Life in and after the Armed Forces: social networks and mental health in the UK military

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Abstract   This study focuses on the influence of structural aspects of social integration (social networks and social participation outside work) on mental health (common mental disorders (CMD), that is, depression and anxiety symptoms, post-traumatic stress disorder (PTSD) symptoms and alcohol misuse). This study examines differences in levels of social integration and associations between social integration and mental health among service leavers and personnel still in service. Data were collected from regular serving personnel ($n = 6511$) and regular service leavers ($n = 1753$), from a representative cohort study of the Armed Forces in the UK. We found that service leavers reported less social participation outside work and a general disengagement with military social contacts in comparison to serving personnel. Service leavers were more likely to report CMD and PTSD symptoms. The increased risk of CMD but not PTSD symptoms, was partially accounted for by the reduced levels of social integration among the service leavers. Maintaining social networks in which most members are still in the military is associated with alcohol misuse for both groups, but it is related to CMD and PTSD symptoms for service leavers only.

Keywords: social networks, service leavers, military, mental health, veterans

Introduction

Moving from military to civilian status is a major life transition for all who have served in the Armed Forces. Approximately 20,000 personnel leave the UK Armed Forces annually and have to negotiate the process of re-integration into civilian life (Defence Analytical Services and Advice, 2011). While a minority of service leavers will face a range of social and mental health-related problems (Iversen *et al.* 2011), all service leavers have to navigate new and changing civilian and military social experiences, resources and networks. The influence of this social transition on mental health among service leavers continues to be an issue for both

academic research and policymakers (Adler *et al.* 2011, Li *et al.* 2011, Ministry of Defence, 2007, Woodhead *et al.* 2011).

Social integration and mental health

The concept of social integration is at the core of understanding how social ties can affect mental health. Following the lead of Durkheim (1951) and Bott (1957), the term social integration commonly refers to involvement with and attachment to others by participation in social organisations and social activities. It links conceptually participation in social activities, embeddedness in social networks and access to various types of social support (Brissette *et al.* 2000, Lin *et al.* 1999). Further, the availability of social support is influenced by the nature, size and density of social networks, and it is through social networks that various types of social support (for example, emotional and instrumental) are accessed (Lin *et al.* 1999, Scott 1988).

The association between less social participation, social isolation via smaller social networks, fewer close relationships and depressive symptoms is well established in non-military samples (Barnett and Gotlib 1988, Kawachi and Berkman 2001, Lin *et al.* 1999). The impact of social networks on health is not random, but varies by gender, socioeconomic status, age and stage in the life course (Hatch and Wadsworth 2008, Kawachi and Berkman 2001). Social networks provide a structure that shapes patterns and standards of behaviour through which sources of information are shared and social support is offered. It is also within social networks that norms and beliefs are shared among the network's members. Equally important is the context in which social networks arise, and the ways in which social networks are embedded in and influenced by social institutions (Kawachi and Berkman 2001). While joining the military has been noted as a potentially protective turning point for life course trajectories in the development of social bonds and social control (Laub and Sampson 2001), it is unclear how the transition from the military back to civilian life influences social integration and impacts on mental health.

Social networks and life transitions

Life transitions generally denote exit from one role and entry into another or a significant redefinition in an individual's role or status (Wheaton 1990). While transitions are often considered as single events, they encompass a sequence of role and status changes that vary by timing and nature which may have mental health consequences (Clarke *et al.* 2011, Wheaton 1990). In addition, transitions vary along several dimensions, such as their importance, predictability, the nature of the role in the transition (for example, the initiator of a divorce) and the level of volition that are likely to result in different mental health outcomes (Wheaton 1990).

At the group level, transitions contribute significantly to restructuring and redefining social networks over the life course (Wheaton 1990). Commonly experienced transitions include changes in relationships with kin (marriage/cohabitation, childrearing, children leaving home, divorce or widowhood), employment changes (acquiring a new job or unemployment), as well as residential changes and mobility (Suitor and Keeton 1997, Wellman *et al.* 1997, Wheaton, 1990). While marital change has been identified as having the greatest impact on changes in social networks, aging is also a notable mode of change that is often accompanied by the instability of close network ties with few ties remaining over time (Wellman *et al.* 1997). However, modes of change are often interrelated (for example, employment change may be related to residential change, marital or cohabitation may be related to residential

and employment change) and it is difficult to determine which has the most influential impact on social networks (Wellman *et al.* 1997).

