and attitudes
- Attitudes beliefs and norms was the least developed concept within the tools and concerns the wider social determinants of alcohol intake and impact

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Table 2 - Included tools, sources of information, and concept mapping

Acronym	Full Name	information	Context *		Concept			
			indiv	Pop	consump	pattern	conseq	attitude
AUDIT and AUDIT- C	Alcohol use disorders Identification Test (AUDIT)	Questionnaire: https://www.drugabuse.gov/sites/default/files/files/AUDIT.pdf Manual: https://www.who.int/substance_abuse/publications/audit/en/	I, Sc	✓	✓	✓	✓	
AUQ	Alcohol Use Questionnaire – US NIH	https://dceg.cancer.gov/tools/design/questionnaires/alcohol-questions-reviewed	P	✓	✓			
B-YAACQ and YAACQ	Brief Young Adults Alcohol Consequences Questionnaire and Young Adults Alcohol Consequences Questionnnaire	The Brief YAACQ – Alcohol Research Lab (arlbuffalo.com) YAACQ – Alcohol Research Lab (arlbuffalo.com) https://arlbuffalo.com/resources/the-young-adult-alcohol-consequences-questionnaire/the-brief-yaacq/	I				✓	
BRFSS (ASBI)	Behavioral Risk Factor Surveillance System - Alcohol Screening & Brief Intervention subsection	https://www.cdc.gov/brfss/questionnaires/pdf-ques/2018_BRFSS_English_Questionnaire.pdf page 35		✓	✓	✓		
CAGE	(Modified version)	http://nationalpaincentre.mcmaster.ca/documents/cage_questionnaire.pdf	I, Sc				✓	
CAPS	College Alcohol Problems Scale	[20] https://elcentro.sonhs.miami.edu/research/measures-library/caps-r/index.html	I				✓	
CARET	Comorbidity-alcohol risk evaluation tool	[21]	I				✓	
CIWA-Ar	Clinical Institute Wirhgdrawal Assessment	Alcohol Withdrawal Assessment Scoring Guidelines (CIWA - Ar) (ewin.nhs.uk)	I,Sc, P				✓	
CLASS	College Life Alcohol Salience Scale	https://osf.io/9kxjz/?pid=su2pz [22]		✓				✓
CNLab_A	CNLab-A (Mobile App)	[23, 24]	I		✓	✓		
CRAFFT	Car, Relax, Alone, Forget, Friends, Trouble	available from CRAFFT.org (2)	I		✓		✓	
DrInC	Drinker Inventory of Consequences	https://pubs.niaaa.nih.gov/publications/projectmatch/match04.pdf https://casaa.unm.edu/inst/DrInC-2L.pdf	I				✓	✓
FAST	FAST	[25]	I, Sc		✓	✓	✓	

GENACIS	Gender, alcohol and culture: an international study	https://www.who.int/substance_abuse/activities/genacis/en/ https://www.kettilbruun.org/projects/genacis/		✓	✓		✓	✓
ICD-9	ICD-9	https://nccd.cdc.gov/dph_ardi/info/icdcodes.aspx (1)		✓			x	
NESARC	National Epidemiologic Survey on Alcohol and Related Conditions	https://www.niaaa.nih.gov/research/nesarc-iii		✓	✓	✓	✓	✓
NHIS	National Health Interview Survey	https://www.cdc.gov/nchs/nhis/alcohol/alcohol_overview.htm https://www.cdc.gov/nchs/nhis/alcohol.htm		✓	✓	✓		✓
NSDUH	National Survey on Drug Use and Health	https://www.samhsa.gov/data/report/nsduh-2018-questionnaire		✓	✓	✓	✓	
OSDUHS	Ontario Student Drug Use and Health Survey Adapted from AUDIT	https://www.camh.ca/-/media/files/pdf---osduhs/form-a-es-grades-7-8-2019-osduhs-pdf.pdf?la=en&hash=A039632AFDB550AE081FA8302B8368DD22329FD0 https://www.camh.ca/-/media/files/pdf---osduhs/form-a-ss-grades-9-12-2019-osduhs-pdf.pdf?la=en&hash=50074F69BB02FC6FDF3A6CAEC4B052A3066D2040		✓	✓	✓	✓	
QFI	Quantity / Frequency Index	[26]	I		✓	✓		
RAPI	Rutgers Alcohol Problems Index (RAPI	https://pubs.niaaa.nih.gov/publications/assessingalcohol/InstrumentPDFs/57_RAPI.pdf file:///Q:/Research/CHSCR/Alcohol/review%20paper/pdf%20references/trapi.pdf	I				✓	
RAPS4	Rapid Alcohol Problems Screen	https://pubs.niaaa.nih.gov/publications/assessingalcohol/InstrumentPDFs/54_RAPS4.pdf https://www.verywellmind.com/the-raps4-alcohol-screening-test-69501	I, Sc				✓	
SCID	Structured Clinical Interview for DSM Disorders I research /non patient edition	[27] (5)	I				✓	
SIP-R	Short Inventory of Problems Revised	https://www.treatmentworksforvets.org/wp-content/uploads/2018/04/SIP005.pdf [28, 29]	I				✓	
TLFB	Timeline Followback Interview	https://pubs.niaaa.nih.gov/publications/assessingalcohol/instrumentpdfs/13_tlfb.pdf	I		✓			

YAAPST	Young Adult Alcohol Problem Screening Test	[30]	I				✓	

* I=intended purpose; Sc= intended for screening; P=use in practice

1. list of physical health conditions associated with alcohol intake. Includes several sections under "Chronic Causes": 100% attributable; Direct Alcohol-Attributable Fractions (AAF) Estimate; Indirect AAF Estimate; Indirect AAF Estimate
2. covers both drug and alcohol abuse
3. a structured interview
4. Originally WHO, now funded by the US NIAAA. There are both core and expanded questions
5. takes 1-2 hours. Often considered a gold standard
6. WHO Collaborative project that links out to the 304 page WHO document "Alcohol and Injuries"

Figure 1