The reliability of personal alcohol consumption estimates in a working population

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Health and safety problems related to alcohol consumption represent a major concern in many businesses and consequently pre-employment questionnaires and workplace health promotion packages frequently contain questions seeking basic estimates of alcohol consumption. Although individuals with very heavy drinking patterns often attract much attention, on a population basis most morbidity is likely to arise from drinkers consuming above the recommended limits but not sufficient to result in gross occupational or social effects. This study reviews the research on the reliability of questionnaire techniques used to quantify alcohol consumption and compares the most valid retrospective interview based estimate of consumption, the time line follow-back (TLFB), with a prospective daily diary (DD) method in a working population. The DD method was acceptable and produced significantly higher estimates of consumption and for 'normal' subjects gave consistent estimates of ±10 units/week over several weeks. Appropriate questionnaire design is discussed and the use of a DD method in health promotion activities recommended.

Key words: Alcohol; consumption and occupation.

INTRODUCTION

Epidemiological studies have shown an association between chronic alcohol consumption levels and the risk of long-term physical harm, such as hypertension, cirrhosis, and psychosocial effects. This has led to official recommended maximum weekly consumption limits for men and women. There is some disagreement between official bodies in the UK as to where these levels should be set. Current BMA recommendations for 'low' risk drinking are a maximum of 14 units of alcohol/week for women and 21 units/week for men, with levels exceeding these being 'intermediate' risk and levels in excess of 35 units/week and 50 units/week respectively considered 'high risk'. Abstinence or control of drinking within such accepted limits are also required for the return of driving licences following withdrawal for drink-driving offences committed by Group 1 and 2 licence holders.

Excessive alcohol consumption is common in the UK with survey data indicating that 11% of women and 27% of men exceed medically acceptable limits. Four percent of the population in England and Wales, and 8% in Scotland are thought to be 'problem' drinkers in whom excessive consumption has led to financial, legal, relationship or occupational problems. In the workplace excessive consumption is a major cause of increased short-term ('Monday morning') and long-term absence, accident rates, injuries and impaired performance. These costs and the effect of alcohol on staff welfare have been recognized by the majority of large employers in the UK who have introduced alcohol policies to curtail consumption and intoxication at work—often on official advice.

The diagnostic difficulties involved in the identification of the ambulant problem drinker are well recognized. Denial and evasion make direct questioning about consumption levels unreliable and the commonly used biomarkers of alcohol consumption, e.g. gamma glutamyl transferase (GGT) and erythrocyte mean cell volume (MCV), have limited sensitivity and specificity in this group. A survey of workers with known drinking problems reported that 50% believed they had been able to disguise any sign of the problem at work (including hangovers) for a year or more following onset, 30% for 3 years or more and 22% for 5 years or more. A longitudinal epidemiological study of construction workers with elevated GGT and aspartate transaminase (AST), initially deemed fit for work following clinical examination, found that such workers had a significantly
The 'preventative paradox' for occupational health and safety professionals is that, although heavy drinkers are most at risk from alcohol-related workplace accidents, the moderately heavy drinking group, being the largest of the heavy drinking categories, account for the majority of such accidents. The bulk of the increased mortality from alcohol-related disorders has also been shown to come from this 'intermediate' group of drinkers. If the drinking habits of the intermediate and high risk groups were reduced to that of the next lowest risk level it is estimated that 90 lives would be saved per 10,000 of the population in 10 years in the intermediate group, compared to 30 lives in the high risk band. Workers in the intermediate consumption group may experience no adverse occupational or health effects initially. Other than the opportunistic finding of elevated GGT or MCV in such workers, only systematic enquiry is likely to uncover this risk factor. Consequently, occupational health (OH) services frequently attempt to formally assess alcohol consumption as part of health promotion initiatives and on pre-employment health declaration forms.

The most common technique used to assess consumption is by 'aggregate estimate' in which the respondents summarize their recent drinking pattern. In its most basic form, and probably most commonly employed in occupational health, is the question 'How much alcohol on average do you consume per week?'. This often leaves the employee to convert consumption into units (where 1 unit = 10 g alcohol) themselves. Research has found this method may be less likely to suffer errors of recall than TLFB but may still be prone to underestimating consumption when compared to more sophisticated questionnaire techniques. Examples of the latter, believed to give an accurate estimate of consumption over time, are retrospective diaries such as the timeline follow-back (TLFB) in which a reviewer asks the patient to recall what was drunk on each day of a specified time period. A calendar and significant personal and national news events, such as birthday parties or meeting with friends, are used to 'anchor' recall. It is likely that this approach too is prone to error.

It may be that a diary of alcohol consumption, completed on a contemporaneous basis, may provide a reasonably accurate estimate of alcohol consumption. This method may be less likely to suffer errors of recall than TLFB but may still be prone to underestimating consumption if subjects complete the diary inaccurately.

This study was undertaken to assess and compare the reliability of personal alcohol consumption estimates. Further involvement in the study was not mentioned at the initial recruitment but two sub-groups were subsequently formed. These represented a broad range of consumption levels and participants who were invited to complete a further 2-week daily diary (DD). When commencing DDs no attempt was made to exclude periods including Bank Holidays, annual leave or anticipated episodes of 'unusually' heavy consumption such as social gatherings.

The specific beverage and quantity consumed was recorded with reference to 'units of alcohol' on each day. Volumes of wine were estimated as the number of 125/150/200 ml glasses or number or fractions of 750 ml bottles. The strength of wine was assumed to be 11–12% but if less than this, the actual strength was recorded. Free-poured spirits were assumed to be doubles. Such beverage-specific questions have been found to result in much higher estimates of consumption (47%) than global questionnaires.

