



Alcohol misuse and functional impairment in the UK Armed Forces: A population-based study

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ABSTRACT

Aim: To assess whether alcohol misuse was associated with functional impairment in the military, and whether an association between any of the measures of alcohol misuse and impairment would be explained by psychiatric comorbidity.

Design: Large cross-sectional study.

Participants: 8585 responders of a random sample of the regular United Kingdom Armed Forces who completed a questionnaire in 2005 were included in the analyses.

Measurements: Five items of the Short Form Questionnaire-36 (SF-36) specifically dealing with functional impairment, and the main independent variable was alcohol misuse based on the Alcohol Use Disorders Identification Test (AUDIT).

Findings: An AUDIT score of ≥ 20 was consistently associated with impairment with odds ratios between 1.8 (95% confidence interval 1.4–2.3) and 3.7 (2.8–4.8). AUDIT scores < 20 did not increase impairment. Those with a hazardous pattern of drinking (AUDIT score 8–15) perceived their functioning to be better than those with an AUDIT score < 8 . A score indicating alcohol dependence was associated with impairment, as, to a lesser extent, was alcohol related-harm. Binge drinking was not associated with impairment. Half of those with an AUDIT score of ≥ 20 had psychological comorbidities.

Conclusion: Perception of impairment was mainly related to those with an AUDIT score of ≥ 20 or more, those who had an indication of alcohol dependence or alcohol related-harm. Intervention on an individual basis should be focused on these groups, while effective public health interventions could be enhanced for everyone.

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1. Introduction

Alcohol misuse is common in the UK and US Armed Forces (Bray et al., 2006; Fear et al., 2007; Hooper et al., 2008; Jacobson et al., 2008) and its prevalence is higher in military than general population (Fear et al., 2007). Most studies on alcohol misuse in the military have shown an association between alcohol misuse and mental illness in terms of mood disorders and posttraumatic stress disorder (PTSD) (Corrigan and Cole, 2008). Alcohol misuse has been shown to increase following military deployments in cross-sectional (Hoge et al., 2006; Milliken et al., 2007) and longitudinal studies (Hooper et al., 2008; Jacobson et al., 2008). There are few military based studies which have assessed the relationship between drinking behaviour and health related quality of life (HRQL), including functional impairment. A study showed a marked positive trend between drinking levels and productivity loss in the

US Armed Forces (Bray et al., 2006). Another study, conducted in ex-service personnel with a mean age of 64 years accessing health services at Veteran Administration facilities, showed a relationship between alcohol dependence and HRQL mainly explained by other psychiatric disorders (Kalman et al., 2004). A study using the Vietnam Era Twin Registry showed that differences in HRQL between discordant twins in relation to alcoholism were explained by socio-economic characteristics and comorbidity (Romeis et al., 1999). The low number of studies in this area is surprising as HRQL measurements in drinkers are essential to monitor the consequences of alcohol misuse (Peters et al., 2003) and that operational effectiveness of military personnel is of paramount importance.

HRQL is a multidimensional subjective measure which includes physical, psychological, social and occupational wellbeing (Donovan et al., 2005). The majority of the studies which have assessed the relationship between alcohol and functional impairment using HRQL scales have been based on patients seeking treatment for alcohol problems (Donovan et al., 2005; Morgan et al., 2003; Smith and Larson, 2003; Stein et al., 1998) or from primary care studies (Spitzer et al., 1995; Volk et al., 1997). A large population study in civilians found that heavy drinkers had lower

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HRQL than other groups of drinkers (Okoro et al., 2004). Such a finding is not unexpected considering that alcohol misuse impinges on many areas of daily living (Babor et al., 2001). However, although it has been found that alcohol dependent subjects have a degree of functional impairment (Donovan et al., 2005; Stein et al., 1998; Volk et al., 1997), studies on alcohol abusers (Volk et al., 1997), or a combined group, including alcohol abusers and alcohol dependents (Spitzer et al., 1995), have not demonstrated an association with HRQL. It has been suggested that impairment in alcoholics is mainly due to psychiatric comorbidity (Romeis et al., 1999; Johnson et al., 1995). However, as a psychiatric comorbidity could precede or follow alcohol misuse (Corrigan and Cole, 2008), it is uncertain whether a psychiatric comorbidity is a confounding or explanatory factor in these studies.

