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Alcohol habits and alcohol-related health conditions of self-defined lifetime abstainers and never binge drinkers

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Abstract

Background: Prior research has shown that using lifetime abstainers as the reference group to examine the association between alcohol use and health-related consequences has several disadvantages. The aim of the present study was to examine the consistency of self-reported lifetime abstinence and never-binge drinking, respectively, using national, longitudinal data collected in 2019 and 2020. Additionally, the prevalence of alcohol-related morbidity among lifetime abstainers was examined by linking survey data to alcohol-related morbidity data in a national patient register.

Methods: Data come from the Danish Health and Wellbeing Survey in 2019 and from a follow-up survey of the same individuals in 2020. A random sample of 14,000 individuals aged 15 years or older was drawn in mid-August 2019. Data were collected between September and December 2019. All those who were invited to the survey in 2019 and who were still alive and living in Denmark were invited to participate in a follow-up survey in 2020. Data in both waves were collected by self-administered questionnaires. Both questionnaires included the standard questions on alcohol consumption from the European Health Interview Survey model questionnaire. Information on alcohol-related morbidity was obtained from the Danish National Patient Register.

Results: In all, 5000 individuals completed the questionnaire in both waves. Approximately half (44.4%) of the individuals who declared that they were lifetime abstainers in 2020 ($n=252$) had reported in 2019 to have drunk at some point in their life. Moreover, 39.7% contradicted earlier reported binge drinking. Furthermore, 2.4% of the respondents who defined themselves as lifetime abstainers in 2020 had earlier been diagnosed with an alcohol-related health condition.

Conclusion: The present research reaffirms previous studies which have found self-reported lifetime abstainers to be unreliable as a consistent reference group. Additionally, the results indicated that a non-negligible proportion of lifetime abstainers had been diagnosed with an alcohol-related health condition.

KEYWORDS

alcohol drinking, binge drinking, health surveys, longitudinal studies, reproducibility of results

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BACKGROUND

Excessive alcohol intake is a well-established cause of morbidity and mortality (GBD 2016 Risk Factors Collaborators, 2017). However, substantial research has also suggested that light-to-moderate drinking may provide some health benefits. For example, light-to-moderate drinking has been shown to be related to a reduced risk of a range of cardiovascular outcomes (GBD 2020 Alcohol Collaborators, 2022; Ronksley et al., 2011) and diabetes (Holst et al., 2017; Pietraszek et al., 2010; Tian et al., 2023). However, the possible health benefits of such modest alcohol consumption have recently been questioned by the use of Mendelian randomization techniques and meta-analyses, and thus the debate on this subject continues (GBD 2016 Risk Factors Collaborators, 2017; Holmes et al., 2014; Stockwell et al., 2024; Zhao et al., 2023). What can be agreed upon is that self-reported alcohol intake is difficult to assess since it is often prone to misclassification bias (e.g., due to recall and social desirability bias).

As is the case in all epidemiological work, the choice of reference group may be of most importance when examining associations between purported risk factors and outcome; in our case, this is the association between alcohol intake, and morbidity and mortality. Lifetime abstainers have been widely used as the reference group in alcohol epidemiology (e.g., Åberg et al., 2020; Burke et al., 2007; Di Castelnuovo et al., 2022; Kerr et al., 2019; Ko et al., 2021; Luben et al., 2018; Nakaya et al., 2004; Xi et al., 2017; Zaitso et al., 2020). The main reason for using lifetime abstainers as the reference group instead of, for example, current abstainers, is to exclude former alcohol users from the reference group. The inclusion of former alcohol users in the reference group might erroneously make the association between alcohol use and health-related consequences weaker or non-existent, due to the so-called “sick-quitter effect” (Shaper et al., 1988). However, there are several disadvantages associated with the use of lifetime abstainers, which have been addressed in previous studies and commentaries (e.g., Naimi et al., 2022; Rehm et al., 2008; Stockwell et al., 2016). For example, several longitudinal studies have shown that self-reported lifetime abstinence is unreliable; studies have widely shown that more than half of respondents who reported to have never had an alcoholic beverage actually reported drinking in previous survey waves (Caldwell et al., 2006 [26 years of follow-up]; Rehm et al., 2008 [8 years]; Bell & Britton, 2015 [28 years]; Callinan et al., 2019 [16 years]). All the studies cited above were carried out on surveys conducted several years apart and relied solely on self-reported data. However, with the use of administrative registry data on alcohol-related morbidity, it is possible to increase our understanding of the behavior of self-reported lifetime abstainers. To the best of our knowledge, such an approach has never been used before.

