Drug and Alcohol REVIEW

APSAD

Drug and Alcohol Review (March 2022), 41, 616–624
DOI: 10.1111/dar.13403

Indigenous Australian drinking risk: Comparing risk categorisations based on recall of recent drinking occasions to AUDIT-C screening in a representative sample

JAMES H. CONIGRAVE[1,2], KATHERINE M. CONIGRAVE[1,2,3], SCOTT WILSON[1,4] & K. S. KYLIE LEE[1,2,5,6,7]

[1]*Faculty of Medicine and Health, Central Clinical School, Centre of Research Excellence in Indigenous Health and Alcohol, The University of Sydney, Sydney, Australia,* [2]*The Edith Collins Centre (Translational Research in Alcohol, Drugs and Toxicology), Drug Health Services, Sydney Local Health District, Sydney, Australia,* [3]*Drug Health Service, Royal Prince Alfred Hospital, Sydney, Australia,* [4]*Aboriginal Drug and Alcohol Council SA Aboriginal Corporation, Adelaide, Australia,* [5]*Faculty of Health Sciences, National Drug Research Institute, Curtin University, Perth, Australia,* [6]*Burnet Institute, Melbourne, Australia, and* [7]*Centre for Alcohol Policy Research, La Trobe University, Melbourne, Australia*

Abstract

Introduction. *Aboriginal and Torres Strait Islander (Indigenous) Australians have identified alcohol consumption as an area of concern. Accurate screening tools are required to help detect and assist at-risk drinkers, and to provide accurate data to policy makers. The Finnish method (determining drinking patterns based on the last two to four drinking occasions), has been proposed as a culturally appropriate and effective screening tool for detecting Indigenous Australians at risk from alcohol consumption. While it has been found to be valid and acceptable for use with Indigenous Australians, the Finnish method has not been compared to the three-item Alcohol Use Disorders Identification Test—Consumption (AUDIT-C) which is currently recommended by the Australian government for use in Aboriginal community-controlled health services.* ***Methods.*** *We compared the performance of the AUDIT-C and Finnish method as screening tools for detecting harms experienced from alcohol in a representative, cross-sectional, sample of Indigenous Australians.* ***Results.*** *AUDIT-C was substantially faster for participants to complete than the Finnish method. Metrics derived from both the AUDIT-C and Finnish method were similarly linked to the frequency of self-reported International Classification of Diseases, 11th revision dependence symptoms and harms.* ***Discussion and Conclusions.*** *The AUDIT-C is likely most appropriate for use in clinical settings due to its speed and ease of use. The Finnish method provides relatively detailed information about drinking and is better suited to population surveys.* [Conigrave JH, Conigrave KM, Wilson S, Lee KSK. Indigenous Australian drinking risk: Comparing risk categorisations based on recall of recent drinking occasions to AUDIT-C screening in a representative sample. *Drug Alcohol Rev* 2022;41:616–624]

Key words: Grog Survey App, Indigenous Australians, AUDIT-C, Finnish method, drinking risk.

Introduction

Alcohol consumption has been identified by Aboriginal and Torres Strait Islander ('Indigenous Australian') communities as a concern [1]. British colonisation has resulted in inter-generational trauma, restricted self-determination and broad disadvantage [2,3]. The increased stress and trauma faced by Indigenous Australians have made risky drinking [4] more likely [2]. Brief intervention can be effective in reducing alcohol-related-harms in general populations [5], but many Indigenous Australians who engage in risky drinking are never identified and so do not receive support [6]. Due to socioeconomic and cultural differences, screening tools which are effective for other populations might not be accurate when used with Indigenous Australians [7,8]. New tools that visually represent quantities of alcohol could help [9].

In Australia, individuals with symptoms of alcohol use disorders wait a median of 18 years before receiving treatment [10]. Treatment delay is particularly concerning for Indigenous Australians who experience a heavier burden from acute traumas caused by intoxication [11,12] and from chronic diseases—which can

James H. Conigrave PhD, Research Fellow, Katherine M. Conigrave PhD, Conjoint Professor, Scott Wilson MIndigH (SubUse), Adjunct Associate Professor, K. S. Kylie Lee PhD, Associate Professor. Correspondence to: Dr James H. Conigrave, Level 6, King George V Building, Drug Health Services, 83-117 Missenden Road, Camperdown, NSW 2050, Australia. E-mail: james.conigrave@sydney.edu.au

Received 22 March 2021; accepted for publication 11 October 2021.

be caused or exacerbated by risky drinking—than other Australians [13,14]. To accurately detect risky drinking, structured screening tools are needed [7]; but existing tools have been developed for general populations, and may not be effective or acceptable when used with Indigenous Australian clients [7,15]. The lack of a clear gold standard means that it is difficult to assess the effectiveness of new screening tools for Indigenous peoples.

The three-item Alcohol Use Disorders Identification Test—Consumption questions (AUDIT-C) is a widely used quantity–frequency measure of drinking risk [16]. The Australian government encourages primary health services to use AUDIT-C with Indigenous Australian clients [17]. But the suitability of the AUDIT-C for use in Indigenous contexts is not clear [7].

