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**Lay understanding of the causes of binge drinking in the United Kingdom and
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Abstract

Binge drinking is associated with deleterious health, social, and economic outcomes. This study explored the lay understanding of the causes of binge drinking in members of the general public in the UK and Australia. Participants in the UK (N=133) and Australia (N=102) completed a network diagram exercise requiring them to draw causal paths and provide path strength ratings between 12 candidate factors (24-hour opening, age, alcohol advertising, alcohol availability, boredom, drinking culture, income, low cost, parental influence, peer pressure, stress, supermarket discounts) and binge drinking. Results indicated good consistency in paths across samples, although differences in frequency and strength ratings for some paths were found. Drinking culture, peer pressure, and low alcohol cost were perceived as direct causes of binge drinking in both samples. Low alcohol cost and drinking culture were most frequently viewed as direct causes of binge drinking in UK and Australian participants, respectively. Supermarket discounts and low cost of alcohol were most frequently viewed as indirect causes of binge drinking by UK and Australian samples. Findings reflect general awareness and prominence of factors affecting binge drinking in both national groups. Findings may inform the development of campaigns to promote public support policies to curb binge drinking.

Keywords: Risky alcohol consumption; network diagram method; causal models; drinking culture

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Introduction

Excessive alcohol consumption and, in particular, risky single-session alcohol consumption, commonly referred to as ‘binge’ drinking, is known to have considerable negative economic, social, and health consequences [1, 2]. There has also been a consistent increase in rates of excessive alcohol consumption and binge drinking in the UK, Australia, and worldwide [3, 4]. In the light of growing public health and social issues associated with excessive alcohol consumption and binge drinking, governments and policymakers are seeking to develop policies and initiatives to reduce these risky patterns of alcohol consumption. Options available include legislative solutions to restrict access to alcohol (e.g., changing licensing laws, raising duty on alcohol) or behavioral interventions to change people’s drinking patterns (e.g., educational campaigns, warning labels on alcoholic beverage packaging). Although the successful introduction of any preventive public health initiative depends largely on empirical evidence for its effectiveness, it is also dependent on the engagement and consent of the general public to provide the policymaking process with the necessary legitimacy for action. With this in mind, an understanding of the beliefs of members of the general public regarding the factors that influence health problems such as binge drinking is likely to prove useful for policymakers when developing public health interventions.

In the present study, we investigated lay understanding of the causes of binge drinking in members of the general public from the UK and Australia. The study used a network diagram approach which enabled us to investigate people’s perceived causes of binge drinking and their interrelations. The result was a set of network diagrams representing non-expert views of people from the general public on the causes of binge drinking and the relative frequency and strength of each cause. The diagrams provide

insight into the factors believed to be causes of binge drinking by the general public. This may provide important evidence of the key factors that should be targeted in public health interventions aimed at changing behavior and may inform the development of information campaigns aimed at increasing the acceptability of policies that may reduce binge drinking.

Non-expert beliefs and health interventions and policy

Research has indicated that binge drinking is caused by multiple social, economic, and psychological factors [5-7]. Specifically, research has indicated that binge drinking is associated with the cost and availability of alcohol [8], attitudes and control beliefs [9], social norms and pressure, social context, and a 'drinking culture' [10, 11], and drinking habits and alcohol identity [12, 13]. These factors have led researchers to target these factors in policy-focused interventions focusing on pricing and restriction of availability and behavioral interventions focusing on social norms [14], salient beliefs [15], planning [16], and managing cues to consumption [17].

However, expert models of the causes of public health issues like binge drinking are likely to contrast with the lay, non-expert beliefs with respect to causes held by the general public and those who engage in binge drinking. Identifying non-expert views on the causes of binge drinking may have utility in identifying the factors that may inform public health interventions and legislation aimed at reducing binge drinking. In one of the few studies examining lay causes of binge drinking, McMahon et al. [18] revealed that boredom, peer pressure, alcohol availability, socioeconomic deprivation, socialization/fun, poor parenting, and excess disposable income were prominent perceived causes. Participants also identified binge drinking as a particular problem among young people. Further research into individuals' lay understanding of the causes of binge drinking could provide an evidence base to inform policymakers' and stakeholders' (e.g., healthcare professionals, emergency services) development of campaigns to foster public support for measures and policies targeting reductions in binge drinking. By emphasising perceived causal factors likely to

confer benefits or mitigate threat, and downplaying factors that are likely to be disadvantageous or heighten threat, policy makers may reduce resistance to, and increase support for, public health interventions. Such support is important in order to smooth the path for legislation which may potentially be unpopular with the general public [19, 20]. Popular support for public health initiatives is frequently important if it is to be endorsed by governments and public health officials who are often mindful of negative public opinion [3, 21].

The network diagram method

One approach to elicit consensus on the individuals' understanding of the causes of a complex issue like binge drinking is to use a network diagram method [22]. The method is well-suited to investigating lay understanding of health issues as it is effective in identifying individuals' perceived patterns of relations among factors and a target issue or behavior, and uses a person-centred inductive approach such that a consensus pattern of relations among lay understanding of causes emerges.