It is well known that binge drinking (also known as heavy episodic drinking) has a substantial impact on health and social outcomes, and it is associated with both short- (e.g., dangerous or violent behavior, accidents, and alcohol poisoning) and long-term (e.g., liver

diseases and cancer) effects (Caamaño-Isorna et al., 2017; Molina & Nelson, 2018; Rossow et al., 2013; Wechsler et al., 1994). Hence, binge drinking is a key indicator in monitoring patterns of risky alcohol consumption. The use of this measure of risky drinking behavior also has some disadvantages as suggested by Rehm et al. (2020). For example, heavy drinkers in a population are less likely to participate in general population surveys (Kopra et al., 2018) and there is also currently no consensus on how to define binge drinking. Nonetheless, to the best of our knowledge, the consistency of self-reporting never binge drinking has not been examined.

The aim of the present study was to examine the consistency of self-reported lifetime abstinence and never binge drinking, respectively, using national, longitudinal survey data collected in 2019 and 2020. Given the comparatively short follow-up time, we hypothesized that we would observe better consistency for lifetime abstinence than in the previous studies which found that most respondents who reported never having had an alcoholic beverage actually reported drinking in previous survey waves. In addition, to validate respondents' reports, we examined the prevalence of alcohol-related morbidity among self-reported lifetime abstainers by linking the study survey data to alcohol-related morbidity data from a Danish national patient registry.

METHODS

Data were obtained from the Danish Health and Wellbeing Survey (DHWS) in 2019 and from a follow-up survey of the same individuals in 2020 (Jensen et al., 2022). The DHWS is the Danish component of the European Health Interview Survey (EHIS), which is a health survey that serves as an instrument to collect reliable and comparable health data among individuals aged 15 years or older across all European Union member states (Hintzpeter et al., 2019). The reference year for the third wave of EHIS was 2019 and the survey was conducted in all member states plus Albania, Iceland, Norway, Serbia and Turkey (Eurostat., 2020).

In all, 14,000 individuals aged 15 years or older, were randomly selected from the Danish Civil Registration System (Pedersen, 2011) and invited to the DHWS in 2019. Data were collected between early September and late December 2019. An invitation letter including a direct link to the web questionnaire was sent by the governmental secure electronic mail service, Digital Post. Since 2014, all individuals in Denmark aged 15 years or older are registered to use Digital Post. However, a small proportion of the sample in 2019 (8.3%) had actively deregistered from the service. Thus, these individuals were sent an invitation letter by regular postal mail (including a paper questionnaire and a pre-paid return envelope were enclosed). Two reminders were sent to non-respondents.

All those who were invited to the survey in 2019 and who were still alive and living in Denmark in mid-August 2020 were invited to participate in a follow-up survey in 2020. In all, 13,474 individuals were invited to the follow-up survey in 2020. Data were collected between early September 2020 and early November

2020. The same data methodology as in the 2019 wave was applied. However, three reminders were sent to those registered to use Digital Post and only one reminder was sent to those not registered. The background and design of the DHWS and the follow-up survey are described in detail elsewhere (Jensen, Thygesen, et al., 2022).

The questionnaire in both 2019 and 2020 included the standard questions on alcohol consumption from the EHIS model questionnaire (Eurostat., 2020). Thus, the following question was used to assess the frequency of alcohol intake in both waves: "In the past 12 months, how often have you had an alcoholic drink of any kind (e.g., beer, wine, spirits, premixes, liquor, etc.)?" The nine possible response categories were: (1) Every day or almost every day, (2) 5–6 days a week, (3) 3–4 days a week, (4) 1–2 days a week, (5) 2–3 days in a month, (6) once a month, (7) less than once a month, (8) not in the past 12 months, as I no longer drink alcohol, and (9) never, or only a few sips or trials, in my whole life. Inspired by the study of Rehm et al. (2008), respondents were grouped into four categories: (1) *consistent lifetime abstainers* (i.e., those who reported never drinking alcohol (except a few sips or trials) in both waves), (2) individuals who reported drinking at some point in their life in the 2019 survey (i.e., response categories 1–8) but reported never drinking alcohol in the follow-up survey in 2020 (defined as *inconsistent lifetime abstainers* in the present study), (3) *former drinkers* (i.e., those who reported no alcohol intake during the past 12 months in the follow-up survey), and (4) *current drinkers* (i.e., those who answered less than once a month or more frequently in the follow-up survey).

