ORIGINAL ARTICLE

Assessment of alcoholic standard drinks using the Munich composite international diagnostic interview (M-CIDI): An evaluation and subsequent revision

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Abstract

The quantity and frequency of alcohol consumption are crucial both in risk assessment as well as epidemiological and clinical research. Using the Munich Composite International Diagnostic Interview (M-CIDI), drinking amounts have been assessed in numerous large-scale studies. However, the accuracy of this assessment has rarely been evaluated. This study evaluates the relevance of drink categories and pouring sizes, and the factors used to convert actual drinks into standard drinks. We compare the M-CIDI to alternative drink assessment instruments and empirically validate drink categories using a general population sample ($n = 3165$ from Germany), primary care samples ($n = 322$ from Italy, $n = 1189$ from Germany), and a non-representative set of $k = 22503$ alcoholic beverages sold in Germany in 2010–2016. The M-CIDI supplement sheet displays more categories than other instruments (AUDIT, TLFB, WHO-CIDI). Beer, wine, and spirits represent the most prevalent categories in the samples. The suggested standard drink conversion factors were inconsistent for different pouring sizes of the same drink and, to a smaller extent, across drink categories. For the use in Germany and Italy, we propose the limiting of drink categories and pouring sizes, and a revision of the proposed standard drinks. We further suggest corresponding examinations and revisions in other cultures.

KEYWORDS

alcohol content, drink categories, drinking amounts, standard drinks, standardized assessment

1 | INTRODUCTION

Alcohol use is an important component cause for mortality and disability (Shield, Parry, & Rehm, 2013; World Health Organization

[WHO], 2014). More specifically, dose–response relationships have been found between ethanol intake and a number of conditions including liver cirrhosis (Rehm et al., 2010b), various forms of cancer (Shield et al., 2013), blood pressure (Taylor et al., 2009), and alcohol use disorders (AUDs) (WHO, 2014). Thus, monitoring drinking levels is necessary in health care settings but also in epidemiological studies, where individual data are triangulated

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with adult per capita alcohol consumption as a basis to estimate alcohol-attributable burden (Poznyak et al., 2013; Rehm et al., 2010a; WHO, 2014).

A precise assessment of individual drinking levels is, however, complicated by the following biases: First, self-reported drinking behavior is often distorted by memory bias and/or intentional underreporting (Greenfield & Kerr, 2008). Second, many respondents lack knowledge of a method that allows them to summarize several drinks of different sizes and alcohol concentrations. Standard drinks have been introduced as a uniform measure for alcoholic drinks, however, their definition varies considerably between countries and situations (Gmel & Rehm, 2004; Kerr & Stockwell, 2012; Mongan & Long, 2015).

Most instruments assessing alcohol intake and/or related problems make use of standard drinks, including two of the three most frequently employed instruments in larger European surveys (Sierosławski, Foster, & Moskalewicz, 2013): the Alcohol Use Disorder Identification Test (AUDIT) (Babor et al., 2001) and the Munich Composite International Diagnostic Interview (M-CIDI) (Lachner et al., 1998; Sierosławski et al., 2013). The AUDIT is a brief instrument to screen for AUDs and its diagnostic validity is mainly determined by respondents' consumption patterns (Bush et al., 1998). The M-CIDI is an extensive interview to diagnose mental disorders. The assessment of drinking levels mainly serves as a filter question for the AUD section since drinking levels are not part of any formal diagnosis. Both instruments make use of the quantity–frequency method, which is the most frequently used method for measuring alcohol consumption (Gmel & Rehm, 2004; Sierosławski et al., 2013). Following this approach, drinking levels are calculated by combining the number of usual drinking days (frequency) with the number of standard drinks the respondent had on these occasions (quantity). The quantity–frequency method is largely standardized, i.e. very similar questions are used by different instruments to determine quantity and frequency. The method presupposes the correct conversion of drinking amounts into standard drinks by the respondents. However, this is problematic because many individuals cannot gauge their alcohol intake correctly and are not familiar with the standard drink concept (Kerr & Stockwell, 2012). This may lead to a considerable distortion when converting actual drinks into standard drinks. Therefore, some instruments try to facilitate the conversion by giving an explicit illustration of standard drinks for lay people, e.g. a simple description of how actual drinks are converted into standard drinks.

The AUDIT was originally published without an illustration of standard drinks (Babor et al., 2001), which has resulted in various versions being developed around the world, each containing a different illustration for the respective target population. In the M-CIDI, a standard supplementary sheet illustrating standard drinks has been published, but has never been evaluated.

In this work, we aimed at evaluating the supplementary sheet of the M-CIDI standard drink assessment by identifying flaws and potentials in the current practice. We evaluated (1) the relevance of drink categories, i.e. drink categories and their sizes, and (2) the factors used to convert actual drinks into standard drinks. Based on this evaluation, a revision of the standard drink assessment was developed.

2 | METHODS

2.1 | Description of the M-CIDI standard drink assessment

The M-CIDI is a standardized interview used to determine DSM-IV and ICD-10 diagnoses (Wittchen, Perkonig, Lachner, & Nelson, 1998). It was developed by modifying the WHO-CIDI (WHO, 1993) and has been used in many larger epidemiological studies, predominately in German settings (e.g. Jacobi et al., 2014; Rehm et al., 2015; Wittchen et al., 1998).

The standard drink assessment in the M-CIDI is embedded into the alcohol section as a filter for subsequent diagnostic questions on AUDs. Mean drinking levels of the past 12 months are assessed using a retrospective quantity–frequency approach. A one-page supplementary sheet illustrates how common drinks can be converted into standard drinks, listing a total of 26 combinations for drink and pouring size ("drink categories", see Figure 1). Respondents can thus specify their usual drinks with the help of the respective drink categories and pouring sizes. Using the conversion factors associated with each drink category and pouring size, a conversion of reported drinks into standard drinks can be done. For instance, two beers with 500 ml each would equal five standard drinks according to this list.

