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Comparison between the WHO and NIAAA criteria for binge drinking on drinking features and alcohol-related aftermaths: Results from a cross-sectional study among eight emergency wards in France

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ABSTRACT

Background: Binge drinking (BD) consists of heavy episodic alcohol use. Whereas the World Health Organization (WHO) defines BD as 60 g of alcohol or more per occasion, the National Institute on Alcoholism and Alcohol Abuse (NIAAA) conceives BD as drinking 70 g (men) or 56 g (women) in less than two hours. We compared the subjects delineated by each definition.

Methods: Eight-center cross-sectional study among 11,695 subjects hospitalized in emergency wards. Participants completed the Alcohol Use Disorders Identification Test – Consumption (AUDIT-C), CAGE and Rapid Alcohol Problem Screen 4 (RAPS4-QF) questionnaires. The WHO criteria were investigated using the RAPS4-QF. Independent questions assessed the NIAAA criteria. The main medical admission motive was noted. The characteristics of subjects meeting respectively: 1) the exclusive WHO criteria (BD1); 2) the NIAAA criteria (BD2); and 3) no BD criteria (noBD) were compared using multinomial regression analyses. Binary age- and gender-adjusted regression analyses directly compared BD1 and BD2. Subjects with at least four drinking occasions per week were excluded from the analyses, to withdrawn regular heavy drinking.

Results: Compared to BD1, BD2 subjects were more frequently males (OR = 1.67 [1.39–2.0]), single (aOR = 1.64 [1.36–1.98]) and unemployed (aOR = 1.57 [1.27–1.90]). BD2 reported significantly more drinks per occasion, and higher heavy drinking frequencies. Previous alcohol-related remarks from family (aOR = 3.00 [2.53–3.56]), ever drinking on waking-up (aOR = 2.05 [1.37–2.72]), and admission for psychiatric motive (aOR = 2.27 [1.68–3.07]) were more frequent among BD2 subjects.

Conclusions: Compared to WHO criteria, NIAAA criteria for BD delineate subjects with more concerning drinking patterns and alcohol aftermaths.

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1. Introduction

Binge drinking (BD) is defined by the World Health Organization (WHO) as heavy episodic alcohol use (World Health Organization, 2014). Though subjects with BD only occasionally meet the criteria for characterized alcohol use disorders, they are significantly more at risk to subsequently develop such disorders (Jefferis et al., 2005; McCarty et al., 2004), and they are also more exposed to a large array of immediate or further social or medical consequences, such as physical injuries, violence, risky or unwanted sexual activity, depression or suicide (Behnkten et al., 2010; Schuler et al., 2015; Townsend et al., 2014; Wilkinson et al., 2016). Such consequences warrant scientific investigations into BD, with the objective to better understand its social, psychological and biological underlying mechanisms, and to develop relevant prevention and treatment health policies.

However, there has been an important debate in the scientific world about how BD should be exactly defined. The most commonly used definitions of BD are based on drinking thresholds. For example, the WHO has retained the cut-off of six WHO standard-drinks (i.e., 60 g of alcohol) or more per occasion to define heavy episodic drinking (World Health Organization, 2014). Alternatively, the National Institute on Alcoholism and Alcohol Abuse (NIAAA) defines BD as “a pattern of drinking that brings blood alcohol concentration (BAC) levels to 0.08 g/dL, [which] typically occurs after 4 [American] drinks [i.e., 56 g of alcohol] for women and 5 [American] drinks [i.e., 70 g of alcohol] for men—in about 2 h” (National Institute on Alcohol Abuse and Alcoholism (NIAAA), 2016). The nuance is meaningful, as the NIAAA cut-offs comprise a minimum drinking speed. Introducing the notion of drinking rapidity into the BD definition more specifically targets a profile of subjects who are eager to drink and to become drunk.

It is thus likely that the two types of BD definitions, namely those based only on the number of drinks per occasion on the one hand, and those based on a drinking threshold plus a minimum drinking speed on the other, do not delineate the same types of profiles. In particular, it may by hypothesized that these two BD populations significantly differ in terms of drinking frequencies, usual drinking amounts, frequency of heavy drinking, and alcohol-related aftermaths. It is important to highlight and to correctly address these specific alcohol-related parameters, depending on which BD definition is used. Otherwise, unclear or even contradictory findings would lead to erroneous messages on BD to the lay public and policymakers. Despite this, no previous study has ever compared the populations defined according to these two conceptual approaches of BD.