Binge drinking was assessed in both waves by the following question: 'In the past 12 months, how often have you had 5 or more standard drinks on one occasion?' The nine possible response categories were: (1) Every day or almost every day, (2) 5–6 days a week, (3) 3–4 days a week, (4) 1–2 days a week, (5) 2–3 days in a month, (6) once a month, (7) less than once a month, (8) not in the past 12 months, and (9) never in my whole life. Respondents were grouped into four categories: (1) consistent never binge drinking (i.e., those who reported never binge drinking in both waves), (2) individuals who reported binge drinking at some point in their life in the 2019 survey (i.e., response categories 1–8) but claimed that they never had binged in the follow-up survey in 2020 (defined as inconsistent never binge drinking), (3) previous binge drinkers (i.e., those who declared no binge drinking in the past 12 months in the follow-up survey), and (4) current binge drinkers (i.e., those who answered less than once a month or more frequently in the follow-up survey).

Information on alcohol-related morbidity was obtained from the Danish National Patient Register between January 1, 2008, and August 31, 2020. The register includes nationwide information on all hospital contacts, including emergency room and outpatient contacts (Lynge et al., 2011). Linkage of data on individual level was possible due to the unique personal identification number given to every resident of Denmark. The following ICD-10 codes were included: F10 (mental and behavioral disorders due to use of alcohol), K70 (alcoholic liver disease), G312 (degeneration of nervous

system due to alcohol), G621 (alcoholic polyneuropathy), G721 (alcoholic myopathy), I426 (alcoholic cardiomyopathy), K292 (alcoholic gastritis), K852 (alcohol induced acute pancreatitis) and K860 (alcohol-induced chronic pancreatitis). We decided to include only morbidity that were directly attributable to alcohol, but excessive alcohol use can also result in various other health conditions such as certain cancers. Information on sex, age, marital status and country of birth was obtained from the Danish Civil Registration System (Pedersen, 2011). Information on the highest level of completed education in 2019 was obtained from the Danish education registries and was categorized into the following groups: (1) Basic school, (2) upper secondary or vocational education, (3) higher education, and (4) no information.

Statistical analysis

Multinomial logistic regression models were used to estimate the association between baseline sociodemographic characteristics (sex, age, marital status, country of birth and highest level of completed education) and the four types of drinkers. Thus, three multinomial logistic regression models were used to investigate whether consistent lifetime abstainers differed in terms of baseline sociodemographic characteristics from inconsistent lifetime abstainers, former drinkers, and current drinkers, respectively. The three groups served as base categories in the regression models. The same analytical approach had been applied in a previous US study (Rehm et al., 2008). Hence, we are able to compare our present results with those published in the US study. Three multinomial logistic regression models were also used to examine if consistent never binge drinkers differed in terms of baseline sociodemographic characteristics from inconsistent never binge drinkers, former binge drinkers, and current binge drinkers, respectively. The results are presented as odds ratios (OR) with 95% confidence intervals (CI). Moreover, we report the prevalence of alcohol-related morbidity by self-reported alcohol and binge drinking habits, respectively, in 2020. In the present study, we did not apply weights to account for non-response, as our emphasis was on internal comparisons rather than estimating population prevalence estimates. All statistical analyses were performed using SAS Version 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

In all, 6629 individuals (47.4%) completed the questionnaire in 2019, out of which 6516 were still alive and living in Denmark at follow-up in 2020 (Figure 1). A total of 5000 individuals completed the questionnaire in both 2019 and 2020. Table 1 shows that respondents who completed both the baseline and follow-up assessment were older on average (55.2 years) than individuals in the baseline sample (48.3 years). Table 1 also shows that the respondents who completed both the baseline and follow-up assessment were more likely to be