In this paper we report the results from a study conducted between 2004 and 2006 of UK Armed Forces personnel who were in service at the time of the Iraq War in 2003 (Hotopf et al., 2006). We assessed alcohol problems using the Alcohol Use Disorder Identification Test (AUDIT), and we collected information about functional impairment using five items of the Short Form-36 (SF-36) which assess occupational and social limitations (Ware et al., 1993).

The main aim of the current study was to assess the relationship between alcohol misuse and functional impairment and whether this association, if present, was restricted to particular types of alcohol misuse such as binge drinking, alcohol dependence or alcohol related-harm. A second aim was to assess whether associations between any of the measures of alcohol misuse and functional impairment would be accounted for by PTSD and psychological distress, a proxy for common mental illness.

2. Methods

2.1. Study sample

The study was based on a cohort study of UK Armed Forces personnel comparing the health of those who participated in TELIC 1 (the codename used by the UK military for the major combat phase of the Iraq war between 18th January and 28th April 2003) with an era group selected from those who did not participate in TELIC 1 but were serving in the military at that time (Hotopf et al., 2006). We surveyed a random sample stratified by Service and enlistment type (regular, reserve). Those sampled were contacted regardless of whether they had since left the Armed Forces. Data were collected via a self-completion questionnaire which participants could complete during a base visit or by post. Non-responders received two further mailings and were further traced through their units, or for those who left the services through electoral registers, telephone directories, or the National Strategic Tracing Service. In total, 3936 regular personnel who were deployed on TELIC 1 and 4750 who were in the era sample completed a questionnaire. 101 regulars were excluded because they did not respond to the questions on impairment or the AUDIT. The overall response rate was 61%. Further details can be found elsewhere (Hotopf et al., 2006). In total 8585 regulars were available for analyses, but denominators varied in the analyses as indicated in the tables because some items in the questionnaire were not completed.

2.2. Measurements

We used the AUDIT to assess alcohol problems. This is a 10-item questionnaire, which describes the pattern of drinking in terms of a total score which can be broken down into scores of less than 8, 8–15 denoting hazardous drinking, 16–19 suggesting the need of continued monitoring and brief counselling, and 20 or more warranting further diagnostic evaluation for alcohol dependence. Additionally three separate domains can be assessed: alcohol consumption at hazardous levels, alcohol dependence and the alcohol related-harm in the last 12 months. In addition to total score, possible dependence (score 4–12) and possible alcohol related-harm (score 4–16) we included a binge drinking measure defined as endorsing consumption of 6 or more units of alcohol on one occasion weekly or daily/almost daily. We used this definition, as it is part of the AUDIT questionnaire and is the nearest to the Office for National Statistics definition of eight units for men and six for women on the heaviest drinking day in the last week (Health and Social Care Information Centre (NHS), 2009). As a standard unit of alcohol in the United Kingdom is 8 g of ethanol, the minimal level of binge drinking in our study corresponds to 48 g at least once week. The standard drink in the United States would correspond to 14 g thus the definition of binge drinking of 5 drinks in a session commonly used in the US would correspond to 70 g of alcohol in a ses-

sion, but the frequency of bingeing could be lower than in our study (Stahre et al., 2009).

We did not include in the analysis the alcohol consumption domain because it is highly correlated with the AUDIT total score.