The AUDIT-C might be less effective for Indigenous Australian clients than others due to cultural differences [7,18]. Some Indigenous Australians drink episodically rather than at regular intervals [18,19]. Drinking can be reserved for special occasions such as sporting events, celebrations or funerals ('Sorry business') [18]. Thus, asking Indigenous people about their 'usual drinking' as part of the AUDIT-C might pose challenges [7]. In some cases, helping Indigenous Australian clients work out how much they drank on single occasions is also difficult [8]. Some Indigenous Australians drink alcohol from improvised containers (e.g. free-poured spirits consumed from re-purposed juice or soft drink bottles) [18]. Use of non-standard containers makes conversions to standard drinks challenging and may lead to inaccurate estimates of drinking risk [7].

A variant of the Timeline Followback [20] method, where participants report on their last two to four drinking occasions in detail (rather than all occasions during a fixed reference period), has been proposed as a better way to estimate drinking risk for Indigenous Australians [7,21]. This method, first used in Finnish population studies [22], requires participants to report the last four occasions that they drank alcohol. The amount consumed and spacing between occasions is used to calculate standard drinks consumed per day, and the maximum consumed on any one occasion.

In Australia, the 'Finnish method' has been included in an iPad application ('The Grog Survey App') to determine drinking risk for Indigenous Australians [9]. As operationalised in the App, the Finnish method has been found to yield similar results to clinical assessments made by Aboriginal health workers [9]. But these health worker assessments were primarily based on Timeline Followback [20] over 2–4 weeks. This short frame of reference may not be suitable for some Indigenous Australians who might only drink a few times in a single year [9]. AUDIT-C is likely a better point of comparison for the Finnish method. Only one study has compared these two measures, but the methods used prevent firm conclusions being made [21]: participants were not asked the second question of the AUDIT-C and the sample was not representative of the local community (heavy drinkers were over-sampled—test accuracy might be different for other kinds of drinkers). To better understand whether the AUDIT-C or Finnish method should be preferred for Indigenous clients, the complete AUDIT-C needs to be compared with the Finnish method in a representative sample of Indigenous Australians.

In the current paper, we compare the complete AUDIT-C and the Finnish method in a representative sample of Indigenous Australians. We aimed to determine whether the AUDIT-C or Finnish method is a more appropriate screening tool for detecting Indigenous Australian clients whose health is at risk due to alcohol consumption. We determine the time taken to complete each tool. We explore whether either scale is more strongly linked with harms from drinking (being hit by someone or injury), or to the frequency at which alcohol dependence symptoms are experienced (based on self-reported International Classification of Diseases, 11th Revision (ICD-11) criteria [23]). Finally, we assess which tool identifies higher proportions of Indigenous Australians at risk from alcohol consumption.

Methods

Indigenous involvement

This paper is part of a broader project—to create an iPad application capable of measuring drinking patterns in culturally appropriate ways—conceived of by Indigenous Australian health professionals (including SW).

Ethics

Ethical approval was obtained from the Aboriginal Health Council South Australia (Ref: 04/15/621) and from Metro South Health Human Research Ethics Committee in Queensland (Ref: HREC/16/QPAH/293).

Survey administration

Data were collected using 'The Grog Survey App' [9]. Questions were worded to be suitable for Indigenous participants and included aspects of storytelling [24]. Participants were offered headphones to listen to questions in English or Pitjantjatjara (a local Indigenous

Australian language). Research assistants (who included Indigenous Australian health professionals) were available to answer participant questions and provide help to operate the App as needed.

Setting

The survey was conducted in two South Australian communities—one urban and one remote (based on Australian Bureau of Statistics classifications [25]). The urban sample has been found to closely reflect local demographics according to the 2016 Australian Census of Population and Housing [26,27]. We attempted to sample all adults (16 years and older) in the remote community.

Instruments

Demographics. Participants reported their age, gender, income and employment status.

AUDIT-C. AUDIT-C is an instrument widely used in Indigenous Australian contexts to screen for risking drinking [8,17,28]. The AUDIT-C was adapted for the Grog Survey App to visualise quantities of alcohol in each user's preferred alcoholic beverage (i.e. in beer, wine, spirits or cider). Risk cut-offs used for the AUDIT-C were 3 for women and 4 for men [29]. Wording was modified for use with Indigenous Australians. The text for AUDIT-1 was: 'Some people drink grog most days, while others drink 'once in a blue moon'. How often have you had any grog in the last 12 months?'. Responses were on a 5-point scale: 'Never', 'Once in a blue moon (less than once per month)', 'Sometimes (2–4 times per month)', '2–3 times per week', 'Most days or every day'. The text for AUDIT-2 was: 'How many drinks of grog do you have on a typical day when you drink?'. Responses to AUDIT-2 were visualisations of alcohol representing 1–2, 3–4, 5–6, 7–9 and 10+ standard drinks. The text for AUDIT-3 was: 'How often would you drink this much grog or more in one day (24 hours)?' (paired with a visualisation of six standard drinks in each user's preferred beverage). The responses for AUDIT-3 were 'Never', 'Once in a blue moon (hardly ever, less than once per month)', 'Sometimes (1-3 times a month)', 'Weekly', 'Most days or every day'.

Finnish method (last two occasions). Self-reported consumption details from the last two drinking occasions (in the past 12 months) were used to calculate the average alcohol consumed per drinking occasion. The dates of the last four drinking occasions relative to when the survey was administered were used to estimate the number of drinking occasions per day (e.g. drinking once a week is 0.14 occasions per day). As the reference period always ends on a drinking occasion, it is biased towards overestimating drinking frequency. To correct for this, half the average gap between drinking occasions was added to the total duration [9]. When participants reported not engaging in four drinking occasions in the past 12 months, the total duration was set to 365 days.