2.2 | Methods used to evaluate the M-CIDI standard drink assessment

Statistical analyses were done using IBM SPSS 23.0 (IBM Corp., Armonk, NY, USA) and Stata 12 (StataCorp, College Station, TX, USA). The evaluation of the supplementary sheet embedded in the M-CIDI standard drink assessment aimed at identifying a comparable and relevant set of drink categories by identifying both superfluous and missing drink categories within the M-CIDI.

2.2.1 | Relevance of drink categories

First, we carried out a brief comparison of the displayed drink categories in the M-CIDI with other instruments. Instruments without visualizations, e.g. Form90 or EuropASI, were not considered. This comparison identified how many and which specific drink categories and pouring sizes are being used by other instruments. A comparison of conversion factors was not considered to be necessary because they strongly depend on the definition of alcohol strength per standard drink in each country, which varies greatly across countries (Babor et al., 2001; Mongan & Long, 2015).

Second, we analyzed the empirical distributions of M-CIDI drink categories in a general population sample (German Health Interview and Examination Survey for Adults study [DEGS1-MH]; Jacobi et al., 2013) and a sample of German and Italian primary care patients (Alcohol Dependence in Primary Care [APC] study; Manthey et al., 2016; Rehm et al., 2015). In DEGS1-MH, $n = 5318$ participants of a nationally representative sample (conditional response rate 88%) were examined at their place of residence by clinically trained interviewers. We analyzed self-reports from $n = 3165$ past-year drinkers out of the $n = 4484$ complete and weighted CIDI cases. In the APC study, general practitioners were sampled from complete registers in east Germany

List**11**

Beer

0,3 l = 1,5 drinks		0,5 l = 2,5 drinks		1,0 l = 5 drinks
Wine			Sherry

0,2 l = 2 drinks	0,7 l = 6,5 drinks	1,0 l = 9 drinks	0,05 l = 1 drink	0,1 l = 1,5 drinks
Sparkling Wine

0,1 l = 1 drink	0,2 l = 2 drinks	0,75 l = 8 drinks		
Schnapps (Vodka, Gin)			Whiskey

1 small glas 0,02 l = 1 drinks	1 large glas 0,04 l = 1,5 drinks	0,7 l = 25 drinks	1 glas 0,04 l = 1,5 drinks	
drinks				
Brandy (Cognac, Armagnac, Metaxa)			sweet Liqueur (Amaretto, Baileys, Batida de Coco)

1 small glas 0,02 l = 1 drink	1 large glas 0,04 l = 1,5 drinks	0,7 l = 25 drinks	0,02 l = 0,5 drinks	
Liqueur (Cointreau, Fernet Branca, Sambuca)			Longdrinks Cocktails

0,02 l = 1 drink	0,04 l = 1,5 drinks	0,7 l = 23 drinks	one unit of alcohol: 0,02 l = 1 drink 0,04 l = 1,5 drinks 0,08 l = 3 drinks 0,16 l = 5 drinks	

FIGURE 1 Supplementary sheet for the standard drink assessment in the M-CIDI

(refusal rate: 58.5%) and a large general practitioner association in Florence (Italy, refusal rate: 79.2%). Patients with alcohol problems were oversampled for interviews in the APC study, thus analyses of the $n = 1189$ German and $n = 322$ Italian non-abstaining primary care patients accounted for sampling distortions by using inverse sampling

probabilities as weights. Frequencies of each M-CIDI drink category and pouring size were examined. The resulting distributions were used to identify rarely used categories that could be removed and frequently used categories that deserve further differentiation (e.g. different subcategories).

2.2.2 | Homogeneity of drink categories

Next, we explored whether the given M-CIDI categories represent a well-defined categorization of actually sold drinks. Therefore, a “beverage list” comprising a non-representative sample of $k = 23569$ alcoholic beverages sold in Germany between 2010 and 2016 was analyzed for the distribution of alcoholic strength in “% vol” both within and between M-CIDI drink categories. Notably, the beverage list did not include drinks mixed individually in bars. All covered beverages were analyzed for their alcoholic strength using Fourier transform infrared (FT-IR) spectroscopy (Lachenmeier, 2007) or, when the FT-IR result differed from the manufacturer’s labeling, the European Union (EU) reference methodology, i.e. distillation followed by pycnometry or electronic densimetry, was used. After excluding drinks labeled as “alcohol-free” ($k = 1649$ drinks with 0.0–1.2% vol, $k = 17$ drinks with 1.2–1.8% vol), a total of $k = 22503$ drinks remained. We grouped all drinks into the respective M-CIDI drink categories described in the original publication (Lachner et al., 1998; Figure 1) and calculated the average alcoholic strength for each drink category. Among each drink category (e.g. beer), descriptive analysis of alcoholic strength distributions including their means and peaks (visually defined given the frequency plots of alcoholic strengths), will identify both similarities between (e.g. compared to wine) and subgroups within the drink categories (e.g. different pouring sizes). Possible subgroups could be identified through multiple peaks within a category-wise alcoholic strength distribution of real drinks. Alcoholic strengths were not compared for the “cocktails, longdrinks” category, because the M-CIDI requires only the amount of the alcoholic component in the cocktail (e.g. vodka, whiskey), whereas the beverage list covers the alcoholic strengths of the entire mixed beverage.

2.2.3 | Standard drink conversion

We examined whether the M-CIDI factors used to convert common drinks into standard drinks (see Figure 1) represent a reliable and valid estimation of the actual alcohol content of these drinks. For this purpose, we first compared the given conversion factors of different drink categories and pouring sizes with each other. Then, we compared different definitions of standard drinks, including the German consensus for alcoholic strengths (Bühner et al., 2002) with 4.8% vol for beer, 11.0% vol for wine/sparkling wine, and 33.0% vol for spirits, in their ability to match the actual measured alcohol content (see beverage list).