We assessed comorbidity using the 17-item National Center for Post Traumatic Stress Disorder Checklist (PCL-C) as a measure of PTSD symptoms (Blanchard et al., 1996), and the general health questionnaire-12 (GHQ-12) as a measure of psychological distress (Goldberg and Williams, 1988). A score of 50 or more for the PCL defined PTSD caseness and a score of 4 or more for the GHQ-12 defined psychological distress. We used five questions from the SF-36 that specifically assessed functional impairment as separate items, one item of physical or emotional problems interfering with normal social activities with family, friends, neighbours, or groups, and four items of problems with work or other regular activities as a result of physical health (Ware et al., 1993). We did not include in the questionnaire the SF-36 items which explored less vigorous activities, as we expected that their relevance was low in active military personnel. We also excluded three items on role-emotional and one on social functioning from the SF-36 because they partially overlapped with the chosen five items, there was a major pressure for space in the questionnaire and the items chosen were consistent with the items included in our previous studies (Unwin et al., 1999).

2.3. Statistical analyses

We assessed the level of impairment for each of the four alcohol variables: total AUDIT score in four categories (less than 8, 8–15, 16–19 and 20 or over); and binge drinking, alcohol dependence and alcohol related-harm, as binary variables. Multiple logistic regressions were carried out separately for each of the five SF-36 items with each of the alcohol use variables as independent variable. Each analysis was adjusted for age, sex, rank, education, marital status, Service (Naval Services, Army, and Royal Air Force) and serving status (in service/left service). Further adjustments were carried out adding to the models PCL and GHQ caseness to assess whether psychiatric comorbidities could explain a possible association between each of the alcohol problem outcomes and functional impairment. The number of participants varied slightly between logistic regression analyses as some participants did not complete an item of impairment/and/or an item of the AUDIT questionnaire. However, within an analysis the number of participants remained the same for both the model adjusting for Service and demographic factors, and the model in which psychiatric comorbidities were added. We initially carried out the analysis separately for women and men, but the pattern of results was similar and the degree of statistical inference in women was relatively poor because of low numbers for some of the alcohol variables. The model adequacy was assessed using a specification test and goodness of fit with the Hosmer and Lemeshow test (Vittinoff et al., 2005).

2.4. Ethical approval

The study received ethical approval from the Ministry of Defence (Navy) personnel research ethics committee and the King's College Hospital local research ethics committee.

3. Results

3.1. Description of drinking by socio-demographic and service characteristics

The median and inter-quartile range (IQR) for the AUDIT score was 9 (6–13), for alcohol related-harm score 0 (0–1) and for alcohol dependence 1 (0–3), and the means were 10.2, 0.8 and 2.0 respectively. All the distributions were skewed to the right. 8.4% of the participants had AUDIT scores of 16–19 and 6.9% had a score of 20 or more. 46% of the participants endorsed binge drinking behaviours, 23% had scores compatible with alcohol related-harm and 6.1% with alcohol dependence. 56.7% of those with an AUDIT score of 20 or more were also in the alcohol dependence group. Table 1 shows socio-demographic and service characteristics of the sample in relation to each of the alcohol use variables. Higher AUDIT scores, alcohol related-harm and alcohol dependence were more common in younger Service personnel, lower ranks, Army personnel, those whose highest level of education was General Certificate of Secondary Education (GCSE) or equivalent, single people, and GHQ and PTSD positive cases. Binge drinkers shared similar characteristics with those in the lower categories of AUDIT score. Positive GHQ and PTSD cases were more likely to be in the groups with higher AUDIT score and the alcohol dependence group.

Table 1

Socio-demographic and military characteristics by AUDIT score, binge drinking, alcohol related-harm and alcohol dependence. Regular personnel, men and women combined (N = 8561–8585).