The average number of Australian standard drinks (each 10 g ethanol) consumed per occasion was multiplied by the number of drinking occasions per day to estimate the average number of standard drinks consumed per day. Using this method, participants were classified as risky drinkers based on current Australian guidelines [30]. Participants were classified as being at short-term risk if they consumed more than four standard drinks during a single drinking occasion, and at long-term risk if they consumed more than 10 standard drinks per week [30].

Dependence. We operationalised ICD-11 dependence criteria [23] into three self-report questions suitable for an Indigenous Australian audience. The first question was: 'Some people feel like grog is the boss of them. How often do you feel grog makes all the decisions? (so you could not stop drinking, even if you tried)'. The second question was: 'Some people's hands shake when they stop drinking or before their first drink of the day. How often does this happen to you?'. The third question was 'Some people spend more time drinking than doing other things they need to do, like looking after family, culture or work. How often does this happen to you?'. Responses were given on a 5-point scale (scored 0–4, respectively) ranging from 'never' to 'most days or every day'. To create a continuous measure of dependence (for use in correlations) we summed the score across each item (maximum score of 12).

Harms. We asked people who drink to indicate whether they had encountered specific harms from drinking in the last 12 months. The harms participants reported were: 'Someone hit me', 'I fell down', 'I had a road accident', 'My money runs out because it goes on grog', 'The kids in my house get scared by my drinking' and 'I get into trouble with police or security guards'. Responses were coded as binary variables.

Data analysis

We used R version 4.1.1 (2021-08-10) [31] for all analyses. To prevent transcription errors, we used the

library 'papaja' to prepare this manuscript [32]. A *t*-test was used to compare the time taken by participants to complete the Finnish method and the AUDIT-C. Spearman correlation was used to look at the similarity between the AUDIT-C and drinking metrics estimated using the Finnish method. Bivariate logistic regressions were used to estimate the odds of participants experiencing harms from drinking based on whether they were found to be at short- or long-term risk from the Finnish method, or at risk based on AUDIT-C thresholds. For logistic regression models, 95% confidence intervals (CI) were estimated using the profile-likelihood method [31,33]. We visualised the distributions of AUDIT-C scores by Finnish method risk classifications and gender using density curves and the library 'ggplot2' [34]. AUDIT-C and Finnish method risk classification agreement were tested with McNemar's test. The sensitivity and specificity of the AUDIT-C were calculated (with the 'epiR' library [35]) for males and females using the Finnish method as a reference test. Receiver operating characteristic (ROC) curves for AUDIT-C thresholds were plotted using Finnish method risk categories as reference tests using the library 'plotROC' [36]. These curves visualise the sensitivity and false-positive rate at various cut-points of the AUDIT-C using Finnish method risk classifications as a reference test.

Results

Sample characteristics

We surveyed 775 participants. Approximately one in five (22.97%) had not consumed alcohol in the past 12 months and were excluded from further analysis. The final sample size was 597. The average age of participants was 36.14 (SD = 14.74). Just over half of the participants were female (n = 300; 50.25%). Further sample details have been reported elsewhere [27].

Comparing AUDIT-C to Finnish method

Time to complete. Participants took more time to complete the Finnish method than AUDIT-C; t = 40.78, df = 658.66; P < 0.001. On average participants took 4.04 min (SD = 1.90) to complete the Finnish method and 0.79 min (SD = 0.44) to complete the AUDIT-C (d = 3.18 (95% CI 2.95–3.41).

Inter-correlations. Table 1 shows the Spearman correlations between AUDIT-C and drinking metrics estimated with the Finnish method. AUDIT-C score and average standard drinks consumed per day (Finnish method) were highly correlated. AUDIT 1–2 were each strongly linked to drinks per day but weakly linked to drinks per occasion. AUDIT-3 was moderately linked to both drinks per day and per occasion. The frequency of self-reported alcohol dependence symptoms (based on ICD-11 criteria) was moderately linked to both AUDIT-C score (r = 0.40, P = < 0.001) and to standard drinks per day as calculated by the Finnish method (r = 0.35, P = < 0.001).

Drinking risk and harms

Table 2 presents the relative odds of experiencing harms for participants classified as at short- or long-term risk (as derived from the Finnish method) and AUDIT-C risk. Short-term, long-term (Finnish method) and AUDIT-C risk were all linked with spending too much money on alcohol and being hit by someone. Long-term risk and AUDIT-C risk predicted interactions with police/security guards. No risk category predicted injuries from falling over or kids feeling scared because of drinking at home.

Risk classification

The Finnish method found more participants to be at-risk than the AUDIT-C; χ^2 (1) = 11.36, P < 0.001

Table 1. *The links between AUDIT-C, the Finnish method and self-reported dependence*

	1	2	3	4	5	6	Median	IQR
1. AUDIT-1	—						2.00	1.00
2. AUDIT-2	0.73***	—					1.00	1.00
3. AUDIT-3	0.28***	0.35***	—				2.00	3.00
4. AUDIT-C	0.75***	0.81***	0.78***	—			5.00	4.00
5. Drinks per day[a]	0.64***	0.62***	0.45***	0.70***	—		0.29	1.17
6. Drinks per occasion[a]	0.28***	0.37***	0.46***	0.50***	0.66***	—	8.16	10.70
7. Dependence	0.41***	0.41***	0.19***	0.40***	0.35***	0.25***	0.00	3.00

*P < 0.05; ** P < 0.01; *** P < 0.001. AUDIT-C is the total score derived from AUDIT 1–3. [a]Drinks per day and per occasion measured using the Finnish method; dependence is the total score from the three dependence items; all correlations are Spearman rho. AUDIT-C, Alcohol Use Disorders Identification Test—Consumption; IQR, interquartile range.