The alcoholic strengths for each drink and pouring size were calculated using the following formula:

$$\text{Alcoholic strength (\% vol)} = \frac{G \times \text{number of CIDI standard drinks}}{C \times \text{drink volume in milliliters}}$$

Variable G denotes the amount of grams of pure alcohol in a CIDI standard drink. While 8 g per standard drink were proposed in the original M-CIDI publication (Lachner et al., 1998), 9 g per standard drink has also been used (Trautmann et al., 2015). Furthermore, standard drink equivalents of 10 g and 12 g are well-established in European research and practice (Mongan & Long, 2015), and might be the conversion factors for a revised supplementary list. The constant C equals the weight of alcohol, i.e. 0.78924 g of pure alcohol per milliliter.

3 | RESULTS

3.1 | Relevance of drink categories

The convenience sample of alternative instruments consists of four AUDIT translations from the United States (National Institute on Alcohol Abuse and Alcoholism, 2003), the United Kingdom (Alcohol Learning Center, 2008), Australia (Department of Veteran’s Affairs, 2003), and Germany (Dybek, 2009; Rist, Scheuren, Demmel, Hagen, & Aulhorn, 2003), as well as the WHO-CIDI (Kessler & Ustun, 2004; WHO, 2004), and the Timeline Followback (TLFB) interview (Nova Southeastern University, 2016; Sobell & Sobell, 1992).

Most translations of the 10-item AUDIT screening for “risky alcohol use” display drink categories in various pouring sizes and their equivalent standard drink amount (Alcohol Learning Center, 2008; Department of Veteran’s Affairs, 2003; National Institute on Alcohol Abuse and Alcoholism, 2003), while some do not (Dybek, 2009; Rist et al., 2003). Displayed categories differ for each translation. Equal to the M-CIDI, both drinking frequency and the number of alcoholic drinks for the past 12 months are directly asked (Bush et al., 1998). Answer categories differ slightly from the M-CIDI with “never, monthly or less, 2 to 4 times a month, 2 to 3 times a week, 4 to 5 times a week, 6 or more times a week” for frequency and “0, 1–2, 3–4, 5–6, 7–9, 10 or more drinks” for quantity.

The WHO-CIDI is a structured interview to assess mental disorders according to DSM-IV and ICD-10 and the assessment of alcohol consumption is realized through a number of questions and a supplementary sheet listing three alcohol categories (hard liqueur, wine and beer or ale) with various pouring sizes and their standard drink equivalent.

While M-CIDI, WHO-CIDI, and AUDIT use the quantity–frequency method, the TLFB method asks for daily drinking amounts for each day within a given period, e.g. 30 days or 24 months. Variability, pattern, and extent of drinking are determined by asking respondents how much milliliters they consumed of each of the four drink categories (beer, wine, liqueur and schnapps) on the day in question.

Other instruments state less drink categories than the M-CIDI, with beer, wine, and spirits presented by all examined instruments. Fortified wine, liqueur, and mixed drinks were infrequently presented. Different sizes for one drink category are given in some AUDIT versions (Australian, United Kingdom), in the TLFB instruction but not in the paper–pencil calendar, and in the WHO-CIDI. Unlike in the M-CIDI, several instruments specify the typical alcoholic strengths per drink category (AUDIT Australia, AUDIT United States, TLFB instruction) or different strengths for beer (AUDIT United Kingdom). No instrument other than the M-CIDI explicitly differentiates between wine and sparkling wine.

Other relevant indicators are empirical distributions of M-CIDI drink categories and sizes in a general population sample and two primary care patient samples (Figure 2). In general, beer, wine and combined spirits represent frequently reported drink categories across the samples, followed by sparkling wine and schnapps (as a single category). Figure 2 descriptively suggests that liqueur and sweet liqueur are more often reported among the Italian primary care sample, while schnapps and whiskey are less-often reported. Beer is more often reported in the general population sample compared to primary care

FIGURE 2 Proportion of CIDI drink categories as reported by primary care patients and a population-based sample. The blue line indicates the result-driven threshold for “rarely reported” categories, i.e. reported by <3% of all respondents

patients, while most spirits are more often reported by primary care patients. Sherry, brandy, liqueur, and sweet liqueur in Germany (whiskey only in the general population), as well as sherry, brandy, and whiskey in Italy were reported by <3% of the participants.

In sum, beer and wine represent relevant categories as indicated by other instruments and self-reports. Since sparkling wine is generally not stated as a single category, the combination with wine could be explored in an alcoholic strength analysis. A combination of several or all spirits was indicated by empirical frequencies, the state-of-the-art in other instruments, and national recommendations (Bührlinger et al., 2002).

3.2 | Homogeneity of drink categories

The analysis of alcoholic strength distributions within each CIDI drink category (see Table 1, for details see Supporting Information) showed that schnapps, brandy and whiskey had one clear peak at around 40.0% vol. Most beverages (90%) in these categories had alcoholic strengths ranging from 30.0 to 45.0% vol. For other drink categories, evidence for inner-categorical heterogeneity was found, i.e. they contained subgroups with lower alcoholic strengths compared to the alcoholic strength of the respective main category. For example, three distinct peaks were identified within the beer category, with peaks at about 2.5, 5.0, and 7.5% vol. A closer inspection of the drinks suggested that mixtures of beer with water, lemonade, or juice form the first peak, followed by the most common beers in Germany (e.g. pilsner, wheat beer) and stronger beer types forming peaks two and three. The distribution of the category wine was left-skewed with two peaks (about 6.0 and 12.0% vol), with 25% of the beverages below 10% vol. The first peak mainly contained wine spritzer, mulled wine and must/new wine, while common red and white wines represented most beverages under the second peak. A similar left-tailed distribution with two peaks was found for sparkling wine (about 8.5 and 11.0% vol) and fortified wine (about 14.0 and 20.0% vol). Both liqueur (about 15.0 and 39.0% vol) and sweet liqueur (about 16.0 and 40.0% vol) had each two peaks at equivalent levels of alcoholic strength,

while sweet liqueur has more drinks around the first peak (about 16.0% vol) and liqueur around the second (about 39.0% vol).