In a large-sample cross-sectional study conducted in eight emergency wards of the Auvergne – Rhône-Alpes, France, we compared – between BD subjects defined according to the NIAAA criteria, and BD subjects defined exclusively according to the WHO criteria – some aspects of the drinking patterns, alcohol-related aftermaths, and main medical causes for admission to the hospital. The reporting of the study is performed according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement (von Elm et al., 2007) (see the Supplemental material 1).

2. Materials & methods

2.1. Type of study

This was a cross-sectional study conducted among subjects recruited in the emergency wards of eight public hospitals in the Auvergne – Rhône-Alpes region, France, between 2012 and 2013. The total recruitment period was one month for each center, which led to 11,695 the final number of included subjects. For more details, the complete study protocol can be found elsewhere (De Chazeron et al., 2015).

2.2. Participants and data collected

Every subject aged 13 or more and hospitalized in the emergency ward was proposed to participate in the study. The only exclusion criterion was prior participation in the study.

Respondents completed an anonymous questionnaire that collected their age, gender, professional status, and education level. Drinking patterns were explored using the Alcohol Use Disorders Identification Test – Consumption questions (AUDIT-C; (Bush et al., 1998)), “Cut down – Annoyed – Guilty – Eye-opener” questionnaire (CAGE; (Ewing, 1984), and Rapid Alcohol Problems Screen 4 – Quantity and Frequency (RAPS4-QF; (Cherpitel, 2002)). Participants were also asked the following two questions: 1) “On average, do you drink more than 15 drinks (10 drinks for women) per week?”, and 2) “Over the last two months, have you ever drunk five (four for women) drinks or more, in less than two hours?”. The 15/10 sd weekly thresholds are the criteria for chronic alcohol misuse, according to the French Alcohol Society (French Alcohol Society, 2015). The ‘drink’ used herein was the American standard-drink (sd), i.e., 14 g of ethanol per sd. A short leaflet was provided to participants, which explained how many sds contained different volumes of the main types of alcoholic beverages. Last, the main reason for medical admission to the emergency ward was systematically noted by an emergency physician according to the ICD-10-CM, and subsequently categorized into: 1) physical: accident, injury, fall, aggression, or blood or sexual exposure; 2) behavioral: acute alcohol or drug intoxication or psychiatric disorder, and 3) other.

2.3. Group definitions

In order to exclude subjects with regular heavy drinking from the analyses, the participants who declared a drinking frequency of four times per week or more (the AUDIT-C) were excluded from the study sample.

A first group of BD was defined according to the response to the question “Over the last two months, have you ever drunk five (four for women) drinks or more, in less than two hours?”. The subjects who positively responded to this question were categorized as the BD2 group. A second group of subjects was defined according to the response to the RAPS4-Q question “During the last year have you had five or more drinks on at least one occasion?”. The subjects who positively respond to this question, but negatively respond to the previous question with regard to the NIAAA definition were categorized as the BD1 group. Lastly, the subjects who negatively responded to both questions were categorized as the noBD group. As a result, the BD1 and BD2 groups were reciprocally exclusive. It is important to remind that the sds used in the survey were the American sds. Therefore, the cut-off used for the WHO definition was 70 g and not 60 g of alcohol, because it was not possible to assess a 60 g use of alcohol using American sds. The 15/10 sd weekly thresholds are the criteria for chronic alcohol misuse, according to the American sds. This point is addressed in the discussion section of the article.

2.4. Statistical analyses

Descriptive analyses are presented as both the mean ± standard deviation (m ± SD) and the median and interquartile range (med; [IQR]) for quantitative variables, and percentage (%) for categorical variables. Bivariable analyses compared the different parameters detailed above according to the BD group. Comparisons of quantitative parameters were undertaken using Kruskal–Wallis tests, while categorical parameters were compared using chi-squared tests. Moreover, using bivariable multinomial logistic regression models, between-group comparisons were performed for age, gender, individual questions of the AUDIT-C, CAGE, and RAPS4-QF questionnaires, and main admission reason. Unadjusted odds-ratios are presented with their 95% confidence interval (OR; 95%CI). Lastly, gender- and age-adjusted logistic regression models were performed to compare the BD1 and BD2 groups. All the analyses were undertaken using the XLISTAT2014.
After exclusion of the participants with a drinking frequency of four occasions per week or more (n = 2048), and those with insufficient collected material or aberrant responses (n = 122), the data of 9525 subjects were finally included in the analyses. Of these, 6657 were categorized as noBD, 1826 as BD1, and 1042 as BD2. The group constitution chart is given in Fig. 1.