Table 2. *The odds and 95% confidence intervals of coming to harm if at short-term risk, long-term risk or AUDIT-C risk*

	Finnish method		
	Short-term OR[a]	Long-term OR[a]	AUDIT-C OR
I fell down	2.58 [1.01, 8.72]	1.55 [0.70, 3.14]	1.22 [0.61, 2.67]
Too much money on grog	5.82 [2.11, 24.11]*	4.39 [2.52, 7.57]*	3.32 [1.59, 8.13]*
Kids scared by drinking	2.45 [0.70, 15.46]	2.02 [0.71, 5.06]	1.57 [0.58, 5.51]
Someone hit me	5.11 [1.54, 31.69]*	2.55 [1.24, 5.01]*	4.81 [1.71, 20.12]*
Trouble with police	1.38 [0.60, 3.72]	3.97 [1.99, 7.76]*	3.29 [1.29, 11.13]*
Any harm	4.31 [2.35, 8.72]*	5.83 [3.69, 9.31]*	3.88 [2.31, 6.88]*

*$P < 0.05$. [a]Short- and long-term risk determined using the Finnish method. Square brackets denote 95% profile-likelihood confidence intervals. Each cell was derived from a separate logistic regression. Short- and long-term risk were derived using the Finnish method. Participants were classified as being at short term risk if they drank more than four standard drinks (each 10 g ethanol) on a single occasion in the past month. Participants were classified at long-term risk if they consumed more than 10 standard drinks per week on average. AUDIT-C cut-offs for risk were 3+ for females and 4+ for males. AUDIT-C, Alcohol Use Disorders Identification Test—Consumption; OR, odds ratio.

(McNemar's test). The Finnish method found 486 (81.41%) drinkers at risk—482 (80.74%) at short-term risk and 96 (16.08%) at long-term risk—whereas the AUDIT-C identified 444 (74.37%) drinkers at risk. Those at short-term risk engaged in 0.83 (SD = 1.53) drinking occasions per week. Those at long-term risk engaged in 2.99 (SD = 2.66) drinking occasions per week. Most participants (95.83%) at long-term risk were also at short-term risk.

Figure 1 visualises the densities of AUDIT-C score by Finnish method risk categorisation and gender. AUDIT-C scores for those at low short-term risk (based on the Finnish method) tended to be low. In contrast, the distributions of AUDIT-C scores for those at high short-term risk were broad. This pattern of results was reversed for the distributions of AUDIT-C scores stratified by long-term risk status. While those at risk had higher AUDIT-C scores, those not at long-term risk had broad distributions. Substantial gender differences were not observed except for those not at long-term risk from drinking. The peak density for women not at long-term risk from drinking was low: an AUDIT-C score of 2.20. In contrast, for men not at long-term risk the peak density was high: an AUDIT-C score of 6.07.

Sensitivity and specificity

We calculated the sensitivity and specificity of AUDIT-C as a tool to identify short- and long-term risky drinking. We used the Finnish method as a reference test as it was more strongly linked to harms. For all kinds of Finnish method risks AUDIT-C was highly sensitive, but had poor specificity.

Short-term risk. AUDIT-C detected the majority of men [81.71% (95% CI 76.43–86.24)] and women [78.67% (95% CI 72.73–83.83)] who were at short-term risk from drinking based on the Finnish method (sensitivity). In contrast AUDIT-C only correctly identified approximately half of men [55.00% (95% CI 38.49–70.74)] and women [48.00% (95% CI 36.31–59.85)] who were not at short-term risk (specificity).

Long-term risk. AUDIT-C detected all men [100.00% (95% CI 94.40, 100.00)] and nearly all women [96.88% (95% CI 83.78, 99.92)] who were at long-term risk from drinking based on the Finnish method (sensitivity). However, the AUDIT-C identified less than a third of men [29.61% (95% CI 23.83, 35.92)] and women [30.97% (95% CI 25.49, 36.88)] who were not at long-term risk (specificity).

Combined risk. AUDIT-C detected most men [81.78% (95% CI 76.52, 86.30)] and women [78.95% (95% CI 73.07, 84.05)] who were at any risk from drinking based on the Finnish method (sensitivity). The AUDIT-C identified about half of men [56.41% (95% CI 39.62, 72.19)] and women [50.00% (95% CI 37.98, 62.02)] who were not at long-term risk based on the Finnish method (specificity).