On completion, the information in the diary was converted to units of alcohol by using standard Health Education Authority (HEA) alcoholic beverage strength tables.

Further involvement in the study was not mentioned at the initial recruitment but two sub-groups were subsequently formed. These represented a broad range of consumption levels and participants who were invited to complete a further 2-week daily diary (15 female, four male), or to undergo a structured interview with the investigator to complete a TLFB retrospective assessment of consumption (15 female, five male). Restricting recall to the preceding week has been found to misclassify a significant number of subjects, due to short-term variation in the consumption of alcohol, so TLFB was completed for the 2-week period of consumption documented by the DD, within 8 weeks of the diary being completed.

RESULTS

Figure 1 illustrates the alcohol consumption in the 42 female and 24 male volunteers for the study, as estimated

**Figure 1.** Average weekly alcohol consumption derived from 2-week daily diaries (DDs). (■), males; (▲), females.
by the first 2-week diary period that they all completed. Approximately 50% of female and 33% of male volunteers exceeded current recommended limits for weekly alcohol intake.

Comparison of the two 2-week drinking diaries

Nineteen volunteers (15 female, four male) completed two 2-week diary periods with an average of 10.2 weeks from the first day of the first diary to the first day of the second. Figure 2 illustrates the relationship between the alcohol consumption recorded on the first and second 2-week diaries. The first daily diaries had a mean of 51.5 units and median of 46.0 units. The subsequent diary had a mean of 49.2 units and median of 45.0 units. The mean difference between the second and first estimates was -2.37 (95% CI -7.56 to 2.82) suggesting consistency in estimates generated by 2-week diaries separated by several months.

The standard deviation of the differences (SD) of the paired data was 10.75, giving 95% limits of agreement for an individual of -23.87 to 19.13. For individual readings over a 1-week period this would equate to 95% limits of agreement of -11.94 to 9.57 units of alcohol.

Comparison of a 2-week diary against TLFB

Twenty volunteers (15 female, five male) were enrolled with an average of 5.6 weeks from the day of recall to the first day of the diary period (range, 3 weeks 3 days to 8 weeks). Figure 3 illustrates the relationship between the alcohol consumption recorded on the first 2-week diary compared to that recalled for the same period several weeks later. The first daily diaries had a mean of 41.1 units and median of 33.5 units. The subsequent TLFB, recalling consumption for the same period, had a mean of 32.9 units and median of 27.5 units. The mean difference between the DD and TLFB was -8.20 (95% CI -16.25 to -0.14), suggesting TLFB gives a significantly lower mean estimate of consumption, suggesting either it underestimates true consumption or DD overestimates true consumption. Although neither method could be validated against actual consumption, it is likely that the TLFB method underestimated consumption rather than the DD overestimating. This would be consistent with epidemiological surveys that have found retrospective assessments of consumption in large representative populations underestimate official sales figures for alcohol by up to 70%. The significant degree of underestimation of consumption using TLFB in this study occurred when all volunteers had already kept a diary of this period, that the TLFB method is considered the most valid retrospective alcohol consumption assessment tool, and all subjects were well motivated participants. It is possible that without the preceding daily diary, estimated consumption may have been even lower.

Most of the volunteers independently suggested they record consumption directly as units of alcohol. Most were aware of HEA advice that a 125 ml glass of wine contains 1 unit and a pint of beer/cider/lager 2 units. This is true for 9% wine and 3.2–3.4% beer only, but both are now less commonly drunk in the UK in favour of premium beers (typically 4.1–5.2%) and French and New World wines (typically 11–12%). This could result in underestimations of consumption of between 33–100% in this study group for whom these trends were clear. The proliferation of 'Alco-pops' and other novel presentations also potentially complicates consumption assessments by occupational health staff, unfamiliar with their alcoholic content.

This study has highlighted the apparent high prevalence of potentially harmful alcohol consumption in an otherwise healthy working population and the difficulties...
in identifying those at risk. However, health promotion programmes in the workplace often specifically attempt to identify such early-phase heavy drinking, in order to institute cost-effective treatments in the form of brief intervention at a stage when alcohol-related harm is reversible. Some health promotion packages consist of a questionnaire posted to workers and subsequently returned for analysis. Instead of including retrospective quantity/frequency assessments of consumption on the questionnaire, a 2-week daily diary of consumption prior to counselling through occupational health, would provide clinically significant higher estimates of alcohol consumption which appear to closely reflect long-term drinking habits and to be acceptable to patients.

Previously published data show that basic quantity/frequency assessments of alcohol consumption, such as those used on pre-employment health declarations, are likely to significantly underestimate consumption even where they are answered in good faith. More sophisticated quantity/frequency estimates have been found to result in significantly higher estimates of consumption but require more extensive questioning and will still give relatively low estimates. Results from such questionnaire items should be interpreted accordingly.

The self-reported assessment of consumption from employees with alcohol problems, undergoing treatment or as part of management of attendance consultations, will remain unreliable for a proportion of workers no matter what assessment method is chosen, due to denial or evasion. The traditional biomarkers of alcoholism are unreliable in the ambulant heavy drinker, yet to develop end-organ damage and the development of reliable biomarkers for consumption will prove invaluable in these cases by avoiding recall bias and error. Novel markers such as carbohydrate deficient transferrin and acetaldehyde adducts of haemoglobin may prove to show a sufficiently close association with consumption to fulfill these requirements. The use of the DD to estimate consumption in validation studies in working populations is therefore recommended.

REFERENCES