As shown in Table 1, recommended alcoholic strengths for Germany (Bührlinger et al., 2002) were replicated for beer, wine and sparkling wine with small differences of up to 1% vol. The mean alcoholic strength of a combined spirits category (schnapps, whiskey, brandy, and liqueur/sweet liqueur with >30% vol) was lower in the beverage list with 40.8% vol, and varied between 20 and 41% vol depending on the drink category. Concerning single categories, schnapps, brandy and whiskey had equal alcoholic strength means around 40.0% vol, followed by liqueur (31.0% vol) and sweet liqueur (20.4% vol).

3.3 | Standard drink conversion

Figure 3 illustrates how the alcoholic strength estimates derived from the M-CIDI list (1) vary within one drink category and (2) differ from the alcoholic strength estimates derived (a) from the sample of German drinks (see section earlier) and (b) from national guidelines (Bührlinger et al., 2002). M-CIDI alcoholic strength estimates did not match earlier alcoholic strengths estimates (Bührlinger et al., 2002). The smallest deviation over all drink categories was found for a conversion factor with one standard drink equaling 8 g pure alcohol, however, this conversion factor did still not result in adequate estimates of the alcoholic strengths found in analysis of real drinks. Concerning the conventional CIDI drink categories, the lowest differences between M-CIDI alcoholic strengths and alcoholic strengths from the beverage list were present for beer, highest for liqueur. Deviations did also differ according to the given pouring size. For wine, sherry, schnapps, brandy, and liqueur, standard conversion factors led to proportionately higher deviations the smaller the pouring sizes. For sparkling wine, the opposite was found with the largest pouring sizes being converted into proportionately more standard drinks than smaller amounts. For beer, deviations were constant across pouring sizes, indicating a constant conversion factor.

TABLE 1 Alcoholic strength distributions of conventional and alternative CIDI drink categories

	k	Alcoholic strength (% vol)				Peaks
		Mean	Median	Standard deviation	90% confidence interval	Number (mean alcoholic strength of each peak in % vol)
Conventional CIDI drink category						
Alcohol free	1090	0.38	0.34	0.29	(0.00; 1.00)	3 (0.0; 0.4; 1.1)
Beer	4339	5.13	5.20	1.28	(2.40; 7.30)	3 (2.5; 5.0; 7.0)
Wine	9249	10.98	11.78	2.62	(5.35; 13.90)	2 (6.0; 13.0)
Sherry	490	15.94	15.07	1.84	(14.40; 19.40)	2 (14.0; 20.0)
Sparkling wine	1063	10.01	10.60	2.21	(5.70; 12.67)	2 (8.5; 11.0)
Schnapps	4571	41.13	40.20	5.72	(37.15; 46.28)	1
Whiskey	165	40.14	39.90	1.42	(39.50; 43.04)	1
Brandy	244	39.88	40.00	6.20	(30.95; 45.96)	1
Sweet liqueur	1089	20.41	18.80	6.38	(13.76; 35.15)	3 (18.0; 25.0; 40.0)
Liqueur	308	31.01	34.26	10.12	(15.40; 46.89)	2 (15.0; 40.0)
Longdrinks, cocktails	961	7.95	6.70	4.23	(4.10; 15.49)	1
Alternative CIDI drink category						
Beer mix	464	2.62	2.50	0.85	(1.60; 4.50)	1
Regular beer	3545	5.22	5.24	0.58	(4.40; 6.00)	1
Strong beer	330	7.73	7.40	1.07	(6.80; 10.05)	2 (7.5; 10.0)
Wine mix	319	6.22	6.30	1.41	(4.70; 8.50)	1
Wine	9993	11.03	11.70	2.50	(5.70; 13.80)	2 (6.0; 12.0)
Fortified wine/sherry	490	15.94	15.07	1.84	(14.40; 19.40)	2 (14.0; 20.0)
Liqueur/sweet liqueur with <30% vol	1114	19.02	18.47	4.15	(13.79; 26.96)	2 (17.0; 25.0)
Spirits ^a	5263	40.83	40.10	5.70	(35.00; 46.00)	1

Note: *k* = number of analyzed beverages, summing up to 21518 drinks overall if categories alcohol free and longdrinks, cocktails are excluded. Note that 90% confidence intervals are less-biased towards outliers than 95% confidence intervals.

^aIncluding schnapps, whiskey, and brandy as well as liqueur/sweet liqueur with alcoholic strength $\geq 30\%$ vol.

FIGURE 3 Deviation from the estimated alcoholic strength for different standard drink definitions across CIDI drink categories. Notably, no estimates for cocktails were available for comparison

4 | DISCUSSION

The supplementary sheet of the M-CIDI standard drink assessment is designed to measure alcohol quantities using various drink categories

and pouring sizes. This study aimed at a thorough evaluation of this assessment, with two main findings: First, respondents of the M-CIDI can choose from comparably many drink categories and pouring sizes to classify their drinking behavior. Some categories appear to be either

superfluous or ambiguous. Second, the proposed factors used to convert the reported drinks into standard drinks are (1) inconsistent within most drink categories across different pouring sizes, and (2) use alcoholic strengths that are substantially different to those determined empirically using a large sample of retailed drinks.

In sum, these findings highlight the need to revise the M-CIDI supplementary sheet for assessing alcohol quantities. A revised supplementary sheet can be found in Figure 4. Future research may cover acceptance, feasibility, and time demands of the revised supplementary sheet. Further, similar studies in other drinking cultures, examinations of the M-CIDI drinking frequency assessment, and tests of the

impact of all revisions on the accuracy of self-reported consumption could contribute to a more reliable assessment of drinking levels using short questionnaires.