ROC analysis for AUDIT-C. As AUDIT-C was sensitive, but lacked specificity, it is possible that higher AUDIT-C cut-offs would bring it into alignment with the Finnish method. We explored this with ROC curves. Figure 2 demonstrates that an AUDIT-C cut-off of 7 for females and 8 for males achieved acceptable

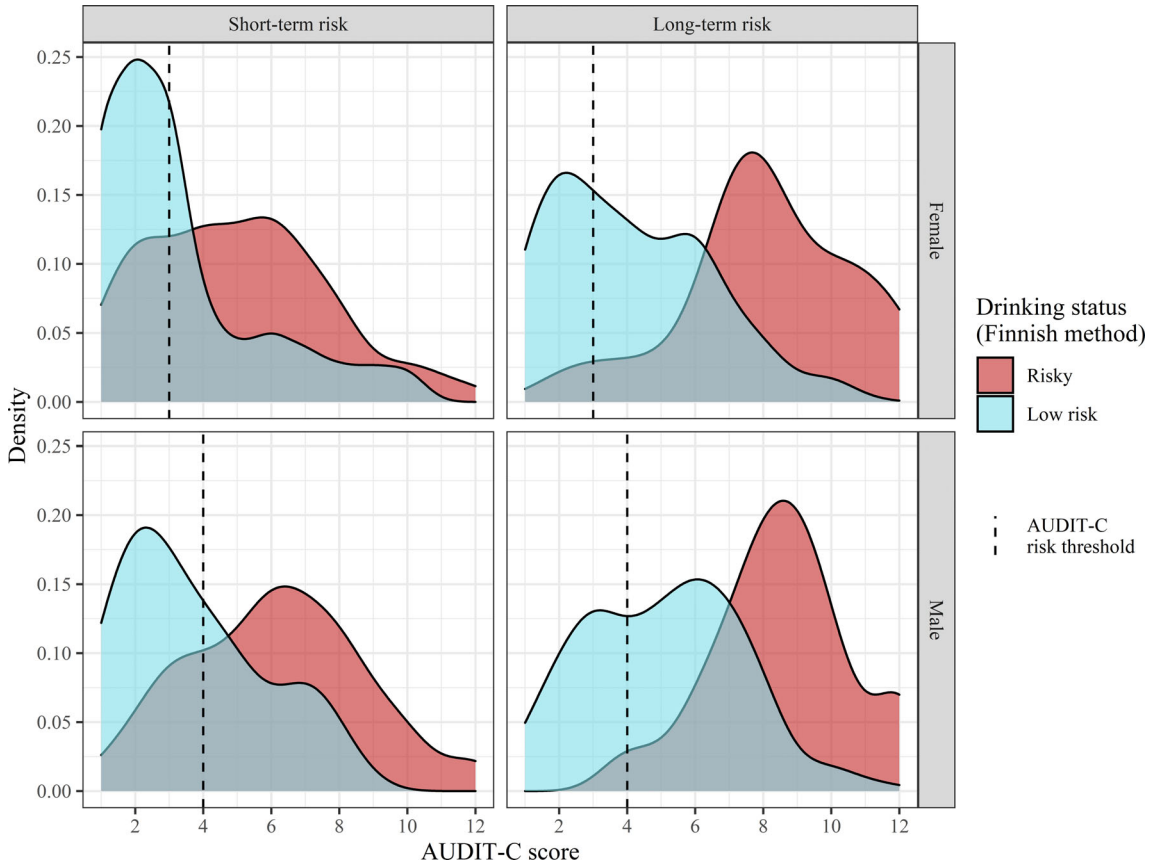

Figure 1. *Density curves of Alcohol Use Disorders Identification Test—Consumption (AUDIT-C) score by Finnish method risk rating. The area under each curve to the right of the dashed line represents the proportion of participants which the AUDIT-C would have rated as risky drinkers.*

sensitivity and specificity for long-term risk. However, for short-term risk no AUDIT-C cut-off could bring the test into alignment with the Finnish method.

Discussion

In this study, we compared the drinking risk categorisations of the AUDIT-C and Finnish method in a representative sample of Indigenous Australians. We identified more risky drinkers using the Finnish method (which assesses risk based on the last two to four drinking occasions) than the AUDIT-C which asks questions about typical drinking. The AUDIT-C and Finnish method were similarly linked to the frequency of self-reported ICD-11 dependence symptoms, and to the experience of harms from drinking. Both measures are likely useful in detecting risky drinkers. As the AUDIT-C was much faster to complete, it may be better suited to clinical settings. The Finnish method, which provides multiple indices of risk and drinking patterns, might be preferred for population surveys [15].

Relationships to risk and dependence

Direct comparisons between the AUDIT-C and Finnish method are difficult as they measure different types of drinking risk. The Finnish method was designed as a population survey tool [7] and measures the quantity and frequency of drinking. This allows for separate estimates of short- and long-term risk to be calculated. In contrast, the AUDIT-C is a composite measure and merges information about quantity and frequency (short- and long-term risk) into a single score. Further, both methods use different time frames, with the AUDIT-C asking about typical drinking, whereas the Finnish method asking explicitly about recent drinking. Due to these differences, some disagreement between these instruments is inevitable. Nonetheless, AUDIT-C score and drinking indices calculated using the Finnish method were strongly correlated with each other. AUDIT-C score and Finnish method indices were also correlated with more frequent self-reported symptoms of ICD-11 dependence [23] and were similarly predictive of harms from drinking.