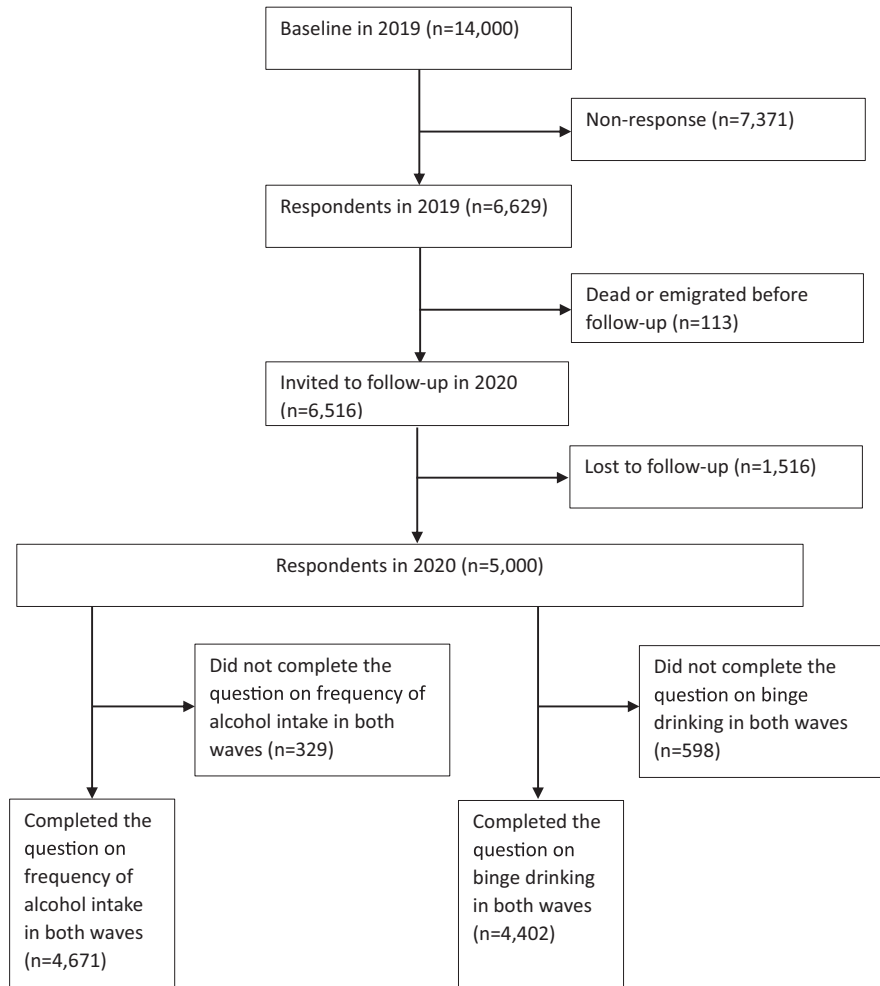


FIGURE 1 Longitudinal study flow diagram.

female, married, with a higher education, and born in Denmark than those who completed the baseline survey.

In total, 4671 individuals completed the question on frequency of alcohol intake in both waves (Table 2). In the follow-up survey in 2020, 252 individuals declared that they were lifetime abstainers, of which 140 individuals (55.6%) gave the same answer in 2019. Hence, 112 individuals (44.4%) had in 2019 reported drinking at some point in their life. Out of these 112 individuals, 11% reported that they had an alcohol drink at least 2–3 days in a month in the past 12 months (data not shown). Furthermore, 10%, 41% and 38% reported that had an alcohol drink once a month, less than once a month and not in the past 12 months, respectively. Consistent lifetime abstainers were on average younger (50.9 years) than the other respondents (Table 2). Furthermore, the table shows that roughly three out of four consistent and inconsistent lifetime abstainers were female.

Table 3 demonstrates that consistent lifetime abstainers had 1.88 (95% CI: 1.28–2.76) times higher odds of being female than current drinkers. Furthermore, the table shows that consistent lifetime abstainers were more likely to be younger than individuals in the other three categories. Consistent lifetime abstainers were also more likely to have a lower educational level than current drinkers

(basic school OR: 4.33, 95% CI: 2.72–6.87; upper secondary or vocational education OR: 1.99, 95% CI: 1.27–3.12). Table 3 also displays that consistent abstainers were more likely to not have been born in Denmark than inconsistent lifetime abstainers (OR: 2.24, 95% CI: 1.14–4.39) or current drinkers (OR: 6.83, 95% CI: 4.51–10.34), respectively.