In the BD2 group, 73 subjects (7.0%) did not positively answer the RAPS-Q question. These subjects were all women who met the NIAAA criteria for BD (at least one drinking episode of four American sds, i.e., 56 g of alcohol, in less than two hours during the two previous months) but reported a maximum drinking level below 70 g during the previous years. Other subjects of the BD2 group met both the WHO and NIAAA criteria for BD. The overall descriptive statistics of the different groups, and the simple bivariable comparisons, are shown in Table 1.

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Descriptive statistics of the study sample and bivariate comparisons showing the sociodemographic and drinking characteristics of subjects meeting, respectively, the exclusive WHO criteria (BD1) or the NIAAA criteria (BD2) for binge drinking, and subjects with no binge drinking (noBD).</strong></td>
</tr>
<tr>
<td>****</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Gender (% females)</td>
</tr>
<tr>
<td>Marital status</td>
</tr>
<tr>
<td>Educational status</td>
</tr>
<tr>
<td>Occupational status</td>
</tr>
<tr>
<td>Drinking frequency * (AUDIT-C)</td>
</tr>
<tr>
<td>Average drinks per occasion (AUDIT-C)</td>
</tr>
<tr>
<td>HDD Frequency (AUDIT-C)</td>
</tr>
<tr>
<td>Average drinking &gt; 15/10 sds per week (% Yes)</td>
</tr>
<tr>
<td>Positive CAGE questionnaire (% Yes)</td>
</tr>
<tr>
<td>RAPS4 Questionnaire</td>
</tr>
</tbody>
</table>

(continued on next page)
The analyses were performed using the data obtained from an 11,695-subject multicenter cross-sectional study conducted among patients hospitalized in emergency wards. Subjects reporting ≥4 drinking episodes per week (n = 2048), and those with insufficient collected material or aberrant responses (n = 122), were excluded from the analyses, using the AUDIT-C question on the drinking frequency. This procedure aimed to exclude subjects with regular heavy drinking from the regression models. By-variability comparisons were performed using Kruskal-Wallis or chi-squared tests (sub-groups with 0% were excluded from the chi-squared tests). All p-values were p < 0.0001. Abbreviations: m: mean, SD: standard deviation, med: median, IQR: interquartile range, sd: American standard-drink (i.e., 14 g of ethanol), UPE: uncompleted primary education, USE: uncompleted secondary education, CSE: completed secondary education, AUDIT-C: Alcohol Use Disorder Identification Test – Consumption (Bush et al., 1998), HDD: Heavy Drinking Days (i.e., 6 or more per drinking occasion), CAGE: ‘Cut-down – Annoyed – Guilty – Eye-opener’ questionnaire (Ewing, 1984), RAPS4: ‘Remorse – Amnesia – Performance – Starter’ questionnaire (Cherpitel, 2002), WHO: World Health Organization, NIAAA: National Institute on Alcoholism and Alcohol Abuse.

Table 1 (continued)

<table>
<thead>
<tr>
<th></th>
<th>NoBD</th>
<th>BD1</th>
<th>BD2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 6657</td>
<td>n = 1826</td>
<td>n = 1042</td>
</tr>
<tr>
<td>Ever alcohol use on waking-up (%Yes)</td>
<td>0.2%</td>
<td>1.5%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Main reason for medical admission to emergency ward n = 9437</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– physical (injury, fall, ...</td>
<td>33.2%</td>
<td>47.5%</td>
<td>51.7%</td>
</tr>
<tr>
<td>– behavioral (psychiatric, drunkenness, ...)</td>
<td>5.3%</td>
<td>5.8%</td>
<td>10.1%</td>
</tr>
<tr>
<td>– others</td>
<td>61.5%</td>
<td>46.7%</td>
<td>38.2%</td>
</tr>
</tbody>
</table>

3.2. Three-group comparisons using bivariate multinomial logistic regression models

The results of the bivariate multinomial logistic regression models can be found in Table 2. Overall, compared to the noBD group, subjects of the BD1 and BD2 groups displayed significantly younger ages and increased male rates, and were more frequently single and less frequently separated or widowed. BD1, and BD2 to a much greater extent, showed higher numbers of drinks per occasion, greater frequency of heavy drinking days, higher rates of chronic alcohol misuse and positive CAGE questionnaire, and more frequent alcohol-related after-maths. Lastly, BD1, and BD2 to a greater extent, showed significantly more frequent admissions to the emergency ward due to physical or behavioral causes.