4.1 | Revision of drink categories

The revised structure of drink categories largely overlaps with comparable instruments. The major drink categories identified, i.e. beer, wine and spirits, are regarded sufficient to represent global and regional alcohol consumption (WHO, 2014). In addition to removing and collapsing drink categories, the revision distinguishes between different

List I1 - revised

Common drink types in various volumes and strengths (Alcohol by volume, ABV). For each volume, a conversion factor is given that translates the drink into a 'standard drink' (SD) with 12g pure ethanol.

Beer e.g. Becks, Krombacher, Paulaner	1 small glass/bottle/can = 300ml / 0.3l	1 regular glass/bottle/can = 500ml / 0.5l

Beer mixed ABV < 3.4%	= ____ (*0.5 SD)	= ____ (*0.9 SD)	
Regular beer ABV: 3.4-6.5%	= ____ (*1.0 SD)	= ____ (*1.7 SD)	
Strong beer ABV > 6.5%	= ____ (*1.5 SD)	= ____ (*2.5 SD)	
<hr/>			
Wine including new wine, sparkling wine, champagne, table wine, sherry, port	1 small glass = 100ml / 0.1l	1 regular glass / small bottle = 200ml / 0.2l	1 regular bottle = 750ml / 0.75l

Wine mixed ABV: 4.7-8.5%	= ____ (*0.4 SD)	= ____ (*0.8 SD)	= ____ (*3.1 SD)
Wine, Sparkling wine ABV: 5.7-13.8%	= ____ (*0.75 SD)	= ____ (*1.5 SD)	= ____ (*5.5 SD)
Fortified wine, Sherry ABV: 14.4-19.4%	= ____ (*1.05 SD)	= ____ (*2.1 SD)	= ____ (*7.9 SD)
<hr/>			
Sweet liqueur e.g. cream liqueur, advocaat, liqueur/sweet liqueur (if ABV<30%)	1 small glass = 20ml / 0.02l	1 regular glass = 40ml / 0.04l	1 regular bottle = 700ml / 0.7l

ABV: 13.8-27.0%	= ____ (*0.25 SD)	= ____ (*0.5 SD)	= ____ (*8.8 SD)
<hr/>			
Spirits e.g. vodka, gin, rum, whiskey, brandy, liqueur/sweet liqueur (if ABV>30%)	1 small glass/single shot = 20ml / 0.02l	1 double shot / 1 whiskey serving = 40ml / 0.04l	1 regular bottle = 700ml / 0.7l

ABV: 35.0-46.0%	= ____ (*0.55 SD)	= ____ (*1.1 SD)	= ____ (*18.8 SD)
<hr/>			
For Mixed drinks (e.g. cuba libre, caipirinha), state the alcoholic part of the drink according to one of the above mentioned drink categories, e.g. Spirits

FIGURE 4 Revised supplementary sheet for the standard drink assessment in the M-CIDI, including revised categories and standard drink conversions. The presented alcoholic strength range represents the 90% confidence interval around the category's alcoholic strength mean

beer and wine strengths: mixtures of beer with water or juice ("beer mix"), beer with more than 6.5% vol ("strong beer") and mixtures of wine with other alcoholic or non-alcoholic beverages ("wine mix"). Wine and sparkling wine are merged into "wine" due to similar alcoholic strengths. Fortified wine/sherry should be kept as a separate group given the outstanding alcoholic strength range. We further propose to unite schnapps, whiskey and brandy, as well as liqueur and sweet liqueur with $\geq 30\%$ vol into "spirits". As liqueur/sweet liqueur with $< 30\%$ vol may play a considerable role in some regions and has alcoholic strengths that would not fit into other categories, it should be kept as a single drink category.

For "cocktails, longdrinks", no evidence-based suggestions can be deducted. However, we have to note that assessing the alcohol content of cocktails is most difficult, because the alcohol concentration is usually not predefined but determined by the drink's recipe or by individual mixing preferences which may result in considerable variations. Given large alcoholic strength variations in mixed drinks at restaurants and bars (Kerr, Patterson, Koenen, & Greenfield, 2008), the assumption that respondents know the pouring amount of the alcoholic part of a mixed drink may be rather optimistic. As a result, the alcohol concentration is frequently overestimated or underestimated by drinkers (Kerr & Stockwell, 2012).

4.2 | Revision of standardized drink units

While several instruments illustrate only one common pouring size, i.e. equivalents to one local standard drink of 8 to 12 g of pure alcohol, empirical data suggests that most drink categories are well represented by several pouring sizes. Thus, we propose to keep smaller sizes that were reported by the majority of respondents, and to delete sizes that can easily be estimated from the given smaller sizes, e.g. deleting 1.0 l beer but retaining 0.5 l beer.

The conversion of beverages into standard drinks in the M-CIDI was most likely based on a conversion factor of about 8 g of pure alcohol per standard drink, thus being lower than most European and international standard drink definitions (Babor et al., 2001; Mongan & Long, 2015). We propose a conversion based on the 12 g standard drink definition (WHO, 2014) that will result in relatively comprehensible numbers of standard drinks (see Figure 4).

In the M-CIDI, standard drinks had obviously been rounded for improved comprehension at costs of overall inconsistent conversion factors. We therefore propose more precise standard drinks based on empirically valid conversion factors. For paper-pencil conducted interviews, standard drinks were adjusted based on the mean empirical alcoholic strength of each drink category. It therefore becomes necessary to train interviewers in using a calculator to multiply and add standard drinks of different pouring sizes and drink categories. While this possibly increases typing and calculating errors, this affects paper-pencil interviews only and should be outweighed by an increased accuracy of quantity assessments. For computer-assisted interviews, which presumably constitute the majority of interviews being conducted nowadays, the program algorithms should allow using the alcoholic strength of the respondents' favorite drinks (if known) over the default mean alcoholic strength. For drinks not yet classified, respondents need to specify the total volume and the estimated or

known alcoholic strength – similar to the current procedure implemented in the M-CIDI.