Interestingly, 2.4% (6 out of 252) of the respondents who defined themselves as lifetime abstainers in 2020 had been diagnosed earlier with an alcohol-related health condition (Figure 2). The corresponding proportion among former and current drinkers was 5.6% and 1.2%, respectively. Further analyses revealed that the proportion was somewhat higher among current drinkers who reported drinking alcohol at least 5 days a week (2.5%) than among current drinkers drinking less frequently (0.8%) (data not shown).

Table 4 displays the sociodemographic characteristics of the four categories of binge drinking. In all, 4402 individuals completed the question on binge drinking in both waves. In the follow-up survey in 2020, 577 individuals declared that they never had five or more standard drinks on one occasion, out of which 348 (60.3%) had given identical answer in 2020. Thus, 229 individuals (39.7%) contradicted earlier reported binge drinking. Out of these, 5% reported that they

TABLE 1 Overview of the study population. Number of individuals and percentages.

	Baseline sample (2019)		Respondents (2019)		Respondents still alive and eligible at follow up (2020)		Respondents in both waves	
	n	%	n	%	n	%	n	%
All	14,000		6629		6516		5000	
Sex								
Men	6800	49.5	2861	43.2	2806	43.1	2086	41.7
Women	7200	50.5	3768	56.8	3710	56.9	2914	58.3
Marital status (in 2019)								
Married	6360	44.1	3637	54.9	3585	55.0	2938	58.8
Not married	7640	55.9	2992	45.1	2931	45.0	2062	41.2
Education (in 2019)								
Basic school	3848	27.5	1496	22.6	1469	22.5	1011	20.2
Upper secondary or vocational education	5576	39.8	2695	40.7	2652	40.7	2069	41.4
Higher education	4248	30.3	2360	35.6	2323	35.7	1876	37.5
No information	328	2.3	78	1.2	72	1.1	44	0.9
Country of birth								
Denmark	12,201	86.5	6084	91.8	5984	91.8	4648	93.0
Not born in Denmark	1799	5.8	545	4.1	532	4.1	352	3.8
Lifetime abstainer (in 2019)								
Yes	N/A		376	5.7	368	5.6	260	5.2
No	N/A		5908	89.1	5813	89.2	4600	92.0
No information	N/A		345	5.2	335	5.1	140	2.8
Never binge drinking (in 2019)								
Yes	N/A		805	12.1	791	12.1	607	12.1
No	N/A		5422	81.8	5334	81.9	4215	84.3
No information	N/A		402	6.1	391	6.0	178	2.7
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (in 2019)	48.3	19.85	53.1	18.87	53.1	18.87	55.2	17.75

had 5 or more standard drinks on one occasion at least 2–3 days a month (data not shown). Moreover, 5%, 31% and 59% reported that they had 5 or more standard drinks on one occasion once a month, less than once a month or not in the past 12 months, respectively. Consistent never binge drinkers were on average younger (58.9 years) than inconsistent never binge drinkers (62.4 years) and former binge drinkers (60.6 years), respectively, but older than current binge drinkers (53.5 years) (Table 4).

Consistent never binge drinkers had a higher odds of being female compared to the individuals in the other three categories (Table 5). For example, they had 3.80 (95% CI: 2.89–4.99) times higher odds of being female than current binge drinkers. They were also more likely to be older than current binge drinkers. Consistent never binge drinkers were also more likely to have basic school as highest completed education than individuals in the other three categories. Furthermore, they were more likely to not have been born in Denmark than individuals in the other three categories.

In 2020, 1.2% (7 of 578) of respondents who reported that they had never had 5 or more standard drinks on one occasion had been diagnosed with an alcohol-related health condition (Figure 2). The proportions were very similar among previous binge drinkers (0.8%) and current binge drinkers (1.2%).

DISCUSSION

In the present study, we aimed to examine the consistency of self-reported lifetime abstinence and never binge drinking. We hypothesized that we would observe a better consistency of lifetime abstinence than in previous studies given the short follow-up period in the present study. Moreover, we investigated the prevalence of alcohol-related morbidity among lifetime abstainers by linking the survey data to alcohol-related morbidity data in a national patient registry.

TABLE 2 Sociodemographic characteristics of the four types of drinkers (The Danish Health and Wellbeing Survey, 2019–2020).