	Total AUDIT score				Binge drinking ^a N = 3998 (47%)	Alcohol related-harm ^a N = 1996 (23%)	Alcohol dependence ^a N = 531 (6%)
	<8 N = 2984 (35%)	8–15 N = 4220 (49%)	16–19 N = 729 (9%)	20 or more N = 628 (7%)			
Male	2610 (87%)	3923 (93%)	690 (95%)	603 (96%)	3769 (94%)	1879 (94%)	497 (94%)
Age							
<25	309 (10%)	798 (19%)	205 (28%)	262 (42%)	979 (24%)	614 (31%)	208 (39%)
25–29	455 (15%)	896 (21%)	231 (32%)	158 (25%)	949 (24%)	525 (26%)	138 (26%)
30–34	644 (22%)	977 (23%)	137 (19%)	104 (17%)	832 (21%)	391 (20%)	90 (17%)
35–39	706 (24%)	860 (20%)	88 (12%)	68 (11%)	672 (17%)	258 (13%)	63 (12%)
40 or more	870 (29%)	689 (16%)	68 (9%)	36 (6%)	566 (14%)	208 (10%)	32 (6%)
Rank							
Other	378 (13%)	725 (17%)	192 (27%)	225 (36%)	852 (21%)	552 (28%)	183 (35%)
NCO	1808 (61%)	2791 (67%)	464 (64%)	372 (60%)	2568 (65%)	1220 (62%)	319 (61%)
Officer	776 (26%)	674 (16%)	67 (9%)	24 (4%)	550 (14%)	202 (10%)	22 (4%)
Service							
Naval Services	487 (16%)	767 (18%)	144 (20%)	108 (17%)	708 (18%)	352 (18%)	98 (18%)
Army	1750 (59%)	2610 (62%)	472 (65%)	454 (72%)	2564 (64%)	1337 (67%)	378 (71%)
RAF	747 (25%)	843 (20%)	113 (16%)	66 (11%)	726 (18%)	307 (15%)	55 (10%)
Currently serving	2642 (89%)	3820 (91%)	662 (91%)	545 (87%)	3603 (91%)	1777 (89%)	460 (87%)
Educational status							
No qualifications	206 (7%)	313 (8%)	63 (9%)	63 (10%)	320 (8%)	179 (9%)	64 (13%)
Usual compulsory qualifications at 16	1051 (38%)	1855 (46%)	336 (48%)	338 (56%)	1827 (48%)	961 (50%)	275 (54%)
Advanced levels	858 (31%)	1201 (30%)	215 (31%)	170 (28%)	1120 (29%)	550 (29%)	137 (27%)
Degree	673 (24%)	659 (16%)	81 (12%)	34 (6%)	564 (15%)	221 (12%)	32 (6%)
Marital status							
Married/cohabiting	2589 (87%)	3227 (77%)	456 (63%)	369 (59%)	2739 (69%)	1330 (67%)	308 (58%)
Single	241 (8%)	724 (17%)	215 (30%)	211 (34%)	970 (24%)	529 (27%)	173 (33%)
Previously married	149 (5%)	258 (6%)	55 (8%)	46 (7%)	277 (7%)	132 (7%)	48 (9%)
GHQ case	479 (16%)	728 (17%)	194 (27%)	275 (44%)	852 (21%)	616 (31%)	225 (43%)
PCL case	77 (3%)	95 (2%)	35 (5%)	115 (18%)	189 (9%)	173 (9%)	90 (17%)

Data are number (%); NCO: non-commissioned officer.

^a Binge drinking, alcohol related-harm and alcohol dependence are separate domains scored independently from the total AUDIT score, cases may overlap for these domains in contrast to the categories of the total score.

3.2. AUDIT scores and AUDIT domains by functional impairment

Those with an AUDIT score of 20 or more and those in the dependence group had the highest relative frequency for each item of impairment (Table 2). There was also a moderate increase in relative frequency in the alcohol related-harm group. Impairment levels were similar in the binge drinkers and those with lower AUDIT scores. In general those who fell into the more severe alcohol problem groups (AUDIT score of 20 or more, alcohol dependence and alcohol related-harm) were clustered at the lower end of scores for inclusion in each group, i.e. 75% of the participants in the AUDIT 20 or over group had a score between 21 and 26 (possible range 20–40), in the alcohol related-harm score between 4 and 8 (possible range for being a case 4–16), in the dependence domain between 4 and 6 (possible range for being a case 4–12).