The Finnish method identified more people as being at risk than the AUDIT-C. However, most of these drinkers were at short-term risk from drinking which is a

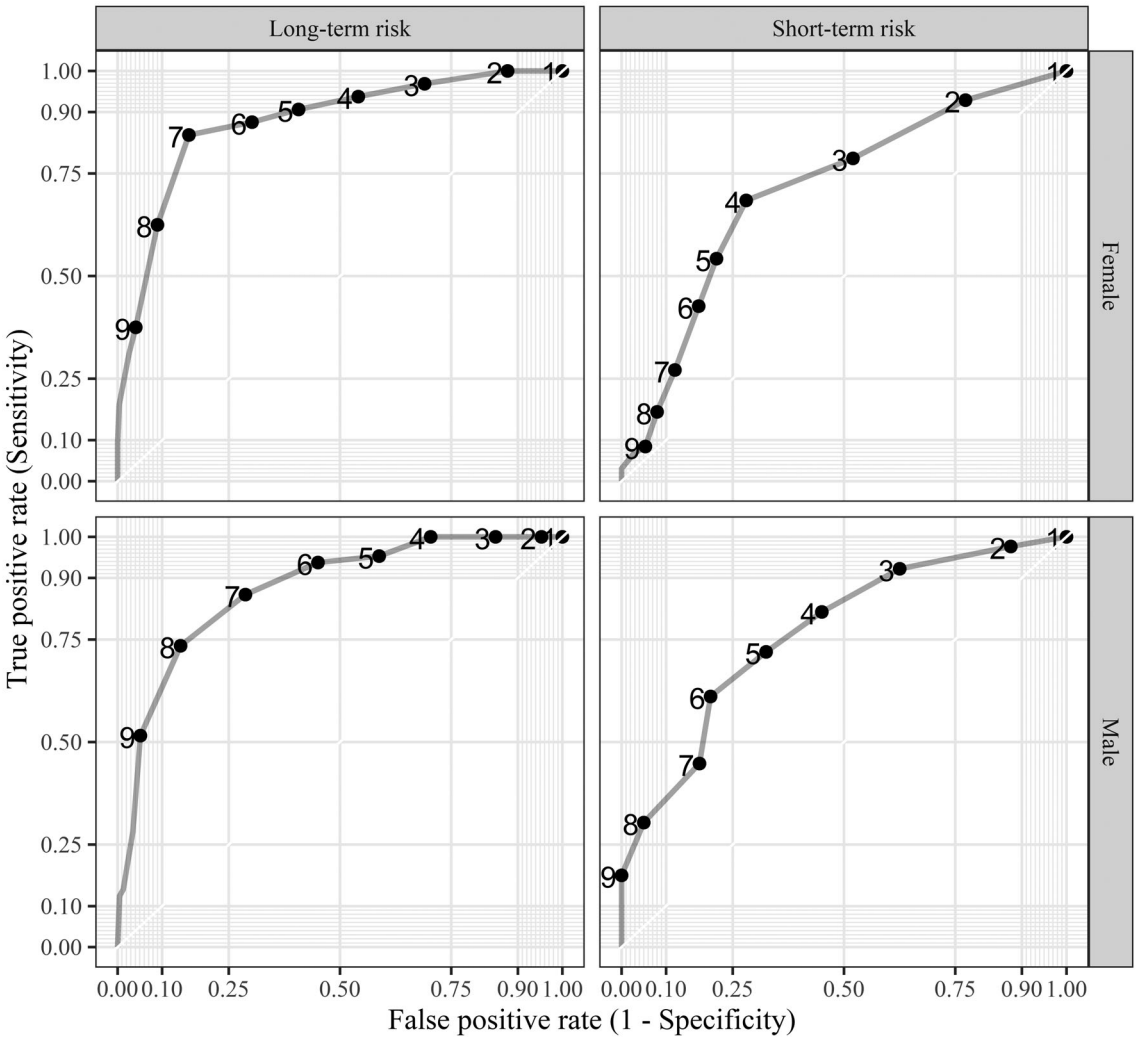

Figure 2. *Receiver operating characteristic curves for the Alcohol Use Disorders Identification Test—Consumption (AUDIT-C) for short-term and long-term risk by gender. Different values of the AUDIT-C (the numbers along the line) are used as cut-point to derive risk. Risk categorisation is then compared for AUDIT-C risk (using the given cut-point) against long- and short-term risk as derived from the Finnish method.*

very sensitive indicator—a single occasion of drinking above national guidelines, up to 12 months ago flagged users as being at risk. But as drinking among Indigenous Australians can often be heavy and episodic (and short-term harms such as physical trauma are a major source of morbidity [12]) conversations about prior risky drinking are probably useful in preventing future harms.

Clinical feasibility

The median time to complete AUDIT-C for study participants was less than a minute. In contrast, it took on average 4 min to complete the Finnish method. This means AUDIT-C is more feasible for use within busy primary health-care settings. However, the use of tablet technology (e.g. The Grog Survey App) means that either measure could be given for clients to complete in waiting rooms without clinical supervision [7]. The Finnish method may also have clinical utility in providing important contextual information to clinicians (i.e. what was consumed, with how many others, when and where). For example, clients consuming bulk-purchased alcohol (e.g. cask wine) alone at home may need different supports to those engaging in risky social drinking at licensed venues.

Population surveys

One advantage of the Finnish method over AUDIT-C is it can relate directly to national drinking guidelines,

rather than providing a composite measure of risk. Policy makers may find the extra detail provided by the Finnish method useful in understanding the needs of local communities. For example, in the communities we sampled, almost all drinkers were at short-term risk, whereas long-term risk was relatively uncommon. Communities with different patterns of consumption may need different kinds of supports. For instance, if many people are at short-term risk, measures may be needed to ensure intoxicated individuals do not cause harm to themselves or others. For communities where long-term drinking risk is more common, health education about how drinking alcohol can cause chronic diseases and cancers might be needed (together with enhanced management of physical co-morbidities).