	Consistent lifetime abstainers (n = 140)		Inconsistent lifetime abstainers (n = 112)		Previous drinkers (n = 144)		Current drinkers (n = 4275)	
	n	%	n	%	n	%	n	%
Sex								
Men	38	27.1	26	23.2	52	36.1	1825	42.7
Women	102	72.9	86	76.8	92	63.9	2450	57.3
Marital status								
Married	69	49.3	58	51.8	59	41.0	2594	60.7
Not married	71	50.7	54	48.2	85	59.0	1681	39.3
Education								
Basic school	53	37.9	39	34.8	43	29.9	791	18.5
Upper secondary or vocational education	54	38.6	48	42.9	65	45.1	1786	41.8
Higher education	33	23.6	25	22.3	36	25.0	1698	39.7
Country of birth								
Denmark	103	73.6	97	86.6	120	83.3	4034	94.4
Not born in Denmark	37	26.4	15	13.4	24	16.7	241	5.6
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	50.9	20.01	56.7	16.91	55.2	15.67	56.0	17.37

TABLE 3 Results from multinomial logistic regression models contrasting respondents who consistently reported lifetime abstinence compared with the remaining study population regarding sociodemographic factors (The Danish Health and Wellbeing Survey, 2019–2020).

	Consistent lifetime abstainers vs. inconsistent lifetime abstainers ^a		Consistent lifetime abstainers vs. previous drinkers ^a		Consistent lifetime abstainers vs. current drinkers ^a		p
	OR	95% CI	OR	95% CI	OR	95% CI	
Women	0.76	0.42–1.35	1.51	0.91–2.50	1.88	1.28–2.76	<0.0001
Age (years)	0.985	0.972–0.999	0.987	0.974–0.999	0.999	0.981–1.000	0.1186
Married	1.05	0.62–1.78	1.74	1.06–2.87	0.82	0.57–1.19	<0.0001
Basic school ^b	1.20	0.61–2.37	1.66	0.88–3.13	4.33	2.72–6.87	<0.0001
Upper secondary or vocational education ^b	0.98	0.51–1.89	1.07	0.58–1.95	1.99	1.27–3.12	
Not born in Denmark	2.24	1.14–4.39	1.72	0.95–3.11	6.83	4.51–10.34	<0.0001

^aBase category.

^bThe reference group is higher education.

Over half (55.6%) of self-reported lifetime abstainers in the follow-up survey were correctly classified as lifetime abstainers in both surveys. Compared with current drinkers, consistent lifetime abstainers were more likely to be women, to have a basic school or upper secondary or vocational education as highest completed education, and to have not been born in Denmark. Furthermore, they were younger than inconsistent lifetime abstainers and former drinkers and they were more likely to be married than former drinkers.

The level of inconsistency (44.4%) between the two survey waves is similar to those levels that have been reported in previous studies (Bell & Britton, 2015; Caldwell et al., 2006; Callinan et al., 2019; Rehm et al., 2008). Hence, the comparatively short follow-up period does

not seem to have had positive influence on the level of inconsistency and thereby not supporting our hypothesis. The US study by Rehm et al. (2008) found that consistent lifetime abstainers were more likely to be female than inconsistent lifetime abstainers. This finding could not be confirmed in the present study, but we did find that consistent lifetime abstainers were more likely to be female than current drinkers and that was in keeping with the US study. Furthermore, the US study found that, in comparison with former drinkers and current drinkers, consistent lifetime abstainers were more likely to be older. The results in the present study indicate that consistent lifetime abstainers are more likely to be younger than inconsistent lifetime abstainers and former drinkers, but no statistically significant difference was observed between consistent lifetime abstainers and

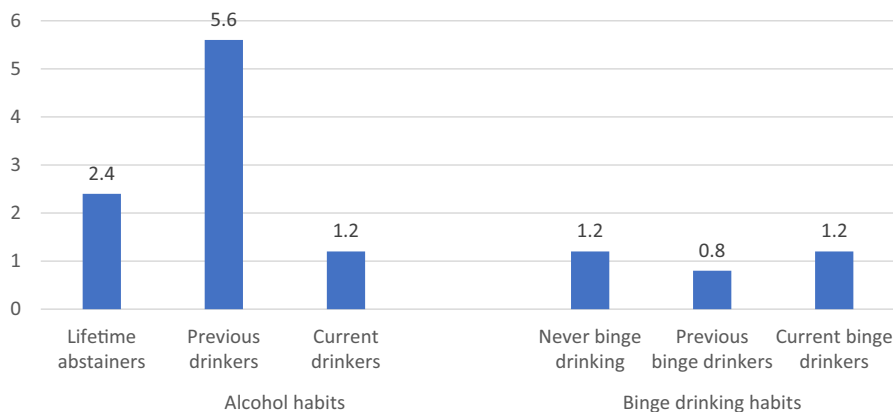


FIGURE 2 The proportion diagnosed with an alcohol-related condition by self-reported alcohol and binge drinking habits in 2020, respectively. Percentages.