In the network diagram method groups of individuals are required to each draw a causal structure that represents their lay understanding of the causes of a key outcome or issue, represented by a series of paths on a causal diagram [22, 23]. By aggregating the diagrams drawn by each individual, it is possible for researchers to formulate a composite network diagram that represents the group consensus on the causes of the target outcome or issue. The composite diagram represents the consensus (i.e., frequency) among individuals' perceived causal patterns among the factors on the outcome or issue. The approach also permits respondents to identify more complex paths by which the factors are perceived to relate to the target outcome. The technique therefore allows participants to specify indirect causal paths and reciprocal relations among factors. A further benefit of the approach is that it allows participants to assign a strength rating to each causal path. The strength rating

attributed to each path is then averaged and presented alongside the frequency ratings for each path in the consensus diagram.

Network diagrams have previously been used to investigate a broad number of issues including the perceived causes of crime [24], health [25], heart attacks [26], lower back pain [27], risk factors for coronary heart disease [28], work-related stress [29], obesity [23], causes of war [30] and terrorism [31], and employment prospects [32]. In light of growing concerns of the adverse health, social, and economic effects of binge drinking, the use of a network diagram method offers a structured, systematic approach to study individuals' lay understanding of the causes of binge drinking.

The present study

The aim of the present study was to investigate the perceived causes of binge drinking in individuals from the general public in the UK and Australia using a network diagram method [28, 33]. The topic is of particular interest to policymakers and public health advocates in the UK and Australia due similarities in the prevalence and causes of binge drinking in these nations. Global surveillance statistics indicate that prevalence rates of risky alcohol consumption are similar in both nations. For example, the proportion of the population consuming alcohol at risky levels was 12.2% and 11.6% in Australia and the UK, respectively [34]. Further, a large proportion of young people below the minimum legal age in both nations regularly consume alcohol [35, 36]. In addition, research has indicated that attitudes, social norms and a 'culture' of drinking are correlated with binge drinking in both nations [37, 38]. Availability of alcohol is also high in both countries with retailers selling alcohol in off-license outlets within, or attached to, supermarkets [3]. In addition, excessive alcohol consumption places a substantive economic burden on the economies of both nations, costing an estimated AUS\$15.30B (US\$11.67B) and £4.86B (US\$6.30B) to the Australian and UK economies each year [39, 40]. Given the commonalities in the patterns and consequences of binge drinking, curbing binge drinking

is considered a health and economic priority in both nations, and there is recognition of the need for legislation and interventions to address the issue [41, 42].

The network diagram method has not previously been applied to the study of lay understanding of the causes of binge drinking. As the method is primarily an exploratory technique, no specific predictions were made with respect to individuals' lay understanding of the causes of binge drinking. However, based on previous research we expected that participants would perceive cost and availability of alcohol, drinking culture, and peer pressure as prominent perceived causes [18]. The diagram method is expected to extend McMahon et al.'s research on the perceived causes by enabling participants to specify relations among causes and include direct and indirect pathways. As a consequence, a more complex network of perceived causal paths is expected to emerge. We aim to provide a generalized perspective on participants' perceived causes of binge drinking by aggregating the number of perceived causes and averaging the strength ratings assigned to each cause across participants' network diagrams [32].

Method

Participants

Participants were recruited through targeted advertisements in community organisations in the metropolitan areas of Perth, Western Australia and metropolitan and rural areas in the East Midlands and North-West regions of the UK as part of a larger focus group study on alcohol pricing and policy [43, 44]. The larger study aimed to conduct focus groups interviews on groups of individuals from a broad spectrum of ethnic and socioeconomic backgrounds including young people and university students, blue collar/manual workers, white collar workers, unemployed people, people from ethnic minority groups, hazardous drinkers, people from rural communities, and older adults. This focus on diversity was reflected in the organisations and groups targeted in our recruitment strategy. The organisations from which we recruited participants included schools, local

employers, local social and sport clubs, job seeker's pages in local newspapers, and unemployment centers. Poster advertisements were displayed prominently on the organisations' noticeboards informing potential participants of the study and encouraging them to contact the lead researcher of the study via the study email address or telephone number. Circular emails were also distributed to the email lists held by the organisations and on the servers of discussion groups with permission from their director or chief executive. Participants were eligible for inclusion if they were alcohol drinkers, had been resident in Australia or the UK for at least one year prior to recruitment, and were fluent in spoken English.

All participants completed the study in person and were provided with an AUS\$20 or UK£10 allowance to cover their travel costs. Participants were provided with full details of the study and the expected requirements of participation. Participants were informed that their name would not be used in conjunction with their data, that their data would be stored confidentially and could not be individually identified, and that they had the right to withdraw at any time without prejudice. They were required to sign a consent form acknowledging receipt of this information and agreeing to participate on the specified terms. Ethical clearance for the study was secured from Curtin University and the University of Nottingham institutional review boards prior to participant recruitment and data collection.

Two hundred and eighty-one participants (Australian sample: $n = 120$; UK sample: $n = 161$) were recruited to complete the network diagram exercise on the perceived causes of binge drinking. Participants that consented to participate were asked to draw their network diagrams during a break in the focus group discussions and were provided with instructions on how to complete their diagrams by the lead researcher. Participants completed the fast alcohol screening test (FAST) [45] to identify rates of hazardous drinking with a total score on the four questions (e.g., "How often do you have eight

(men)/six (women) or more drinks on one occasion?”). The FAST has shown good sensitivity and specificity in identifying hazardous drinking with scores ≥ 3 indicative of probable hazardous drinking. Scores across the current samples indicated that 32% of UK participants and 66% of Australian participants were classified as hazardous drinkers. These scores exceed overall percentages of hazardous drinking derived from national data (12.2% in Australia and 11.6% in UK) [34], but different methods were used to identify hazardous drinking to the current research making it difficult to make definitive comparisons. In addition, it is also likely that our samples comprised a larger proportion of younger adults who have higher rates of harmful drinking and figures in the current study are comparable to those rates [46, 47].