The benefits of screening for communities

It is often unclear who is at risk as some people do not drink out in public—those who feel disconnected from others, or who otherwise have thwarted basic psychological needs might engage in at-risk drinking to feel better [37]. Our data suggest that AUDIT-C and the Finnish method would both be useful tools that communities could use to detect at-risk drinkers such that they could be supported.

In some cases, communities might not have access to services to support at-risk drinkers. In these instances, screening data could help inform communities when drafting policies on how licensed venues can operate, or how much take-away alcohol can be sold from bottleshops. Data on the prevalence of at-risk individuals could also be used by communities to help attract funding/supports from external organisations to establish new social services.

Limitations

We modified the AUDIT-C and Finnish method to be culturally appropriate [38]. While these adaptations may increase Indigenous Australian engagement, our conclusions may not apply to instances where these tools are delivered without modification. Additionally, the harms measured in this study were mostly acute. Research linking both measures to chronic diseases, and other long-term harms would be useful. Given the significant variability in drinking patterns between Indigenous Australian samples [39], our findings might not be generalisable to some Indigenous Australian communities. Finally, it would be beneficial to compare both the AUDIT-C and Finnish method to another tool which could be considered a 'gold standard'. This is currently not possible as no such tool exists for Indigenous peoples. But our results suggest that the AUDIT-C and Finnish method would be useful points of comparisons for researchers to use when trying to validate new screening tools for Indigenous peoples.

Conclusion

We demonstrated that both the AUDIT-C and Finnish method are correlated with the frequency of self-reported dependence symptoms and harms. Both instruments are useful in identifying clients who are experiencing harms from drinking. AUDIT-C, being quick to administer, is best suited to clinical settings The Finnish method may be better suited to population studies where more detailed information on drinking patterns and different kinds of drinking risk are needed.

Acknowledgements

This work was supported by the National Health and Medical Research Council through a Project Grant (#1087192), the Centre of Research Excellence in Indigenous Health and Alcohol (#1117198) and a Practitioner Fellowship for KMC (#1117582). We would like to acknowledge the communities who supported this project. We would also like to thank Michelle Fitts, David Warrior, Shane Bond, Dudley Ah Chee, Keith Weetra, Teagan Weatherall, Mustafa Al Ansari, Taleah Reynolds, Catherine Zheng, Monika Dzidowska and Summer Loggins for their contributions.

Data Availability Statement

Data for this project is stored at the University of Sydney based at Drug Health Service, 83-117 Missenden Road, Camperdown, NSW 2050, Australia. Due to ethical constraints data is not publicly accessible. Contact kylie.lee@sydney.edu.au for enquiries.

References

[1] Ministerial Council on Drug Strategy. National drug strategy: Aboriginal and Torres Strait Islander peoples complementary action plan 2003-2009. Australian Government Department of Health and Ageing for the National Drug Strategy, 2003.
[2] King M, Smith A, Gracey M. Indigenous health part 2: the underlying causes of the health gap. Lancet 2009;374:76–85.
[3] Sahdra BK, Ciarrochi J, Parker PD *et al*. Discrimination as a frame-of-reference effect in overlapping friendship communities of ethnically diverse youth. Cultur Divers Ethnic Minor Psychol 2020;26:71–81.