Although the large sample of alcoholic drinks in Germany was not internationally representative, the resulting alcoholic strength estimates are comparable to those from US-based samples (Kerr, Greenfield, & Tujague, 2006). Notably, the average alcoholic strength of beverage groups has been rather stable during the last decades (Lachenmeier, Godelmann, Witt, Riedel, & Rehm, 2014), which may be explained by direct or indirect legislation (The European Parliament and The Council 2011). For the assessment of drinking quantities via standard drinks, consistent alcoholic strengths over time clearly help to ensure a precise measurement.

The largest degree of alcoholic strength imprecision has been found for rarely reported drinks, while conversion factors for the major drink categories were relatively precise. Therefore, we do not assume that previous results from studies using this sheet are invalid and need be retracted. Nevertheless, secondary analyses using conversion factors of the revised supplementary sheet may be run for various subgroups to quantify the distorting effect.

4.3 | Further implications

Next to our minor revisions of a supplementary sheet, more important questions concerning the use of the M-CIDI in the context of standard drink assessment are at hand: Are retrospective quantity-frequency interviews state-of-the-art or rather outdated? And is the M-CIDI better than other, more specific instruments?

Reducing the number of displayed categories may simplify the list, however, the alcoholic strength and the exact amount of each drink remains estimated rather than measured. Asking for exact values would require more calculation efforts both by interviewee and interviewer. Interestingly, current quantity-frequency assessment measures were performed well versus a more extensive calendar based assessment tool (Sobell et al., 2003).

Retrospective assessments are generally at risk of memory biases, leading to the elimination of idiosyncratic drinking occasions for the benefit of stable drinking patterns. The M-CIDI fosters this by explicitly asking for "time periods" of drinking while at the same time, precision gains by revised standard drinks are threatened by the generalization of varying drinking patterns. More recently invented, prospective momentary assessment tools are presumably more precise (Morgenstern, Kuerbis, & Muench, 2014), supposedly due to the elimination of a memory bias in recollecting and aggregating drinks over a longer period of time (Greenfield & Kerr, 2008). However, both methods may produce biased answers as both ask for subjective data and may suffer from lower reported amounts due to social desirability. Momentary assessment may even become increasingly unfeasible with increasing alcohol intoxication, but so does the retrospective recall of larger amounts of alcohol. In the end, it remains unclear how both methods can erase the well-known self-reporting bias (Greenfield & Kerr, 2008).

Assessing the drinking frequency, both M-CIDI and AUDIT force respondents to generalize their individual drinking behavior with idiosyncratic drinking into pseudo-stable drinking patterns. It remains unclear, how answer categories such as "1–3 days a month" are

converted into exact number of days and whether this represents a reliable and valid estimation of actual drinking days. The skewedness of category distributions using category means does add to this problem. In consequence, the current M-CIDI rule of using drinking levels as filter for diagnostic questions on AUD may thus lead to an incorrect exclusion of low level drinkers or individuals that might not be able to gauge their alcohol use correctly. As AUD diagnoses are formally not related to drinking levels, we suggest to remove this filter.

This article demonstrated that there are different approaches generalizing standard drinks on certain occasions over a given period of time, used by the examined instruments. In real-life situations, many drinkers are unaware of the standard drink concept (Bendtsen, Karlsson, Dalal, & Nilsen, 2011; Kerr & Stockwell, 2012) and commonly consumed drinks are often larger than standard drinks (Kerr & Stockwell, 2012), which may be one cause of underreporting in quantity-frequency measures. Facilitating respondents' classification of their drinking behavior in uniform measures is not only relevant for the M-CIDI but also for short screening scales and prospective momentary assessment tools, which may directly implement the revised sheet or benefit from the earlier described process when drafting a new standard drink illustration. Unlike the AUDIT, the M-CIDI does not force respondents to aggregate their drinks into standard drinks themselves, which may result in more precise estimates.

Having these arguments at hand, it seems plausible for us to use the revised M-CIDI alcohol assessment section as a tool to monitor drinking levels in primary health care settings or epidemiological studies, while momentary assessment instruments should be used for detailed monitoring of individual drinking levels in treatment settings. Although the M-CIDI was not developed to serve as a screening tool, we argue that its drinking level assessment section is very comparable to the AUDIT.

4.4 | Limitations

We acknowledge the following limitations of our work: the revised sheet allows for a more accurate approximation of actual drinking amounts while keeping the inevitable loss of information to a minimum. Acceptance, feasibility, and time demands of the revised supplementary sheet, in comparison with the previous version of that sheet, still have to be determined. Neither can we pre-estimate the difference in the calculated consumption with the revised drink categories, nor could we estimate the difference given the conversion factor adjustment as this was beyond the scope of this study.

We did not control for mathematical abilities, for the understanding of the standard drink concept, or for experience with the CIDI. The quality of CIDI alcohol consumption data and calculating of respective standard drinks does indeed improve with interviewer experience and training (Meyer, Rumpf, Hapke, & John, 2000). However, all interviewers of our studies were trained according to WHO standards.

The beverage list is not weighted for sales numbers of each drink. It is also unclear, if the mean alcoholic strength of each drink category actually represents the best option for estimating the drink category's alcoholic strength as we did not correct for consumption preferences within each category. Our results strongly depend on the alcohol

market of Germany, German and Italian drink preferences, and legislations concerning national and European drinking regulations. Even though this revision has been conducted in German and Italian settings, the resulting sheet may be used in any setting with similar pouring sizes and comparable alcoholic strengths for the respective drinks. Thus, applications in most European countries are possible. Conversion factors may be amended if typical alcoholic strength values deviate substantially. Still, similar studies in other drinking cultures are necessary as they differ widely across the globe (Shield et al., 2013; WHO, 2014).