TABLE 4 Sociodemographic characteristics of the four types of binge drinkers (The Danish Health and Wellbeing Survey, 2019–2020).

	Consistent never binge drinking (n = 348)		Inconsistent never binge drinking (n = 229)		Previous binge drinkers (n = 798)		Current binge drinkers (n = 3027)	
	n	%	n	%	n	%	n	%
Sex								
Men	75	21.6	75	32.8	233	29.2	1468	48.5
Women	273	78.4	154	67.2	565	70.8	1559	51.5
Marital status								
Married	196	56.3	151	65.9	489	61.3	1823	60.2
Not married	152	43.7	78	34.1	309	38.7	1204	39.8
Education								
Basic school	115	33.0	54	23.6	123	15.4	545	18.0
Upper secondary or vocational education	130	37.4	97	42.4	350	43.9	1261	41.7
Higher education	103	29.6	78	34.1	325	40.7	1221	40.3
Country of birth								
Denmark	285	81.9	212	92.6	744	93.2	2883	95.2
Not born in Denmark	63	18.1	17	7.4	54	6.8	144	4.8
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	58.9	19.47	62.4	15.10	60.6	15.76	53.5	17.24

current drinkers regarding age. There are similarities between the alcohol habits in Denmark and the US. For example, the recorded per capita (15+ years) alcohol consumption is similar in Denmark (9.32L of pure alcohol in 2018) and the US (8.93L in 2018) (World Health Organization, 2023a). Furthermore, the prevalence of lifetime abstainers was similar in 2016 (10.7% in Denmark and 9.2% in the US) (World Health Organization, 2023b). However, there are also differences regarding e.g., the prevalence of 12-month alcohol use, where Denmark has a markedly higher prevalence (85.4% in 2021, age 16+) than the US (69.5% in 2019, age 18+) (Jensen, Davidsen, et al., 2022; SAMHSA, Center for Behavioral Health Statistics and Quality, 2023). Furthermore, there are differences in ethnic and religious composition of these two countries. These differences might, at least partly,

explain some of the observed discrepancies in the characteristics of consistent lifetime abstainers between the two studies.

In concert with previous studies (Caldwell et al., 2006; Callinan et al., 2019; Rehm et al., 2008), we found that inconsistent lifetime abstainers reported a low frequency of alcohol intake in the first survey wave. This indicates that the impact on estimating associations between alcohol intake and health-related consequences probably is of minor importance since there is no distinct association between infrequent and low-quantity alcohol intake and chronic health outcomes (Rehm et al., 2008). However, and somewhat surprisingly, we found that one out of 40 lifetime abstainers in 2020 had an alcohol-related diagnosis. This finding suggests that misclassification of former heavy drinkers as lifetime abstainers is not negligible. Especially

TABLE 5 Results from multinomial logistic regression models contrasting respondents who consistently reported never binge drinking compared with the remaining study population regarding sociodemographic factors (The Danish Health and Wellbeing Survey, 2019–2020).

	Consistent never binge drinker vs. inconsistent never binge drinking ^a		Consistent never binge drinker vs. previous binge drinkers ^a		Consistent never binge drinker vs. current binge drinkers ^a		<i>p</i>
	OR	95% CI	OR	95% CI	OR	95% CI	
Women	1.65	1.13–2.42	1.46	1.08–1.98	3.80	2.89–4.99	<0.0001
Age (years)	0.991	0.980–1.001	0.996	0.988–1.004	1.027	1.020–1.034	<0.0001
Married	0.77	0.54–1.10	0.95	0.73–1.23	0.84	0.66–1.07	0.1712
Basic school ^b	1.89	1.21–2.96	3.47	2.45–4.91	2.91	2.15–3.94	<0.0001
Upper secondary or vocational education ^b	1.17	0.78–1.75	1.34	0.99–1.82	1.38	1.04–1.82	
Not born in Denmark	2.74	1.54–4.88	3.43	2.29–5.12	6.07	4.30–8.56	<0.0001

^aBase category.