Network diagram method

In order to provide demonstration of a network diagram, participants were shown an example diagram drawn by a fictitious student of 12 pre-determined factors (e.g., social deprivation, community cohesion, drug abuse) as causes of crime levels in Australia and the UK, respectively. Following this example, participants were asked to produce a similar diagram to illustrate their thoughts regarding the causes of binge drinking in Australia or the UK. Participants were given a pre-determined list of 12 candidate causes or factors: 24-hour opening, age, alcohol advertising, alcohol availability, boredom, drinking culture, income, low alcohol cost, parental influence, peer pressure, stress, supermarket discounts. These candidate causes were selected based on a content analysis of research articles examining the causes of binge drinking [e.g., 6, 48]. The articles were identified as they reflected a synthesis of data on binge drinking research adopting large-scale representative samples in national groups with a similar socioeconomic and ethnic profiles to the current sample and an in-depth qualitative analysis of the causes of binge drinking, respectively. The lead researcher extracted an exhaustive list of factors from both articles and identified commonalities. A second researcher performed the extraction exercise independently and

the resulting list was compared with the lead researcher's list. The lists were virtually identical and only one factor, alcohol tolerance, was included on the lead researcher's list that was not included by the second researcher's list. This factor was dropped.

The restriction of factors to a pre-determined set of candidate causes is common practice in network diagram approaches to guide participants toward relevant factors and away from minor or irrelevant factors. This is in keeping with the focus on perceived causal relations rather than the identification of the factors per se and is consistent with the procedures adopted in previous research adopting the network diagram approach [28, 32]. Participants were instructed to restrict their diagrams to these 12 factors. Participants were told that they were free to omit any of the factors that they did not consider to have an influence on binge drinking. Participants were also asked to indicate which of the 12 factors they believed had a direct and indirect influence on binge drinking. The researcher provided a demonstration to illustrate how to draw direct and indirect paths in their diagrams. Finally, participants were asked to provide a rating as to how strong they perceived each factor included in their diagram was as a cause of binge drinking on a scale ranging from 0 to 100. The scale was anchored by '*not a causal factor at all*' (0) and '*factor completely causes binge drinking*' (100).

Participants were given approximately five minutes to complete their diagrams, after which they were asked (a) to ensure their diagram included every factor they believed was a cause of binge drinking from the candidate list of factors; (b) to check that arrowheads were used appropriately to indicate the direction(s) of the paths drawn in their diagram; and (c) to ensure that had rated the strength of each path drawn in their diagram.

Results

Participants

Five participants from the UK sample declined to participate in the network diagram exercise. In addition, twenty-three participants included factors that were not on the list of candidate factors or did not assign a strength rating to all the causal paths drawn in their diagrams, so their data were excluded from the analyses consistent with previous analytic approaches to network diagrams [32]. This resulted in a final UK sample of 133 participants (females, $n = 74$, males, $n = 87$; M age = 41.38, $SD = 22.09$, range = 16-89). Participants reported their ethnicity as White British/European ($n = 67$), South East-Asian ($n = 12$), or Southern or Central Asian ($n = 13$), with the remaining participants identifying another ethnic category. Eighteen of the Australian participants declined to participate and all those that agreed completed the exercise as instructed resulting in a final sample of 102 (females, $n = 50$, males, $n = 52$; M age = 39.34, $SD = 21.34$, range = 18-39). Participants reported their ethnicity as White Australian/European ($n = 122$) or Southern or Central Asian ($n = 25$), with the remaining participants reporting another ethnic category. We did not formally collect data on the socioeconomic background of participants. However, given that participants were recruited to focus groups representing particular socioeconomic and/or ethnic groups, we have some basic descriptive data on participants' socioeconomic background. In the UK sample, the focus groups comprised students ($n = 25$), blue collar/manual workers ($n = 20$), white collar workers ($n = 16$), unemployed people ($n = 19$), people from ethnic minority groups ($n = 16$), older adults and retirees ($n = 21$), hazardous drinkers ($n = 7$), and people from rural communities ($n = 9$). In the Australian sample, participants belonged to focus groups representing students ($n = 38$), blue collar/manual workers ($n = 10$), white collar workers, including secretarial, managers and professional ($n = 31$), unemployed people ($n = 10$), people from ethnic minority groups ($n = 14$), and older adults and retirees ($n = 17$).

Network diagrams

A number of analytic approaches to interpreting network diagrams exist [23, 28, 33]. We adopted Green and McManus's [28] method in which the proportion of participants identifying each factor as a cause of binge drinking was computed and expressed as a percentage. In addition, we computed the average strength ratings for each path. This provided a summary of how frequently participants included a particular factor as a cause and the overall strength rating for that path across the sample. Composite diagrams summarising participants' frequency of identification and strength ratings from the network diagram exercise were developed to permit easy comparison of the perceived causal factors across the samples. The diagrams summarize the proportion of the sample that nominated each factor as a perceived cause of binge drinking according to the following categories: high (70% to 100% of the sample), medium (40% to 69%), and low (10% to 39%). The diagrams also depict the average strength rating for each path across the sample categorized as high (paths with an average strength rating of 70 or greater), medium (paths with average strength ratings between 40 and 69), and low (paths with average strength ratings between 10 and 39). Noted trends and variations in path frequency and strength ratings across the samples were based on qualitative observation.