An underlying premise of social network research is homophily, defined as a preference for interacting with others with similar attributes (Brissette *et al.* 2000, Goldenberg, 1984, Lazarsfeld and Merton 1954, McPherson *et al.* 2001). Theories of homophily suggest that status changes following a life transition are likely to lead to significant changes in social networks, specifically as a result of new status-related identity development and different reference groups (Suitor and Keeton 1997). New ties characterised by shared values and life experiences generate additional sources of emotional social support (Suitor *et al.* 1995, Suitor and Keeton 1997). However, status-based transitions (for example, following educational attainment, divorce or marriage) also involve a decrease in perceptions of similarity with existing social network members and thus, have long-term negative consequences for existing ties (Suitor and Keeton, 1997, Wellman *et al.* 1997).

Related to, but distinct from, homophily is the influence of social structures and processes on how individuals alter their behaviour and beliefs to become more similar to their reference group (Feld 1982, Feld and Grofman 2009, Podolny and Baron 1997). Further, organisations or social institutions are likely to use social control and collective identity to create densely knit networks to enact both processes (that is, encouraging interactions with others with similar attributes and actively altering one's behaviour and beliefs to increase such similarity) (Wellman *et al.* 1997). While transitions tend to reduce intimacy levels between ties (that is, how close a person feels to a network member) or end relationships, high structural embeddedness (that is, the extent of interactions in a group) increases the likelihood that ties will be sustained following transitions (Feld 1981, Wellman *et al.* 1997). Structural embeddedness can be characterised by both strong and weak ties (Feld 1981). Although the existence and persistence of strong ties are an obvious focus in this research area, the persistence of a large number of weak ties (for example, informal, infrequently accessed ties) has been shown to be valuable as a source of key information about available opportunities or access to individuals in decision-making positions (Granovetter 1973). Numerous weak ties can increase chances of mobility into and within social institutions and occupational organisations (Lin *et al.* 1981, Podolny and Baron, 1997). However, little is known about the persistence of weaker ties following life transitions.

Social influences of the military institution
Social institutions such as the military have been described as both total and greedy institutions, making extensive demands with high expectations and impacting on multiple life domains, such as work, family and social relationships outside work (Coser 1974, Dandeker *et al.* 2003, Segal and Harris 1993). As an institution, the military is structured to achieve the development of a strong military identity and internal group cohesion that will sustain the motivation to engage in combat and ensure a workforce capable of engaging in war; the ultimate purpose of any armed force (Wessely 2006). This is achieved by instilling distinct traditions and rituals within its own culture, requiring a unique duty of care (including the provision of internal health care and legal systems) and job requirements (for example, deployments and often frequent relocations) (Moskos 1986, Moskos and Wood 1988). This level of institutionalism is further engrained within what Coser (1974) termed as an important characteristic of greedy institutions; namely that they rely on voluntary compliance and exert pressure for members to break ties with other institutions or individuals who might make conflicting demands. Alternative conceptions of the dynamic interrelationship between the military and civilian society have explored two models of the military, institutional and occupational (Moskos 1986). The former refers to the characteristics described above, while

the latter, among other factors, denotes a shift to prioritising self-interest rather than collective interest and having salient reference groups that are external to the military, which in turn has implications for levels of social integration.

Notwithstanding trends away from an institutional format towards a civilian occupational model (see Moskos 1986) and debates about the extent to which the military can combine elements of both models (see Segal 1986), the military remains a unique example of an institution that demands a higher level of social integration than other organisations as part of its purpose and excludes those who do not integrate at the training stage, but ensure that military personnel voluntarily or involuntarily break those ties after a finite number of years. Leaving the military breaks these social ties either partially or completely. Although there are many ways (via reunions, regimental associations, commemorations, close friendships and family links) by which some service leavers seek to maintain these ties over time, it is likely that for many they will weaken. This loss of social embeddedness and group cohesion is often difficult to bear and is said to impede the successful transition and re-integration into civilian life (Dandeker *et al.* 2003). Thus, social integration, particularly how connected or isolated one is from a variety of civilian and military/ex-military networks, and the presence or absence of mental health problems provide the focus of the present study.