^bThe reference group is higher education.

when keeping in mind that registry data only captures the most severe cases of alcohol-related morbidity.

There are some possible explanations for the inconsistency in responses. For instance, it is well known that re-interview decreases the willingness of previously symptomatic respondents to disclose sensitive or socially undesirable information (Fendrich & Rosenbaum, 2003; Jorm et al., 1989). Another reason for the inconsistencies might also be so simple that some respondents had forgotten that they had consumed alcohol. In this case, it seems plausible to assume that this only may be relevant for light drinkers, especially bearing in mind the short follow-up time.

Roughly 60% of those who declared in the follow-up survey that they never had five or more standard drinks on one occasion also gave the same answer at baseline. Compared with individuals in the other three categories (inconsistent lifetime abstainers, former drinkers, and current drinkers), consistent never binge drinkers were more likely to be women, having basic school as highest completed education and not to have been born in Denmark. In addition, they were more likely to be older and have an upper secondary or vocational education as highest completed education compared to current drinkers. Somewhat unexpectedly, the proportion of inconsistent responses (39.7%) was similar as for lifetime abstainers (44.4%). Additionally, the proportion of never binge drinkers who had been diagnosed with an alcohol-related health condition was the same (around 1%) as among former and current binge drinkers, respectively.

No direct comparisons with other studies were possible since this was the first study to examine the consistency of never binge drinking. Hence, further studies are needed to confirm our findings. A comparison of the consistency between lifetime abstainers and never binge drinking shows some interesting similarities, but also some differences. Besides the high proportion of inconsistent responses in both populations, the analyses, for example revealed that compared with current drinkers and current binge drinkers, respectively, both consistent lifetime abstainers and consistent never binge drinkers were more likely to be women, to have a basic school

or upper secondary or vocational education as highest completed education, and not to have been born in Denmark. On the other hand, consistent never binge drinkers were more likely to be older compared to current drinkers, while this was not observed for lifetime abstainers. These results seem plausible since binge drinking is most widespread in Danish adolescents and young adults, whereas the prevalence of 12-month alcohol use is similar in all age groups (Eurostat, 2024).

The strengths of the present study include its nationwide design, a relatively short follow-up time and the linkage of data from the Danish National Patient Register to survey data. The latter made it possible to examine the alcohol-related morbidity among respondents who described themselves as lifetime abstainers and never binge drinkers, respectively, and in that way, add another perspective to evaluating the consistency of a reference group of lifetime abstainers or never bingers. A possible limitation with the study is the relatively low response proportion in the first wave. However, in the present study, the main aim relates to consistency in self-reported lifetime use of alcohol and, thus, non-response bias is not likely to be an important threat to the validity and reliability. In addition, a high proportion (75.4%) of the respondents in the first wave also participated in the second wave of the survey. For the last decades, epidemiological survey research has been struggling with declining response proportions (Galea & Tracy, 2007), but in this case our research has benefitted from interested respondents willing to participate in the follow-up survey. Another possible limitation was that registry information on alcohol-related morbidity only was available for the period January 1, 2008, through August 31, 2020. Hence, respondents who had been diagnosed with an alcohol-related health condition before 2008 and with no subsequent alcohol-related diagnosis (including both primary diagnosis and secondary diagnosis), will be categorized as false negative. As a result, it is possible that we slightly underestimated the proportion of individuals who have been diagnosed with an alcohol-related health condition among

self-identified lifetime abstainers and respondents who reported that they had never had 5 or more standard drinks on one occasion, respectively.

CONCLUSIONS

The present study has revealed high levels of inconsistency for both lifetime abstinence (44.4%) and never binge drinking (39.7%), respectively. The level of inconsistency for lifetime abstinence was similar to those who have been observed in studies with much longer follow-up periods. Moreover, the results indicated that a non-negligible proportion of lifetime abstainers had been diagnosed with an alcohol-related health condition. Our study supports and elaborates on previous research on the difficulties of using lifetime abstainers as the reference group in epidemiological studies by demonstrating that some self-reported lifetime abstainers were found to suffer from alcohol-related morbidity. In fact, self-reported data on lifetime abstinence and never binge drinking should always be avoided or should be interpreted with caution.

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CONFLICT OF INTEREST STATEMENT

No conflicts of interest.

DATA AVAILABILITY STATEMENT

Research data cannot be shared. All data in the present study were analyzed on a secure research server at Statistics Denmark.

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