UK participants included an average of 12.45 causal paths ($SD = 5.11$) in their diagrams. The mean number of direct causal paths linking the 12 factors and the target binge drinking was 5.33 ($SD = 1.84$), participants also included, on average, 7.12 indirect causal paths ($SD = 5.16$) between the causes. Table 1 shows the frequency of path inclusion and mean strength rating for causal paths included by at least 10% of the UK participants. A composite diagram summarising the perceived causal paths and strength ratings is provided in Figure 1. Australian participants included an average of 12.78 causal paths ($SD = 5.05$) in their diagrams. The mean frequency of direct causal paths linking the 12 factors and binge drinking was 8.18 ($SD = 3.13$), participants also included, on average, 4.65 indirect causal paths ($SD = 5.03$) between the factors. Table 2 shows the frequency of path

inclusion and mean strength rating for causal paths included by at least 10% of the Australian participants. The accompanying composite diagram depicts the pattern of perceived causal paths (Figure 2). Reliability of paths was calculated by assigning participants to two randomly-selected groups using a random number generator. We then compared the two groups on frequency of paths they nominated and average path strength ratings using *t*-tests, consistent with previous research using network diagram methods [23, 27, 28]. In both samples, the two randomly selected groups did not significantly differ ($ps > .05$) in terms of the frequency of path inclusion or average path strength.

Direct causes. All 12 of the pre-determined factors were included in the final composite diagrams for the UK and Australian samples as each was viewed as a direct cause of binge drinking by at least 10% of the participants. Low cost of alcohol (71.43%) and stress (68.42%) were the causes most commonly perceived to be causes of binge drinking with the highest strength ratings (low cost of alcohol, $M = 80.29$, $SD = 20.92$; stress, $M = 68.02$, $SD = 22.71$) by UK participants. These factors were also frequently cited (low cost of alcohol = 65.69%; stress = 77.45%) with medium strength ratings (low cost of alcohol, $M = 59.58$, $SD = 25.672$; stress, $M = 60.09$, $SD = 23.28$) in the Australian sample. Drinking culture was most frequently perceived to be the cause of binge drinking by participants in the Australian sample (89.21%) with high strength ratings ($M = 81.48$, $SD = 17.18$). Drinking culture also had high strength ratings as a cause of binge drinking in the UK sample ($M = 77.50$, $SD = 17.64$), but it was less frequently viewed as a cause (48.12%). Peer pressure was also perceived to be a cause of binge drinking by a large proportion of the Australian sample (83.34%) with a high strength ratings ($M = 74.84$, $SD = 22.72$). By comparison, the frequency (65.41%) and strength ratings ($M = 70.38$, $SD = 19.04$) for this factor as a cause were lower in the UK.

Among other direct causes, availability of alcohol received high strength ratings in the UK sample ($M = 79.08$, $SD = 21.12$), but only approximately half of the sample

perceived this factor to be a cause of binge drinking (53.38%). By comparison, the strength ratings for this factor as a cause were lower in the Australian sample ($M = 61.16$, $SD = 27.05$), but it was viewed as a cause by a larger proportion of participants (73.57%). Age was perceived to be a cause of binge drinking with high frequency by Australian participants (80.39%), but had a moderate causal strength ratings ($M = 64.39$, $SD = 26.02$). Boredom (57.83%) and 24-hour opening of points of sale (45.10%) were also frequently viewed as causes in the Australian sample but with relatively weak strength ratings (boredom, $M = 40.92$, $SD = 26.99$; 24-hour opening, $M = 42.83$, $SD = 28.00$). By comparison, fewer participants in the UK sample perceived these factors as causes of binge drinking.

Indirect causes. In addition to the factors perceived to be direct causes of binge drinking, the method also permitted the analysis of participants' lay understanding of indirect causes. In the UK sample, the factors most commonly viewed as indirect causes of binge drinking were supermarket discounts via low cost of alcohol (42.11%) with high strength ratings ($M = 71.34$, $SD = 25.68$). Supermarket discounts was also frequently viewed as an indirect cause (16.54%) via increased availability of alcohol with high strength ratings ($M = 79.09$, $SD = 22.02$). Participants also viewed income via low cost of alcohol (28.57%) and age via peer pressure (28.57%) as indirect causes of binge drinking. However, the average strength ratings for age ($M = 75.42$, $SD = 21.12$) were higher than the average strength ratings for income ($M = 65.50$; $SD = 25.05$). For the Australian sample, age and low cost of alcohol were most frequently viewed as indirect causes of binge drinking. The factor most commonly nominated as an indirect cause of binge drinking was age via drinking culture (19.60%) with medium strength ratings ($M = 66.84$, $SD = 24.96$). The next most commonly viewed indirect cause was age via peer pressure (18.63%), which received high strength ratings ($M = 71.84$, $SD = 19.80$).

Discussion

The aim of the present study was to investigate individuals' lay understanding of the causes of binge drinking in samples of the general public from the UK and Australia. A network diagram approach was used to produce aggregate diagrams summarizing participants' lay understanding of causes of binge drinking in the UK and Australia. Though all 12 candidate factors provided to participants were included in the final summary diagrams of the data from both samples, a small subset of factors were most prominent in terms of their frequency and strength ratings. For the UK sample, three factors were viewed to be direct causes of binge drinking with high strength ratings and at least medium frequency: low cost of alcohol, drinking culture, peer pressure, and alcohol availability. Australian participants' perceived drinking culture and peer pressure to be the most frequently cited causes of binge drinking with high strength ratings.