Studies of the relationship between social networks and health generally test one of two theoretical models: (i) the stress buffering model, which refers to social support as a buffer of the effects of stress on health and (ii) the main effects model, which focuses on position in the broader social structure as having a direct influence on behaviour such as engagement in social activities and the generation of meaningful roles and behaviour within social networks that may benefit health (Cohen 2004, Cohen and Wills 1985, Lin *et al.* 1999, Turner and Turner 1999). The main effects model has received little attention in research on the mental health of military populations. This is despite the fact that social participation and networks are particularly important for understanding the behavioural (active engagement) and cognitive (sense of communality and role identity) structural basis for social support as protective factors in relationship to health (Cohen, 2004, House *et al.* 1988, Lin *et al.* 1999).

In response to this identified gap in the literature, this study has the following aims: (i) to determine differences in social participation outside work, social networks and mental health between service leavers and still serving personnel; (ii) to examine associations between social networks and mental health among service leavers and still serving personnel. We focus on the available mental health outcomes: symptoms of common mental disorder (CMD), alcohol misuse and post-traumatic stress disorder (PTSD) symptoms. In this article, the term service leavers refer to members of the Armed Forces who have completed basic training and have now left, whether they have been deployed or not. The UK uses the most inclusive definition of veteran of any Western nation (Dandeker *et al.* 2006). Service leavers (also referred to as ex-service personnel and veterans[1]) are defined as those who have left military employment having served for more than 1 day. This inclusive definition of veteran status allows for an evaluation of social inclusion on a wider scale than in many other countries (Dandeker *et al.* 2006).

Methods

Study design and participants

This study utilised data collected by the self-completion of questionnaires as part of the second phase of a UK-based cohort study that was designed to monitor the physical and mental health of a representative sample of UK Armed Forces personnel. Phase 1 of the

study began in 2003 to monitor the health of individuals who had taken part in the initial invasion of Iraq (Hotopf *et al.* 2006). Phase 2 was conceived in response to the continued operations in Iraq and the addition of the major UK deployment to Afghanistan. The phase 2 sample was supplemented by two new groups, which resulted in the inclusion of data from three sources: 9395 participants from phase 1 (a randomly selected group of deployed and non-deployed personnel from the 2003 Iraq war); 1789 randomly selected personnel who had been deployed to Afghanistan between April 2006 and April 2007; and a replenishment sample of 6628 randomly selected individuals who had joined the UK Armed Forces since the phase 1 cohort was recruited in 2003, the inclusion of which aimed to maintain the representativeness of the cohort. Data collection for phase 2 began in November 2007 and ended in September 2009, with non-responders actively followed up with repeat mailings, base visits and intensive tracing involving telephone contact where possible (Fear *et al.* 2010). Data were collected during visits to bases within and outside the UK. To increase quality control, data were double entered, with inconsistencies examined by multiple raters, and a consensus was taken after review. Further details of data collection procedures and participants are described elsewhere (Fear *et al.* 2010). Completed study questionnaires were returned by 9984 participants, resulting in a response rate of 56 per cent. As previously reported, response was associated with older age, being female, being an officer and being a member of the regular Forces (Fear *et al.* 2010). Non-response at phase 2 was previously shown to be related to practical issues such as difficulty in tracing individuals or apathy, and crucially not associated with mental health status (PTSD symptoms, CMD or alcohol misuse) at phase 1 (Fear *et al.* 2010) or social integration indicators. The response rate in this sample is comparable to or higher than other longitudinal studies of military personnel (Riviere *et al.* 2011).

The cohort study of UK military personnel was approved by the UK Ministry of Defence research ethics committee and King's College Hospital's local research ethics committee. The UK Ministry of Defence funded this study but had no role in the study design, data analyses or data interpretation. This was made clear to all participants.