Table 2

<table>
<thead>
<tr>
<th></th>
<th>BD1</th>
<th>BD2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>[95%CI]</td>
</tr>
<tr>
<td>Age (for each 10-year increase)</td>
<td>0.48 [0.48-0.48]</td>
<td>0.47 [0.47-0.47]</td>
</tr>
<tr>
<td>Gender (male vs. female)</td>
<td>3.33 [2.90-3.67]</td>
<td>3.22 [2.81-3.72]</td>
</tr>
<tr>
<td>Being under18 (Yes vs. No)</td>
<td>0.82 [0.62-1.09] a</td>
<td>2.18 [1.71-2.79]</td>
</tr>
<tr>
<td>Marital status (vs. having a partner)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– separated/divorced/widowed</td>
<td>0.44 [0.36-0.53]</td>
<td>0.57 [0.44-0.76]</td>
</tr>
<tr>
<td>Educational status (vs. UPE)</td>
<td>2.89 [2.42-3.43]</td>
<td>2.60 [1.98-3.11]</td>
</tr>
<tr>
<td>Occupational status (vs. active)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– unemployed</td>
<td>1.43 [1.26-1.62]</td>
<td>0.89 [0.76-0.99] b</td>
</tr>
<tr>
<td>– retired</td>
<td>0.17 [0.14-0.21]</td>
<td>0.05 [0.03-0.07]</td>
</tr>
<tr>
<td>Average drinks per occasion (vs. 1 or 2 sd)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– 3 or 4 xds</td>
<td>10.51 [9.13-12.09]</td>
<td>15.84 [13.05-19.23]</td>
</tr>
<tr>
<td>– 5 or 6 xds</td>
<td>63.65 [44.66-90.71]</td>
<td>166.80 [114.9-242.3]</td>
</tr>
<tr>
<td>– 7-9 xds</td>
<td>56.89 [29.24-110.9]</td>
<td>335.60 [174.2-646.2]</td>
</tr>
<tr>
<td>– 10 or more xds</td>
<td>66.59 [30.31-146.3]</td>
<td>472.20 [218.4-1020.9]</td>
</tr>
<tr>
<td>Average drinking &gt; 15/100 sds per week (Yes vs. No)</td>
<td>6.62 [4.29-10.23]</td>
<td>20.69 [13.82-30.96]</td>
</tr>
<tr>
<td>RAPS4 questionnaire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– previous guilt or remorse</td>
<td>10.28 [8.53-12.40]</td>
<td>18.91 [15.52-23.05]</td>
</tr>
<tr>
<td>– previous reasons from family</td>
<td>20.86 [16.35-26.61]</td>
<td>64.08 [50.03-82.09]</td>
</tr>
<tr>
<td>– ever alcohol use on waking-up</td>
<td>9.96 [5.95-20.05]</td>
<td>17.69 [8.78-35.64]</td>
</tr>
<tr>
<td>Main reason for medical admission (vs. other cause)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– physical (injury, fall, aggression, ...)</td>
<td>1.88 [1.70-2.10]</td>
<td>2.51 [2.18-2.88]</td>
</tr>
<tr>
<td>– behavioral (psychiatric, drunkenness, ...)</td>
<td>1.44 [1.15-1.81] c</td>
<td>3.06 [2.41-3.88]</td>
</tr>
</tbody>
</table>

The analyses were performed using the data obtained from an 11,695-subject multicenter cross-sectional study conducted among patients hospitalized in emergency wards. Subjects reporting ≥4 drinking episodes per week (n = 2048), and those with insufficient collected material or aberrant responses (n = 122), were excluded from the analyses, using the AUDIT-C questionnaire. This procedure aimed to exclude subjects with regular heavy drinking from the regression models. The ORs presented herein are unadjusted.


All p-values are p < 0.0001 except for a (p = 0.163); b (p = 0.035); c (p = 0.002); subjects (aOR = 1.57; 95%CI = 1.27–1.90; p < 0.0001).