3.3. The associations between AUDIT scores and AUDIT domains, and functional impairment

AUDIT score of 20 or more, alcohol related-harm and alcohol dependence were consistently associated with the five impairment items (Table 3). The effect sizes were highest in relation to the item “physical and emotional problems interfere with social activities” than the other items which are restricted to physical health only. The effect sizes were moderate for AUDIT score of 20 or more and for alcohol dependence (if an odds ratio (OR) of between two and four is defined as moderate) whereas the effect size for alcohol related-harm was small. Binge drinking and AUDIT score 16–19 were not associated with functional impairment. There was some evidence

that those in the AUDIT score of 8–15, usually defined as hazardous drinking, perceived less functional impairment than the reference group (AUDIT score < 8).

Further adjustment for psychological distress and PTSD case-ness greatly decreased the level of association between the alcohol measures and impairment (Table 4). However, there were still residual associations between alcohol dependence and the impairment items and, to a lesser extent, an AUDIT score of 20 or more and impairment.

We carried out an analysis to assess the OR change when the threshold of alcohol related-harm was increased from four to six or to eight. The OR with the item “physical and emotional problems interfere with social activity” increased from the value in Table 3 to OR 2.57 (95% CI 2.11–3.13) with a threshold of six and 3.44 (95% CI 2.72–4.37) with a threshold of eight. Adjustment for PTSD and GHQ-12 reduced the associations to 1.37 (95% CI 1.09–1.72) and 1.75 (95% CI 1.33–2.31) respectively. The percentage of personnel included with a threshold of six decreased to 731 (9%) and with a threshold of eight to 539 (6%).

4. Discussion

This is the first large survey of a random sample to assess the association between alcohol misuse and functional impairment in the UK Armed Forces. Functional impairment is important in the military because it comprises a young population required to meet high standards of fitness needed for service duties and to perform roles demanding alertness and rapid response to situations which may be new and often unusual. There were clear

Table 2
Functional impairment according to alcohol problem. Regular personnel, men and women combined (N = 8206–8534).

	N (%) impaired	Total AUDIT score				Binge drinking ^a N = 3998	Alcohol related-harm ^a N = 1996	Dependence ^a N = 531
		<8 N = 2984	8–15 N = 4220	16–19 N = 729	20 or more N = 628			
Health interfered social life (binary ^b)	745 (9%)	221 (8%)	300 (7%)	68 (9%)	146 (24%)	369 (9%)	262 (13%)	108 (21%)
Cut down time on work/other activities (yes)	946 (12%)	332 (12%)	381 (9%)	90 (13%)	129 (22%)	438 (12%)	284 (15%)	120 (24%)
Accomplished less than would like (yes)	1731 (21%)	591 (21%)	737 (18%)	166 (24%)	223 (38%)	793 (21%)	529 (28%)	183 (37%)
Limited in type of work (yes)	1415 (17%)	508 (18%)	622 (15%)	116 (17%)	158 (27%)	638 (17%)	389 (21%)	131 (27%)
Difficulty performing work (yes)	1376 (17%)	470 (17%)	608 (15%)	120 (17%)	166 (28%)	630 (17%)	405 (21%)	135 (27%)

^a Binge drinking, alcohol related-harm and alcohol dependence are separate domains scored independently from the total AUDIT score, cases may overlap for these domains in contrast to the categories of the total score.

^b Quite a bit or extremely

Table 3
Multiple logistic regression for the association between alcohol use and functional impairment, odds ratios (OR) and 95% confidence intervals (CI).

	Physical and emotional problems interfere with social activities (binary) OR (95% CI) N = 7299–7319 ^a	Cut down time on work because of physical health OR (95% CI) N = 7030–7049 ^a	Accomplished less because of physical health OR (95% CI) N = 7068–7084 ^a	Limited in kind of work because of physical health OR (95% CI) N = 7048–7067 ^a	Difficulty performing work because of physical health OR (95% CI) N = 7041–7058 ^a
AUDIT score					
<8	1.0	1.0	1.0	1.0	1.0
8–15	0.96 (0.79–1.17)	0.82 (0.69–0.97)	0.87 (0.77–1.00)	0.91 (0.79–1.05)	0.95 (0.82–1.09)
16–19	1.29 (0.95–1.76)	1.22 (0.93–1.59)	1.22 (0.98–1.51)	1.01 (0.79–1.28)	1.17 (0.92–1.48)
≥20	3.69 (2.84–4.80)	2.19 (1.70–2.83)	2.37 (1.92–2.92)	1.79 (1.42–2.25)	2.21 (1.75–2.77)
Binge drinking	1.09 (0.93–1.29)	1.02 (0.88–1.18)	0.96 (0.85–1.07)	0.99 (0.87–1.12)	1.01 (0.89–1.15)
Alcohol related-harm	1.88 (1.58–2.23)	1.58 (1.34–1.86)	1.69 (1.48–1.92)	1.38 (1.19–1.59)	1.59 (1.38–1.83)
Dependence	2.75 (2.15–3.51)	2.69 (2.12–3.40)	2.30 (1.88–2.82)	1.79 (1.43–2.24)	2.08 (1.67–2.60)