Low cost of alcohol was viewed as a direct cause of binge drinking with medium-to-high frequency and importance ratings in both samples, although it was more frequently cited and had higher strength ratings among UK participants. This finding is important given the recent focus of the high affordability of alcohol as a key determinant of binge drinking [49, 50], and recently-proposed government policies aimed at tackling alcohol misuse and binge drinking by regulating the price of alcohol [20, 42]. Given that the UK has tabled legislation to promote changes in pricing policy in recent years such as minimum pricing, a policy that was unpopular with the general public [19, 21], it is unsurprising that this factor featured so prominently as a cause of binge drinking among UK participants. The debate has not been so prominent in Australia, despite extensive coverage of other aspects of hazardous drinking, which may explain the comparatively lower importance ratings. However, the fact that pricing was perceived to be a cause in the present sample indicates a generalized awareness of potential for price to affect hazardous drinking patterns. This reflects the modeling literature identifying the important role that alcohol price has on consumption and the likely effectiveness of pricing policies in curbing alcohol

consumption and reducing alcohol-related harm [49, 50]. However, the understanding alone may not be sufficient in persuading the general public to support pricing initiatives to curb alcohol consumption which have, hitherto, been received with scepticism and opposition [19]. Campaigns that highlight the salient benefits of pricing policies to aimed at reducing alcohol-related harm to the general public are required if support prior to legislation implementation is to be secured.

Peer pressure was viewed to be a direct cause of binge drinking with at least medium frequency in both samples. This finding mirrors research on the correlates of binge drinking which has identified peer influence as an important contributing factor to excessive alcohol consumption [51]. This has also been corroborated in previous research on the perceived causes of binge drinking in which peer pressure was identified as the most frequent perceived cause after boredom [18]. This is consistent with evidence that binge drinking and alcohol related tend to be more prevalent in younger drinkers, who may be more susceptible to peer pressure [10]. Peer influence has also featured prominently in reporting of binge drinking in young people in the popular media and social networks [52] and is predominantly viewed by the general public as a problem for young adults [18]. It is, therefore, understandable that peer pressure was viewed as a cause of binge drinking. In many cases, the consistency of participants' lay understanding of the causes of binge drinking and actual causes is likely to reflect 'meta-cognitive' beliefs regarding binge drinking, that is, binge drinkers demonstrate an awareness of the role that their peers play in influencing their own binge drinking. However, knowledge of peer influence alone may not be related to actual behavior change, consistent with research indicating that knowledge provision alone has null or small effects on behavior change [53].

Related to social pressure, 'drinking culture' was also perceived to be a cause binge drinking with high strength ratings and at least medium frequency in both samples. These perceptions are congruent with previous research identifying drinking culture, reflecting

strong normative values attached to alcohol consumption within a social group, as a consistent cause of binge drinking [38, 54]. The perceived link between cultural norms and excessive patterns of alcohol consumption, may have implications for policymakers and those developing interventions manage binge drinking by changing cultural norms around alcohol consumption [55, 56]. There may also be an element of self-protection involved in participants' identification of drinking culture as a major predictor of binge drinking. Efforts to change 'drinking cultures' may, therefore, need to focus on changing accepted patterns of drinking particularly in young people and fostering new or alternative norms that negate or compete with existing cultural norms [57]. Raising awareness of the need to tackle norms and a drinking culture may assist public 'buy in' to policies which may otherwise be viewed as undermining personal freedoms [19].

An advantage of the current network diagram method is that it offers an opportunity to study the perceived indirect causes of binge drinking, which might otherwise be overlooked when using traditional survey methods. Participants' network diagrams showed that low cost of alcohol was viewed as an indirect cause of binge drinking in the UK via supermarket discounts and alcohol availability. Other factors including supermarket discounts, alcohol advertising, income and the availability of alcohol were also perceived to be indirect causes of binge drinking via low cost of alcohol. For example, income was viewed as an indirect cause of binge drinking via low cost of alcohol, which illustrates that participants' understanding of the causes were consistent with research suggesting the disparity between the rate at which personal income and the price of alcohol have increased over time [41]. The availability of alcohol was also regarded as an indirect determinant of binge drinking with high strength ratings by participants in both samples. Just over half of the participants in the Australian and UK samples viewed alcohol availability as an indirect cause of binge drinking via supermarket discount and low cost of alcohol. This finding illustrates that availability is perceived to be a corollary of supermarket discounts and low

cost of alcohol. It is also consistent with previous research in which alcohol availability was frequently viewed as a cause of binge drinking [18], although the research did not elaborate on the perceived indirect causes. By contrast, 24-hour opening hours was only nominated as an indirect cause by a small minority of participants via availability. These factors are consistent with research that has identified cost and availability of alcohol as key determinants of excessive alcohol consumption, particularly in young people [8, 58, 59]. This is particularly important for policy makers as it seems that participants considered the increasing affordability of alcohol to be the most significant contributor to its growing availability, not extended opening hours. This is an issue in need of further investigation: whether actual and perceived causes of binge drinking align, as this will better inform policymakers' decisions regarding which issues are targeted in campaigns to foster general public support for initiatives to reduce the affordability of alcohol.

Limitations and directions for future research

A number of limitations of the current study should be noted. First, while the current network diagram method has advantages in examining consensus among participants' of their lay understanding of the causes of binge drinking, the paths identified should not be interpreted as data on actual causes based on population data and analysed using inferential statistics. Furthermore, the causal direction is inferred by the participants and should not be inferred as the true direction of the identified factors on binge drinking. The current data are intended to provide a summary of participants' lay understanding of the causes of binge drinking and provide formative evidence for policymakers in the development of campaigns and strategies to promote greater acceptability and justification for policy changes aimed at curbing alcohol consumption.