Overall, the drinking frequencies were significantly increased in BD2 subjects, and the number of average drinks per drinking occasion was much greater in this group. Using an average number of drinks of 1 or 2 per drinking occasion as the reference, BD2 subjects exhibited much more frequently than BD1 subjects an average number of drinks of 7–9 (aOR = 5.38; 95%CI = 4.64–9.21; p < 0.0001) or even 10 drinks or more (aOR = 6.53; 95%CI = 4.63–9.21; p < 0.0001). BD2 subjects...
more frequently met the criteria for chronic alcohol misuse, i.e., an average weekly drinking above 15/10 drinks per week (aOR = 5.25; 95%CI = 3.13–7.33; p < 0.0001). BD2 subjects were significantly more likely to be associated with a positive CAGE screening, i.e., at least two positive answers (aOR = 2.09; 95%CI = 1.75–2.50; p < 0.0001).

According to the RAPS4 questionnaire, BD2 subjects also reported more frequent alcohol-related guilt or remorse (aOR = 1.83; 95%CI = 1.54–2.18; p < 0.0001), alcohol-related remarks from family or close relatives (aOR = 3.00; 95%CI = 2.53–3.56; p < 0.0001), alcohol-induced failure to do what was expected (aOR = 2.49; 95%CI = 1.92–3.24; p < 0.0001), and ever drinking alcohol on waking-up (aOR = 2.05; 95%CI = 1.14–2.72; p < 0.0001). Last, BD2 subjects were more frequently admitted to the emergency wards for physical (aOR = 1.34; 95%CI = 1.14–1.58; p = 0.001) and behavioral/psychiatric (aOR = 2.27; 95%CI = 1.68–3.07; p < 0.0001) reasons, compared to BD1 subjects.

### 4. Discussion

The main objective of the study was to compare the socio-demo-graphic and drinking characteristics of subjects with exclusive WHO criteria for BD (BD1 group), subjects with NIAAA + WHO criteria for BD (BD2 group), and subjects with no criteria for BD.

Regarding comparisons with the noBD group, our results are in line with the findings of previous studies performed, especially those conducted at emergency departments. BD was associated with younger age, increased rates of male subjects, and increased rates of subjects with psychiatric disorders (Adam et al., 2016; Trillo et al., 2012). Moreover, BD2 vs. BD1 comparisons provided new and important findings. To our knowledge, the study is the first to compare two different epidemiological definitions of BD, with regard to the drinking features and BD repercussions. Overall, we found that BD2 subjects (NIAAA + WHO criteria) did not only differ from BD1 subjects (exclusive WHO definition) on mere drinking speed. They also exhibited much more important drinking frequencies, average drinking levels, and frequencies of heavy-drinking days. They showed a generalized increase in all alcohol-related aftereffects, including alcohol-related remarks by family, impact of alcohol on the ability to do what is expected, and rates of ever drinking alcohol on waking-up. Lastly, BD2 subjects were more frequently hospitalized in the emergency ward for behavioral or psychiatric reasons. Though these findings have some limitations, which are addressed below, they suggest that the NIAAA definition of BD delimits a population of subjects with significantly more vulnerability factors and alcohol-induced repercussions, compared to those defined according to the WHO criteria. More specifically, our results underscore that there was an overall severity gradient between noBD, BD1, and BD2 subjects.

The validity of using drinking thresholds as the sole definition criteria for BD has been recently questioned (Pearson et al., 2016). Our findings suggest that the WHO criteria are actually very broad and inclusive, and may categorize as binge drinkers a significant proportion of subjects with limited vulnerability factors and alcohol-induced aftereffects. As previously suggested (Havard, 2016), but to our knowledge never previously shown, this inclusive feature of the WHO definition could alter the quality and relevance of the scientific findings generated based on these criteria. This suggests that, the more a definition of BD is focused and restrictive, the more it is able to delineate a population of subjects with associated vulnerability features and actual aftereffects. For this reason, some researchers have recently proposed that the definition of BD should go beyond the mere drinking thresholds, and focus on the concrete impact of alcohol use on individuals (Andreason, 2016; Luquiens et al., 2016; Read et al., 2008; Rolland and Naassila, 2017). This might target the most vulnerable subjects and possibly increase the response to brief interventions.