Adjusted for age, sex, rank, marital status, education, Service, serving/discharged.

^a The number of participants varied according to the range provided for each analysis because of missing data for each analysis.

indications, that alcohol dependence and, to a lesser degree, a high AUDIT score (20 or more) and alcohol related-harm were associated with functional impairment. However, binge drinking and an AUDIT score below 20 were not positively associated with impairment, if anything those in the hazardous drinking group (AUDIT 8–15) perceived less impairment than those who had a score of <8. Much of the perceived association between having an AUDIT score of 20 or more and alcohol dependence, and impairment were explained by psychological distress and PTSD. Our results show that alcohol misuse is an important health problem in the UK Armed Forces because approximately a tenth of the sample had either an AUDIT score of 20 or more, or an indication of alcohol dependence which was consistently associated with functional impairment, and this group would increase to a quarter if we also include the alcohol related-harm group. Nearly half of those with an AUDIT score of 20 or more or alcohol dependence had a possible psychiatric comorbidity.

Our results are consistent with studies carried out in primary care settings, specialised outpatient clinics and general population-based studies which have shown that alcohol dependence, regardless of the measurement instrument, is associated with impairment (Kalman et al., 2004; Romeis et al., 1999; Smith and Larson, 2003; Stein et al., 1998; Volk et al., 1997). An exception is a study from a primary care setting which seemed to have low statistical power to assess the relationship (Johnson et al., 1995). Our study makes a further contribution as it demonstrates that even scores at the lower extreme of dependence in the AUDIT scale, such as those seen in our study, are associated with functional impairment.

An AUDIT score of 20 or more also identified a fairly large group who perceive themselves as having functional impairment. We used a four category analysis related to the AUDIT score following the approach recommended by WHO (Babor et al., 2001), as it has the advantage of linking the identification and management of

Table 4
Multiple logistic regression of alcohol use and functional impairment outcomes adjusting additionally for possible psychiatric morbidity.

	Physical and emotional problems interfere with social activities (binary) OR (95% CI) N = 7299–7319 ^a	Cut down time on work because of physical health OR (95% CI) N = 7030–7049 ^a	Accomplished less because of physical health OR (95% CI) N = 7068–7084 ^a	Limited in kind of work because of physical health OR (95% CI) N = 7048–7067 ^a	Difficulty performing work because of physical health OR (95% CI) N = 7041–7058 ^a
AUDIT score					
<8	1.0	1.0	1.0	1.0	1.0
8–15	0.96 (0.78–1.18)	0.81 (0.68–0.96)	0.84 (0.73–0.96)	0.90 (0.78–1.04)	0.93 (0.80–1.08)
16–19	0.98 (0.70–1.37)	1.02 (0.77–1.35)	0.97 (0.77–1.23)	0.85 (0.67–1.10)	0.96 (0.74–1.23)
≥20	1.73 (1.28–2.32)	1.29 (0.98–1.70)	1.33 (1.04–1.68)	1.11 (0.87–1.42)	1.26 (0.97–1.62)
Binge drinking	0.99 (0.83–1.19)	0.99 (0.83–1.13)	0.89 (0.79–1.01)	0.94 (0.83–1.07)	0.96 (0.84–1.09)
Alcohol related-harm	1.17 (0.96–1.42)	1.18 (0.99–1.40)	1.25 (1.09–1.44)	1.07 (0.92–1.24)	1.17 (1.00–1.37)
Dependence	1.42 (1.07–1.89)	1.80 (1.39–2.32)	1.45 (1.15–1.82)	1.23 (0.96–1.56)	1.31 (1.02–1.67)

Adjusted for age, sex, rank, marital status, education, Service, serving/discharged, GHQ case and PCL case.