Second, the current sample was not recruited using a systematic or stratified sampling strategy and is not likely to be representative of the population. Like much research in this field, our sampling strategy may have resulted in affirmation bias in the

current data. In addition, rates of hazardous drinking reported by participants in the current study exceeded those reported in national statistics. This discrepancy was attributed to the higher proportion of young people in the sample relative to the general population, and further indicates the lack of representativeness of our sample. It is important, however, to recognize that younger people tend to be those who are more likely to engage in binge drinking. Findings from the current sample will, therefore, be highly pertinent to stakeholders interested in developing recommendations to curb binge drinking in groups most likely to benefit.

Finally, although we sourced the 12 causal factors used in the network diagram exercises from a synthesis of research on binge drinking causes the list of factors was not comprehensive. It is, therefore, possible that causes omitted from the list in current study may have been rated important by participants in the current study. For example, the current set of causes included only two causal factors that could be considered ‘internal’ or ‘personal’ causes: stress and boredom. Inclusion of other personal perceived causal factors such as ‘alcohol as coping’ may have been identified as important causes by the sample, which would have resulted in a different set of paths in participants’ causal diagrams.

Future research could investigate whether binge drinkers hold different network representations compared to those who drink very little or not at all, as research has shown that non-drinkers hold substantially different beliefs to regular drinkers. It would also be important to compare network diagrams of binge drinkers with those of emergency service providers (e.g., police, paramedics) and policymakers who are directly involved in efforts to manage and treat the outcomes of binge drinking and reduce its prevalence. It may also be important to examine whether individuals from different socioeconomic and age groups hold different views of the causes of binge drinking. Investigations of this kind would demonstrate whether people tend to hold largely similar beliefs about the causes of binge

drinking, or if these beliefs are determined by an individual's drinking habits, profession, and background.

Conclusions

The present research used a network diagram approach to investigate people's lay understanding of the causes of binge drinking in study participants from the UK and Australia. This approach allows for the identification of participants' perceived direct and indirect causes of binge drinking and the relative strength they assign to each cause. Summarising the frequency with which participants identified specific causal paths from a candidate set of causes and the medium strength ratings of the paths enabled us to develop an overall understanding of peoples' beliefs of the causes of binge drinking. Present findings suggest that the price of alcohol was most frequently cited by participants as a cause of binge drinking with high strength ratings in the UK. In contrast, drinking culture was perceived to be a cause of binge drinking in Australia, and received high strength ratings. However, drinking culture was also perceived to be the cause of binge drinking in the UK sample with high frequency, a key area of convergence in the diagrams of participants in both samples. In both cases, the causes of binge drinking mirror the findings of research on the correlates of binge drinking. Current findings suggest that public health policymakers in both national groups may consider focusing on alcohol price and drinking culture as the factors that need to be targeted in campaigns to promote acceptability and public 'buy in' to legislation and policies to curb excessive alcohol consumption.

Conflict of interest

The authors declare no conflict of interest.

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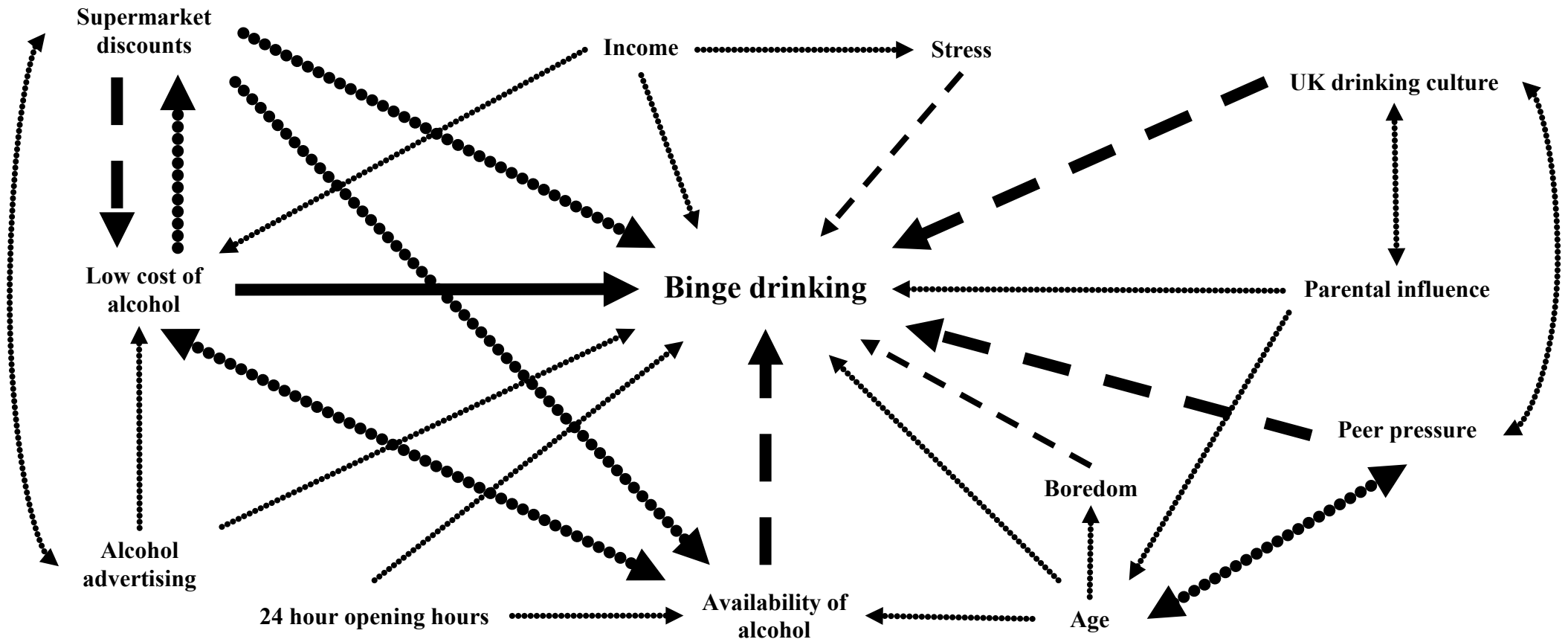
Table 1