The study and its main findings have some limitations that should be acknowledged. First, it can be questioned why we chose to exclude regular drinkers from the analyses. In most of the studies on BD, this subgroup is not excluded. However, with respect to the very conception of BD, i.e., ‘episodic heavy use of alcohol’, we believe that including subjects with daily or almost-daily heavy use of alcohol is a major source of confusion regarding the investigations on BD. A second limitation of the study is the assessment of recent alcohol drinking patterns. Using an exhaustive assessment method, such as the alcohol timeline follow-back (Sobell and Sobell, 1992), would have collected a more precise information. However, this would also have been much more time consuming, and could have thus reduced the number of participants in the study. Another limitation that appears more concerning is the constitution the BD1 and BD2 definitions. First, by definition, most of the subjects who met the NIAAA criteria also met the WHO criteria. Though BD1 and BD2 groups were reciprocally exclusive,
comparing these groups was not a direct comparison between the WHO vs. NIAAA subjects, but more a comparison between the exclusive WHO vs. WHO + NIAAA subjects. Our findings support the statement that including drinking speed criteria in the definition of BD more precisely delineates subjects with enhanced severity criteria (Courtney and Polich, 2009).

Another point is that, whereas the BD1 group was defined based on the previous year’s alcohol use, the BD2 group definition was based according to the drinking patterns during the previous two months. This may have artificially selected, in the BD2 group, subjects with more frequent periods of heavy alcohol use, or subjects whose maximum drinking period was more recent than in the BD1 group. In this case, some of the comparisons may have been significantly skewed. This is especially the case for the medical reasons for admission to the emergency wards. If the period of maximum alcohol drinking was more recent in the BD2 group, this could in part explain why the admission for behavioral reasons were more frequent in this group. Consequently, this particular result should be interpreted in the light of this limitation.

However, for other BD2 vs. BD1 comparisons, we believe that the time gap in the two group definitions had no impact on the findings, as the questions of the AUDIT-C and RAPS-QF questions deal with the alcohol drinking patterns of the previous year, whatever was the period of maximum drinking levels during this year. Similarly, the CAGE and RAPS4 questions do not include any time restriction, and deal with lifelong alcohol-related afterwards. Another limitation of the study was the slight gap between the official cut-off for the WHO definition of heavy drinking (i.e., six WHO sds or more, which makes 60 g of alcohol), and the cut-off used in the study (i.e., five American sds or more, which makes 70 g of alcohol). We acknowledge that this gap has excluded some subjects from the BD1 group. However, the explicative leaflet used by the participants could only be based on a single sd definition. The 60 g cut-off corresponded to 4.28 American sds, which was an impossible number to use in self-reports. The discrepancy between the WHO and American definitions of sd required to approximate either the WHO or the NIAAA drinking thresholds for BD.

Another limitation is the entirely self-report dimension of the data analyzed. This limitation is well known with regard to investigations into BD, and objective measures such as the blood alcohol concentrations are known to strengthen the thoroughness of both data and conclusions (Andreasson, 2016). However, collecting such objective measures is hard to implement in studies with very large samples. Last, the study was undertaken in emergency rooms, and extrapolating its main results to other populations should be considered with some caution.

In conclusion, our study points out that, depending which definition of BD is used, the resulting samples may largely differ in terms of underlying drinking patterns, associated vulnerability factors, including possible psychiatric comorbidities, and overall alcohol-induced afterwards. This underscores the importance of systematically specifying which BD definition has been used in a given study, to better appraise the nature of the sample that was investigated. This precaution is warranted for original research, and even more so for literature reviews and meta-analyses.

Contributors

Georges Brousse and Ingrid de Chazeron designed the study protocol.
Georges Brousse was the grant holder.
Ingrid de Chazeron, Françoise Carpenter, Fares Moustafa; Alain Viallon, Xavier Jacob; Patrick Lesage, Julie Geneste, Delphine Ragone, Annick Genty, and Georges Brousse collected the data.
Benjamin Rolland and Mickaël Naassila analyzed the data.
Benjamin Rolland, Georges Brousse, Ingrid de Chazeron, and Mickaël Naassila wrote the first draft of the manuscript.
All authors have read and approved the final version of the manuscript.

Role of funding source

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Conflicts of interest

Benjamin Rolland received lecture or expert fees from Ethypharm, Lundbeck, Indivior, Bouchara-Recordati, Gilead, AstraZeneca, Bristol-Myers-Squibb, Otsuka, and Servier. Maurice Dematteis has received sponsorship to attend scientific meetings, speaker honoraria, and consultancy fees from Lundbeck, Ethypharm, Indivior, Merck-Serono, and Bouchara-Recordati. Georges Brousse has received sponsorship to attend scientific meetings, speaker honoraria, and consultancy fees from Lundbeck and Merck-Lipha. Other authors report no conflict of interest related with the content of the article.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.drugalcdep.2017.01.034.

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