^a The number of participants varied according to the range provided for each analysis because of missing data for each analysis.

harmful drinking and alcohol dependence (Babor et al., 2001; Room et al., 2005). Our study demonstrated that those with an AUDIT score of 20 or more are not only more likely to have functional impairment but also that psychiatric morbidities are more common in this group. These characteristics were not observed in the other AUDIT score groups suggestive of alcohol misuse. It is possible that the reason for our findings is that a major component of the total score in these two groups is related to the amount and pattern of alcohol consumption rather than to the consequences of drinking. This would explain why the AUDIT 8–15 and 16–19 score groups were not more likely to perceive functional impairment than the reference group, and this would be in agreement with studies which have reported lack of association between alcohol misuse and functional impairment (Donovan et al., 2005; Volk et al., 1997; Johnson et al., 1995).

Our study was consistent with previous reports (Romeis et al., 1999; Johnson et al., 1995), as it demonstrates that psychiatric comorbidities made a major contribution to the association between impairment and alcohol misuse outcomes. This can be inferred from our study by the marked decrease of the association between impairment and outcomes after adjusting for psychiatric comorbidity in terms of high GHQ-12 scores and PTSD caseness.

It was unexpected that binge drinking, a behaviour which is widespread in the UK Armed Forces, was not associated with functional impairment. Other researchers have reported impairment associated with binge drinking in the general population (Babor et al., 2001; Volk et al., 1997) and recently in US military personnel (Stahre et al., 2009). The contrast between our study and the study of Stahre et al. (2009) is the more intriguing because both studies were based on random samples of Armed Forces personnel. The prevalence of binge drinking in the study of Stahre et al. (2009) was 43.2%, similar to our study (47%), but their threshold of binge drinking was lower as it was required to binge once in a month in contrast to once a week in our study. The relevant effect size in their study, e.g. job performance problems, was OR 6.5 in contrast to no effect in our study. A possible explanation for the difference is that the questions on functional impairment in our study were in a separate section from those exploring drinking behaviour whereas the study of the US military linked work performance directly to drinking. The majority of those endorsing a binge drinking pattern in our study drank six or more units in one session on a weekly basis rather than on a daily basis. Within the military culture and to a great extent among British youngsters to drink six units on one occasion is common. Impairment may be related to binge drinking but at a higher threshold of units per session than we were able to use. In future studies, it would be advisable to extend the binge drinking item to include a category with greater number of units per session to define bingeing. For the majority of Service personnel categorised as binge drinking, functional impairment does not appear to be a problem.

This was a large study of the UK Armed Forces. The rank and sex relative frequencies in our study were similar to those in the regular Armed Forces as a whole. The Army was overrepresented in our study because they were overrepresented in TELIC 1, and the mean age in our study was 33 years in contrast to 30 years in the total UK regular Armed Forces, but the population mean includes personnel in training who were not eligible for our sample as they were not deployable (Defence Analytical Services and Advice, 2003). The response rate was satisfactory given that a large percentage of the sample was made up of young, male, low socio-economic personnel, and we know that these groups are notoriously reluctant to complete questionnaires (Hotopf et al., 2006; Ryan et al., 2007). As we were interested in assessing the association between two phenomena occurring concurrently, alcohol misuse and functional impairment, the cross-sectional design of this study should not

affect the validity of the results. Furthermore, it was not our intention to examine whether alcohol misuse preceded or followed other psychological symptoms.