Percentage of UK Participants Including Paths in Network Diagrams and Mean Strength of Paths in Network Diagrams for Binge Drinking

Source factor	Target factors ^a	Percentage including the path (n) ^b	Mean path strength (SD) ^c
Income	Binge drinking	28.57% (38)	66.58 (29.23)
	Low cost of alcohol	28.57% (38)	65.50 (25.05)
	Stress	10.53% (14)	59.64 (30.35)
Age	Peer pressure	28.57% (38)	75.42 (21.12)
	Binge drinking	34.59% (46)	66.09 (22.30)
	Availability of alcohol	10.53% (14)	62.50 (24.71)
	Boredom	14.29% (19)	61.58 (24.33)
Availability of alcohol	Binge drinking	53.38% (71)	79.08 (21.12)
	Low cost of alcohol	18.80% (25)	70.00 (20.21)
UK drinking culture	Binge drinking	48.12% (64)	77.50 (17.64)
	Peer pressure	17.29% (23)	56.52 (29.52)
	Parental influence	10.53% (14)	48.57(26.63)
Low cost of alcohol	Binge drinking	71.43% (95)	80.29 (20.92)
	Supermarket discounts	10.53% (14)	77.86 (26.44)
	Availability of alcohol	15.79% (21)	73.81 (20.73)
Alcohol advertising	Low cost of alcohol	15.79% (21)	64.29 (27.26)
	Binge drinking	18.80% (25)	61.64 (23.97)
	Supermarket discounts	15.04% (20)	55.75 (27.01)
Stress	Binge drinking	68.42% (91)	68.02 (22.71)
Peer pressure	Age	17.29% (23)	77.78 (20.56)
	Binge drinking	65.41% (87)	70.38 (19.04)
	UK drinking culture	12.03% (16)	69.06 (19.17)
Supermarket discounts	Availability of alcohol	16.54% (22)	79.09 (22.02)
	Binge drinking	34.59% (46)	75.54 (21.57)
	Low cost of alcohol	42.11% (56)	71.34 (25.68)
	Alcohol advertising	10.53% (14)	63.21 (33.49)
Parental influence	UK drinking culture	12.78% (17)	64.18 (23.04)
	Binge drinking	27.82% (37)	62.97 (27.97)
	Age	15.04% (20)	54.00 (25.83)
24 hour opening hours at points of sale	Binge drinking	33.08% (44)	68.52 (26.44)
	Availability of alcohol	16.54% (22)	64.32 (26.96)
Boredom	Binge drinking	48.87% (65)	59.94 (22.84)

Note. ^aFactors listed in order of descending mean path strength; ^bFor inclusion, paths had to be nominated as a cause by at least 10% of participants; ^cMean path strength between a factor and binge drinking was calculated by summing all relevant paths for that factor [28].

Figure 1. Composite network diagram for the UK sample.



KEY:

	High	Sample proportion ^a	Low
High			
Medium			
Low			

Note. ^aProportion of the sample that included the path in their diagram, classified into high (70% to 100% of the sample), medium (40% to 69%), low (10% to 39%) categories; ^bAverage of participants' strength ratings for the causal path on a scale