[4] Haber PS, Riordin BC. Guidelines for the treatment of alcohol problems, 4th edn. Sydney: Specialty of Addiction Medicine, Faculty of Medicine and Health, The University of Sydney, 2021.
[5] Kaner E, Beyer F, Muirhead C *et al*. Effectiveness of brief alcohol interventions in primary care populations. Cochrane Database Syst Rev 2018; 2:CD004148.
[6] Stewart JM, Sanson-Fisher R, Eades S, D'Este C. Aboriginal health: agreement between general practitioners and patients on their health risk status and screening history. Aust N Z J Public Health 2014;38: 563–6.
[7] Lee KSK, Chikritzhs T, Wilson S *et al*. Better methods to collect self-reported alcohol and other drug use data from Aboriginal and Torres Strait Islander Australians: Indigenous substance use data. Drug Alcohol Rev 2014;33:466–72.
[8] Islam M, Oni H, Lee KK *et al*. Standardised alcohol screening in primary health care services targeting Aboriginal and Torres Strait Islander peoples in Australia. Addict Sci Clin Pract 2018;13:5.
[9] Lee KSK, Conigrave JH, Callinan S *et al*. Asking about the last four drinking occasions on a tablet computer as a way to record alcohol consumption in Aboriginal and Torres Strait Islander Australians: a validation. Addict Sci Clin Pract 2019;14:15.
[10] Chapman C, Slade T, Hunt C, Teesson M. Delay to first treatment contact for alcohol use disorder. Drug Alcohol Depend 2015;147: 116–21.
[11] Australian Institute of Health and Welfare. Substance use among Aboriginal and Torres Strait Islander people. Canberra: Australian Institute of Health and Welfare, 2011.
[12] Al-Yaman F. The Australian Burden of Disease Study: impact and causes of illness and death in Aboriginal and Torres Strait Islander people, 2011. Public Health Res Pract 2017;27:2741732.
[13] Gracey M, King M. Indigenous health part 1: determinants and disease patterns. Lancet 2009;374:65–75.
[14] Gibson O, Lisy K, Davy C *et al*. Enablers and barriers to the implementation of primary health care interventions for Indigenous people with chronic diseases: a systematic review. Implement Sci 2015;10:71.
[15] Chikritzhs T. The elusiveness of representativeness in general population surveys for alcohol: commentary on Rehm *et al*. Drug Alcohol Rev 2021; 40:166–8.
[16] Johnson JA, Lee A, Vinson D, Seale JP. Use of AUDIT-based measures to identify unhealthy alcohol use and alcohol dependence in primary care: a validation study. Alcohol Clin Exp Res 2013;37(Suppl 1): E253–9.
[17] Australian Institute of Health and Welfare. AIHW National Key Performance Indicators database: User guide reporting period ending 30 June 2017. Australian Institute of Health and Welfare, 2017. Available at: https://www.aihw.gov.au/getmedia/8137670c-809f-4bc9-ad71-1282a15af18e/nkpi-user-guide-june2017-version3.pdf.aspx (accessed 6 November 2018).
[18] Lee KK, Conigrave J, Wilson S *et al*. Patterns of drinking in Aboriginal and Torres Strait Islander peoples as self-reported on the Grog Survey App: a stratified sample. BMC Med Inform Decis Mak 2019;19:180.
[19] Hunter E, Hall W, Spargo RM. Distribution and correlates of alcohol consumption in a remote Aboriginal population. Sydney: National Drug and Alcohol Research Centre, University of New South Wales, 1991.
[20] Sobell L, Sobell M. Timeline follow back: a calendar method for assessing alcohol and drug use (User's Guide). Toronto, ON: Canada Addiction Research Foundation, 1996.
[21] Lee KSK, Conigrave JH, Wilson S *et al*. Short screening tools for risky drinking in Aboriginal and Torres Strait Islander Australians: modified AUDIT-C and a new approach. Addict Sci Clin Pract 2019;14:22.
[22] Alanko T. An overview of techniques and problems in the measurement of alcohol consumption. In: Research advances in alcohol and drug problems. Boston, MA: Springer, 1984:209–26.
[23] World Health Organization. ICD-11 for mortality and morbidity statistics. 22: 2018.
[24] Lee KK, Wilson S, Perry J *et al*. Developing a tablet computer-based application ("App") to measure self-reported alcohol consumption in Indigenous Australians. BMC Med Inform Decis Mak 2018;18:8.
[25] Australian Bureau of Statistics. Australian standard geographical classification (ASGC). Canberra, Australian Bureau of Statistics; 2011.
[26] Australian Bureau of Statistics. Census of population and housing: reflecting Australia – stories from the census, 2016. Canberra: Australian Bureau of Statistics, 2017.
[27] Lee KK, Fitts MS, Conigrave JH *et al*. Recruiting a representative sample of urban South Australian Aboriginal adults for a survey on alcohol consumption. BMC Med Res Methodol 2020;20:183.
[28] Calabria B, Clifford A, Shakeshaft AP *et al*. Identifying Aboriginal-specific AUDIT-C and AUDIT-3 cutoff scores for at-risk, high-risk, and likely dependent drinkers using measures of agreement with the 10-item Alcohol Use Disorders Identification Test. Addict Sci Clin Pract 2014;9:17.
[29] Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a brief screen for alcohol misuse in primary care. Alcohol Clin Exp Res 2007;31:1208–17.
[30] National Health and Medical Research Council. Australian guidelines to reduce health risks from drinking alcohol. 2020. Available at: https://nla.gov.au/nla.obj-2903400717 (accessed 5 March 2021).
[31] R Core Team. R: a language and environment for statistical computing. Vienna: R Foundation for Statistical Computing, 2021. Available at: https://www.R-project.org/ (accessed 25 September 2021).
[32] Aust F, Barth M. papaja: Prepare reproducible APA journal articles with R Markdown. 2020. Available at: https://github.com/crsh/papaja (accessed 25 September 2021).
[33] Venables WN, Ripley BD. Modern applied statistics with S, 4th edn. New York, NY: Springer, 2002.
[34] Wickham H. ggplot2: elegant graphics for data analysis. New York: Springer-Verlag, 2016. Available at: https://ggplot2.tidyverse.org (accessed 25 September 2021).
[35] Stevenson M, Telmo Nunes ES with contributions from, Heuer C, Marshall J, Sanchez J, Thornton R, et al. epiR: Tools for the analysis of epidemiological data. 2021. Available at: https://CRAN.R-project.org/package=epiR
[36] Sachs MC. plotROC: a tool for plotting ROC curves. J Stat Softw 2017; 79:2.
[37] Conigrave JH, Bradshaw EL, Conigrave KM *et al*. Alcohol consumption and dependence is linked to the extent that people experience need satisfaction while drinking alcohol in two Aboriginal and Torres Strait Islander communities. Addict Sci Clin Pract 2021;16:23.
[38] Lee KK, Conigrave JH, Al Ansari M *et al*. Acceptability and feasibility of a computer-based application to help Aboriginal and Torres Strait Islander Australians describe their alcohol consumption. J Ethn Subst Abuse 2021;20:16–33.
[39] Conigrave JH, Lee KSK, Zheng C *et al*. Drinking risk varies within and between Australian Aboriginal and Torres Strait Islander samples: a meta-analysis to identify sources of heterogeneity. Addiction 2020;115:1817–30.