It is possible that participants provided inaccurate records of their alcohol drinking behaviour, but given the high prevalence of alcohol misuse reported in this sample it is unlikely that many participants would have hidden their drinking behaviour. It has been shown that the AUDIT is an accurate and valid instrument (Babor et al., 2001; Allen et al., 1997), and a study found high validity of self-reported drinking measures in US Army personnel (Bell et al., 2003). Our measures of impairment are subjective. It does not indicate the extent to which the participants' views on their functionality are shared by others in their unit or by their commanding officers. We would argue, however, that a person's own perception of their functioning would be a better determinant of willingness to address a drink problem.

The WHO advises that any person with an AUDIT score of eight or more may benefit from a brief or more prolonged intervention according to the AUDIT score (Babor et al., 2001; Room et al., 2005). Such an approach would include two-thirds of the UK Armed Forces and is impractical within existing resources. For the great majority, judicious use of policies which create an environment that discourage problem drinking, impose greater controls on the availability and price of alcohol and encourages commanders to use disciplinary measures where appropriate would seem the preferable resource efficient options (Academy of Medical Sciences, 2004; Bell et al., 2003; Fear et al., 2007; Room et al., 2005). Our study would provide support for an alternative and manageable intervention algorithm. We suggest that because there is a definite threshold in the association with an AUDIT score, in the first instance, assessment and management of individuals should be concentrated on those with an AUDIT score of 20 or more and those with an indication of alcohol dependence symptoms; this would amount to around 9% of Armed Forces personnel. This group may be willing to undergo treatment because they perceive that alcohol misuse has an impact on their work and social functioning. Furthermore many of them may also be suffering from common mental disorders and/or PTSD (Corrigan and Cole, 2008; Donovan et al., 2005; Johnson et al., 1995; Kalman et al., 2004; Romeis et al., 1999). This management approach would provide the opportunity for tackling simultaneously alcohol problems and mood disorders (Kalman et al., 2004). If more resources were available, another group that could benefit from management at the individual level is the alcohol related-harm group. We were able to demonstrate some impairment in this group, but the percentage which would need to be managed would increase to approximately a quarter of the UK Armed Forces. It would be a more feasible option to increase the threshold for caseness in the alcohol related-harm category. For example, a threshold of eight in the alcohol related-harm domain greatly increases the association with impairment and would include six percent of our study group, two third of whom are not dependent or do not have a total AUDIT score of 20 or more. The underlying paradigm of our recommendation is that personnel sufficiently concerned about their drinking problem are more likely to respond to a brief intervention (Kaner et al., 2007; Wilk et al., 1997). Our recommendation is also underpinned by the finding that universal screening in general practice does not seem an effective mean to reduce excessive alcohol use (Beich et al., 2003), probably because awareness of a functional impairment may be a precursor for willingness to be treated. Our suggestions would have a greater chance of success if barriers to accessing care, such as stigma are overcome.

In conclusion alcohol dependence and a total AUDIT score of 20 or more are associated with functional impairment and other psychiatric morbidities. Given the extent of alcohol misuse in the UK Armed Forces, our findings may help to target resources effi-

ciently to tackle the effects of drinking behaviours which are likely to impinge on the effectiveness and preparedness of the Armed Forces at a time of high demand.

Conflict of interest

Simon Wessely is Honorary Civilian Consultant Advisor to the British Army. All the other authors declare that they have no conflict of interests.

Role of funding source

The study was funded by the UK Ministry of Defence (MOD). Although MOD has facilitated data collection, they have had no input in the hypotheses under study, design, analysis, writing, interpretation or in the decision to submit the paper for publication.

Contributors

Roberto J. Rona, Nicola T. Fear, Matthew Hotopf and Simon Wessely as principal investigators planned the study and oversaw the conduct of it. Roberto Rona designed the analysis and wrote the paper. Margaret Jones collected data, carried out the analyses, and helped to write the paper. Nicola T. Fear discussed the approach, helped with the analysis, and made comments to the drafts. Lisa Hull coordinated the study, was involved in the planning of it, and made comments to the drafts. Matthew Hotopf and Simon Wessely made comments on the analysis and the drafts. All the authors have approved the final manuscript.

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