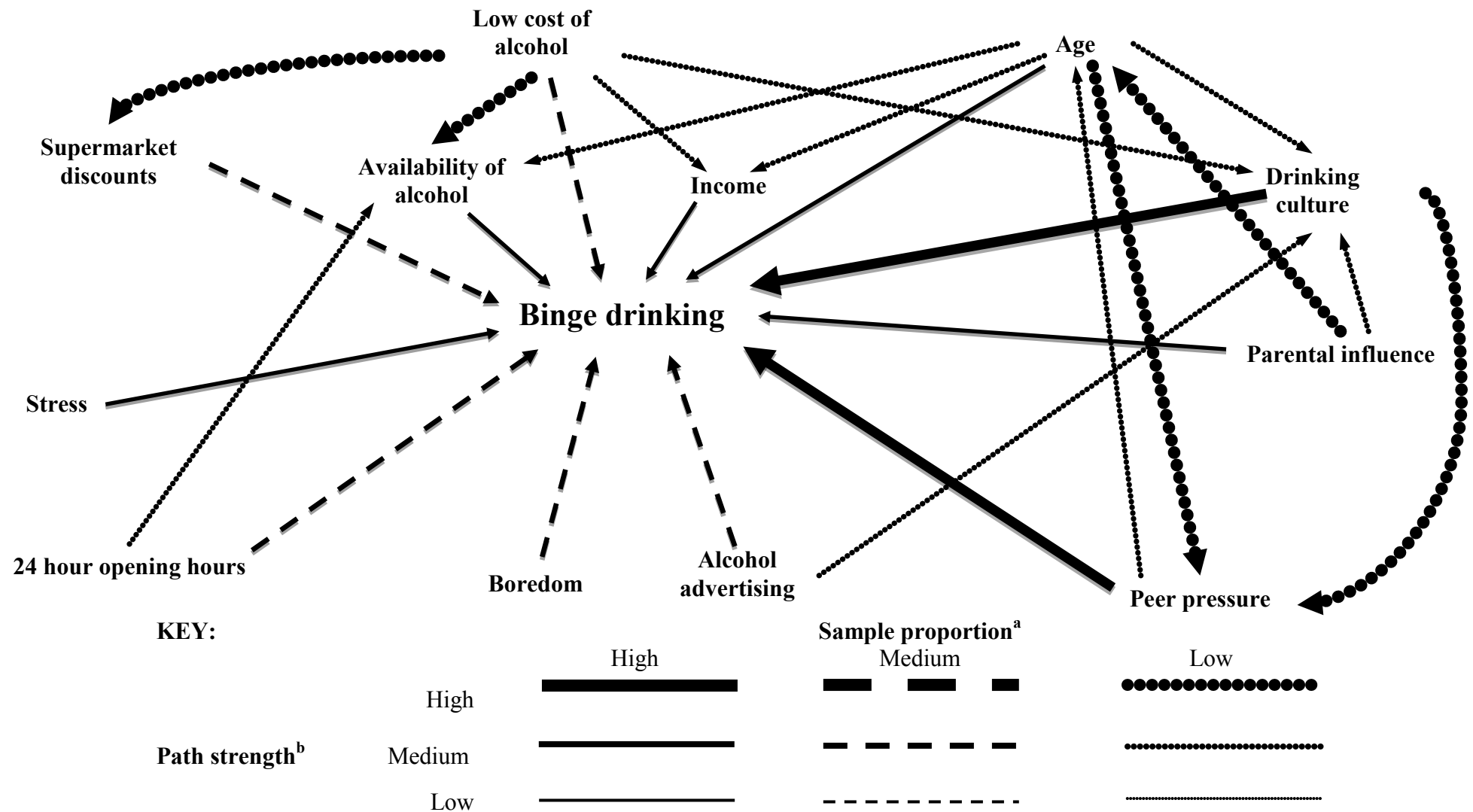
from 0 (not a causal factor at all) to 100 (factor completely causes binge drinking) classified into high (paths with an average strength rating of 70 or greater), medium (paths with average strength ratings between 40 and 69), and low (paths with average strength ratings between 10 and 39) categories.

Table 2

Percentage of Australian Participants Including Paths in Network Diagrams and Mean Strength of Paths in Network for Binge Drinking

Source factor	Target factors ^a	Percentage including the path (<i>n</i>) ^b	Mean path strength (<i>SD</i>) ^c
Income	Binge drinking	69.61% (72)	50.21 (27.08)
Age	Peer pressure	18.63% (19)	71.84 (19.80)
	Drinking culture	19.60% (20)	66.84 (24.96)
	Income	11.76% (12)	65.41 (30.60)
	Binge drinking	80.39% (82)	64.39 (26.02)
	Availability of alcohol	10.78% (11)	51.82 (18.34)
Availability of alcohol	Binge drinking	73.57% (73)	61.16 (27.05)
Drinking culture	Binge drinking	89.21% (91)	81.48 (17.18)
	Peer Pressure	18.63% (19)	74.47 (21.91)
Low cost of alcohol	Supermarket discounts	16.67% (17)	74.71 (20.65)
	Availability	10.78% (11)	74.44 (24.55)
	Drinking culture	10.78% (11)	67.22 (15.63)
	Binge drinking	65.69% (67)	59.48 (25.67)
	Income	18.63% (19)	57.89 (23.94)
Alcohol advertising	Drinking culture	10.78% (11)	59.44 (27.89)
	Binge drinking	53.92% (55)	53.21 (26.82)
Stress	Binge drinking	77.45% (79)	60.09 (23.28)
Peer pressure	Binge drinking	83.34% (85)	74.84 (22.72)
	Age	10.78% (11)	64.50 (28.91)
Supermarket discounts	Binge drinking	42.16% (43)	44.53 (23.57)
Parental influence	Age	10.78% (11)	74.00 (29.14)
	Drinking culture	16.67% (17)	63.33 (26.90)
	Binge drinking	72.54% (74)	59.26 (26.34)
24 hour opening hours	Binge drinking	45.10% (46)	42.83 (28.00)
	Availability of alcohol	14.73% (14)	42.14 (22.16)
Boredom	Binge drinking	57.83% (59)	40.92 (26.99)

Note. ^aFactors listed in order of descending mean path strength; ^bFor inclusion, paths had to be nominated by at least 10% of participants; ^cMean path strength between a factor and binge drinking was calculated by summing all relevant paths for that factor [28].



Note. ^aProportion of the sample that included the path in their diagram, classified into high (70% to 100% of the sample), medium (40% to 69%), low (10% to 39%) categories; ^bAverage of participants' strength ratings for the causal path on a scale from 0 (not a causal factor at all) to 100 (factor completely causes binge drinking) classified into high (paths with an average

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strength rating of 70 or greater), medium (paths with average strength ratings between 40 and 69), and low (paths with average strength ratings between 10 and 39) categories.