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DECLARATION OF INTEREST STATEMENT

The authors SKP, DWL, FK, PTK, and HUW declare to have no conflicting interests. JR declares grants and honoraria from Lundbeck, and honoraria from DA pharma, outside and unrelated to his work on this article. JM declares receiving personal fees from Lundbeck.

REFERENCES

- Alcohol Learning Center. (2008). AUDIT – Alcohol use disorders identification test. Retrieved from http://www.alcohollearningcentre.org.uk/_library/AUDIT.doc
- Babor, T. F., John, C., Higgins-Biddle, J. C., John, B., Saunders, J. B., & Monteiro, M. G. (2001). *AUDIT. The Alcohol Use Disorders Identification Test. Guidelines for Use in Primary Care*. Geneva: WHO.
- Bendtsen, P., Karlsson, N., Dalal, K., & Nilsen, P. (2011). Hazardous drinking concepts, limits and methods: Low levels of awareness, knowledge and use in the Swedish population. *Alcohol and Alcoholism*, 46(5), 638–645. <https://doi.org/10.1093/alcalc/agr065>
- Bühringer, G., Augustin, R., Bergmann, E., Bloomfield, K., Funk, W., Junge, B., ... Töppich, J. (2002). *Production and consumption statistics Alcohol Consumption and Alcohol-related Problems in Germany*. (pp. 11–21). Seattle, WA: Hogrefe & Huber.
- Bush, K., Kivlahan, D. R., McDonnell, M. B., Fihn, S. D., Bradley, K. A., & Ambulatory Care Quality Improvement (1998). The AUDIT alcohol consumption questions (AUDIT-C) – An effective brief screening test for problem drinking. *Archives of Internal Medicine*, 158(16), 1789–1795. <https://doi.org/10.1001/archinte.158.16.1789>

- Department of Veterans Affairs. (2003). Alcohol screen (AUDIT). Document D0718 - 8/03. <http://www.health.nt.gov.au/library/scripts/objectifyMedia.aspx?file=pdf/63/68.pdf> or http://www.olderpa.org/Resources/Documents/AUDITApplication_pdf.pdf (accessed 6 March 2017)
- Dybek, I. (2009). *Screening-Verfahren zur Entdeckung alkoholbezogener Störungen in Allgemeinärztl. Praxen: Reliabilität und Validität des AUDIT, AUDIT-C und LAST*, MD Doctoral dissertation. Retrieved from Deutsche Nationalbibliothek database.
- European Parliament and of the Council. (2011). Regulation (EU) no 1169/2011. Retrieved from <http://eur-lex.europa.eu/eli/reg/2011/1169/oj>
- Gmel, G., & Rehm, J. (2004). Measuring alcohol consumption. *Contemporary Drug Problems*, 31.
- Greenfield, T. K., & Kerr, W. C. (2008). Alcohol measurement methodology in epidemiology: Recent advances and opportunities. *Addiction*, 103(7), 1082–1099. <https://doi.org/10.1111/j.1360-0443.2008.02197.x>
- Jacobi, F., Mack, S., Gerschler, A., Scholl, L., Hofler, M., Siegert, J., ... Wittchen, H. U. (2013). The design and methods of the mental health module in the German health interview and examination survey for adults (DEGS1-MH). *International Journal of Methods in Psychiatric Research*, 22(2), 83–99. <https://doi.org/10.1002/mpr.1387>
- Jacobi, F., Hofler, M., Strehle, J., Mack, S., Gerschler, A., Scholl, L., ... Wittchen, H. U. (2014). Mental disorders in the general population: Study on the health of adults in Germany and the additional module mental health (DEGS1-MH). *Nervenarzt*, 85(1), 77–87. <https://doi.org/10.1007/s00115-013-3961-y>
- Kerr, W. C., & Stockwell, T. (2012). Understanding standard drinks and drinking guidelines. *Drug and Alcohol Review*, 31(2), 200–205. <https://doi.org/10.1111/j.1465-3362.2011.00374.x>
- Kerr, W. C., Greenfield, T. K., & Tujague, J. (2006). Estimates of the mean alcohol concentration of the spirits, wine, and beer sold in the United States and per capita consumption: 1950 to 2002. *Alcoholism: Clinical and Experimental Research*, 30(9), 1583–1591. <https://doi.org/10.1111/j.1530-0277.2006.00190.x>
- Kerr, W. C., Patterson, D., Koenen, M. A., & Greenfield, T. K. (2008). Alcohol content variation of bar and restaurant drinks in northern California. *Alcoholism: Clinical and Experimental Research*, 32(9), 1623–1629. <https://doi.org/10.1111/j.1530-0277.2008.00741.x>
- Kessler, R. C., & Ustun, T. B. (2004). The world mental health (WMH) survey initiative version of the World Health Organization (WHO) composite international diagnostic interview (CIDI). *International Journal of Methods in Psychiatric Research*, 13(2), 93–121. <https://doi.org/10.1002/mpr.168>
- Lachenmeier, D. W. (2007). Rapid quality control of spirit drinks and beer using multivariate data analysis of Fourier transform infrared spectra. *Food Chemistry*, 101(2), 825–832. <https://doi.org/10.1016/j.foodchem.2005.12.032>
- Lachenmeier, D. W., Godelmann, R., Witt, B., Riedel, K., & Rehm, J. (2014). Can resveratrol in wine protect against the carcinogenicity of ethanol? A probabilistic dose-response assessment. *International Journal of Cancer*, 134(1), 144–153. <https://doi.org/10.1002/ijc.28336>
- Lachner, G., Wittchen, H.-U., Perkonig, A., Holly, A., Schuster, P., Wunderlich, U., ... Pfister, H. (1998). Structure, content and reliability of the Munich-composite international diagnostic interview (M-CIDI) substance use sections. *European Addiction Research*, 4, 28–41. <https://doi.org/10.1159/000018922>
- Manthey, J., Gual, A., Jakubczyk, A., Pieper, L., Probst, C., Struzzo, P., ... Rehm, J. (2016). Alcohol use disorders in Europe: A comparison of general population and primary health care prevalence rates. *Journal of Substance Use*, 21(5), 478–484. <https://doi.org/10.3109/14659891.2015.1063719>
- Meyer, C., Rumpf, H.-J., Hapke, U., & John, U. (2000). The composite international diagnostic interview: Feasibility and necessity of editing and interviewer training in general population surveys. *International Journal of Methods in Psychiatric Research*, 9(1), 32–42. <https://doi.org/10.1002/mpr.78>
- Mongan, D., & Long, J. (2015). Standard drink measures throughout Europe; peoples' understanding of standard drinks and their use in drinking guidelines, alcohol surveys and labelling. Retrieved from <http://www.rarha.eu/Resources/Deliverables/Lists/Deliverables/Attachments/14/WP5%20Background%20paper%20Standard%20drink%20measures%20HRB.pdf>
- Morgenstern, J., Kuerbis, A., & Muench, F. (2014). Ecological momentary assessment and alcohol use disorder treatment. *Alcohol Research: Current Reviews*, 36(1), 101–110.
- National Institute on Alcohol Abuse and Alcoholism. (2003). AUDIT. Retrieved from <http://pubs.niaaa.nih.gov/publications/Audit.pdf>
- Nova Southeastern University. (2016). Instructions for filling out the timeline alcohol use calendar. Timeline Followback Calendar: 2016. Retrieved from http://www.nova.edu/gsc/online_files.html
- Poznyak, V., Fleischmann, A., Rekve, D., Rylett, M., Rehm, J., & Gmel, G. (2013). The World Health Organization's global monitoring system on alcohol and health. *Alcohol Research: Current Reviews*, 35(2), 244–249.
- Rehm, J., Kehoe, T., Gmel, G., Stinson, F., Grant, B., & Gmel, G. (2010a). Statistical modeling of volume of alcohol exposure for epidemiological studies of population health: The US example. *Population Health Metrics*, 8, 3. <https://doi.org/10.1186/1478-7954-8-3>
- Rehm, J., Taylor, B., Mohapatra, S., Irving, H., Baliunas, D., Patra, J., & Roerecke, M. (2010b). Alcohol as a risk factor for liver cirrhosis: A systematic review and meta-analysis. *Drug and Alcohol Review*, 29(4), 437–445. <https://doi.org/10.1111/j.1465-3362.2009.00153.x>
- Rehm, J., Allamani, A., Elekes, Z., Jakubczyk, A., Landsmane, I., Manthey, J., ... Wojnar, M. (2015). General practitioners recognizing alcohol dependence: A large cross-sectional study in 6 European countries. *Annals of Family Medicine*, 13(1), 28–32. <https://doi.org/10.1370/afm.1742>
- Rist, F., Scheuren, B., Demmel, R., Hagen, J., & Aulhorn, I. (2003). Der Münsteraner Alcohol Use Disorders Identification Test (AUDIT-G-M). In A. Glöckner-Rist, F. Rist, & H. Küfner (Eds.), *Elektronisches Handbuch zu Erhebungsinstrumenten im Suchtbereich (EHES) Version 3.00*. Mannheim: Zentrum für Umfragen, Methoden und Analysen.
- Shield, K. D., Parry, C., & Rehm, J. (2013). Chronic diseases and conditions related to alcohol use. *Alcohol Research: Current Reviews*, 35(2), 155–173.
- Sierostawski, J., Foster, J., & Moskalewicz, J. (2013). Survey of European drinking surveys. Alcohol survey experiences of 22 European countries. *Drugs: Education, Prevention and Policy*, 20(5), 383–398. <https://doi.org/10.3109/09687637.2013.797381>
- Sobell, L. C., & Sobell, M. B. (1992). Timeline Follow-back: A technique for assessing self-reported ethanol consumption. In R. Z. Litten, & J. P. Allen (Eds.), *Measuring Alcohol Consumption: Psychosocial and Biological Methods* (pp. 41–72). Totowa, NJ: Humana Press.
- Sobell, L. C., Agrawal, S., Sobell, M. B., Leo, G. I., Johnson Young, L., & Cunningham, J. A. (2003). Comparison of a quick drinking screen with the timeline Followback for individuals with alcohol problems. *Journal of Studies on Alcohol*, 64(6), 858–861. <https://doi.org/10.15288/jsa.2003.64.858>
- Taylor, B., Irving, H. M., Baliunas, D., Roerecke, M., Patra, J., Mohapatra, S., & Rehm, J. (2009). Alcohol and hypertension: Gender differences in dose-response relationships determined through systematic review and meta-analysis. *Addiction*, 104(12), 1981–1990. <https://doi.org/10.1111/j.1360-0443.2009.02694.x>
- Trautmann, S., Schonfeld, S., Behrendt, S., Heinrich, A., Hofler, M., Siegel, S., ... Wittchen, H. U. (2015). Predictors of changes in daily alcohol consumption in the aftermath of military deployment. *Drug and Alcohol Dependence*, 147, 175–182. <https://doi.org/10.1016/j.drugalcdep.2014.11.019>
- Wittchen, H.-U., Perkonig, A., Lachner, G., & Nelson, C. B. (1998). Early developmental stages of psychopathology study (EDSP): Objectives and design. *European Addiction Research*, 4, 18–27. <https://doi.org/10.1159/000018921>
- World Health Organization (WHO) (1993). *The Composite International Diagnostic Interview – Version 1.1*. Geneva: WHO.

World Health Organization (WHO). (2004). CAPI V21.1.4 Respondent Booklet. Retrieved from http://www.hcp.med.harvard.edu/wmhcdi/ftpd_public/CAPI%20Instrument/CAPI%20V21.1.4/CAPI%20v21.1.4_Respondent%20Booklet.pdf

World Health Organization (WHO) (2014). *Global Status Report on Alcohol and Health 2014*. Geneva: WHO.

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