Measures of mental health
All participants were asked to complete a series of validated measures of mental health symptoms. Symptoms of CMD were measured using the 12-item general health questionnaire (GHQ-12) (Goldberg and Williams 1988). These include symptoms of anxiety and depression, with a cut-off for caseness of four or more (Goldberg *et al.* 1997, 1998). Symptoms consistent with post-traumatic stress disorder (PTSD) were identified using the 17-item National Centre for PTSD checklist, with PTSD symptoms defined by a score of 50 or more (Weathers *et al.* 1994). Alcohol use was assessed using the 10-item World Health Organization alcohol use disorders identification test (Babor *et al.* 2001). This is a validated and widely used measure of potential alcohol misuse, with scores of 16 or more indicating level of consumption that is likely to be harmful to health (Babor *et al.* 2001).

Measures of social integration
Social participation was indicated by the number of social organisations respondents belonged to or activities they regularly engaged in outside work. Ten possible activities were provided: team sports or outdoor pursuits, further education, religious gatherings, social or hobby-related clubs, voluntary services, visiting friends or family, going to pubs or clubs, going to sporting events with friends, going to the gym with friends or other activities. All responses, including those in the other category, were summed, with a higher score indicating more social participation (range from 0 to 10). Social network size referred to the number of

close friends or relatives whom respondents met or talked to on a regular basis. Response categories were as follows: none, 1–2, 3–5, 6–10, 11–15, more than 15. Categories representing six or more social network members were grouped into a single category to improve the distribution of the indicator. Social participation and social network size items were based on existing measures (for example, Hatch and Wadsworth 2008, Lin *et al.* 1999). Participants were also asked if most people they socialised with were involved in the military (yes/no). To establish relationship status, participants indicated whether they were currently married, living with a partner, in a long-term relationship, single and not in a long-term relationship, separated, widowed or divorced. We hypothesised that having a partner would influence the level of social integration, and therefore the latter responses were recategorised to indicate that they were single and not in a relationship.

Other measures
Information on potential confounders including gender, age, rank, service branch (Naval Service [the Royal Navy and the Royal Marines], Army or the Royal Air Force), length of service (self-reported time in service as regular and reservist personnel) and deployment status (no deployment versus deployed) was also collected.

Statistical analysis
All analyses were conducted using STATA version 11 software (StataCorp 2009). As experiences of social integration and transitions between military and civilian life among reservist personnel are different from regular personnel, in part due to frequent transitions from military to civilian life (Browne *et al.* 2007, Harvey *et al.* 2011), we excluded reservists (500 among the service leavers and 1196 among the serving personnel) from this study. Analyses were weighted to take into account the sample type (follow up, deployed to Afghanistan or replenishment) and predictors of non-response (including gender, rank, engagement type, age, sample and the interaction between sample and engagement type). All tables include unweighted frequencies and weighted percentages.

Univariable and multivariable regression analyses were carried out to identify differences in social integration and mental health between service leavers and serving personnel. We used linear regression to estimate the differences in the number of social activities outside work, ordered logistic regression to estimate differences across social network size categories and multinomial logistic regression for differences across relationship status categories in comparison to being single and not in a long-term relationship. Logistic regression was used to estimate differences in the proportion of respondents, indicating that most of their social network members are still serving in the Armed Forces, as well as CMD and alcohol misuse mental health outcomes. Due to the small number of PTSD cases, symptoms of PTSD were examined as a score using negative binomial regression. Unadjusted and adjusted incidence rate ratios (IRR) and 95% CI are shown for models. All full models for social integration factors were adjusted for the following potential confounders: gender, age (as a continuous variable), rank, service branch, deployment status and length of service (as a continuous variable). For the analysis of mental health outcomes, the following models were estimated: model 1 is unadjusted; model 2 adjusts for the potential confounders listed above; model 3 further adjusts for social integration factors and model 4 further adjusts for interaction terms between service leaver status and social integration indicators. Where appropriate, predicted probabilities were assessed and tests for trends were conducted for the final models. There were 1753 service leavers and 6511 serving personnel in the sample; the analysis was conducted on those with complete data for all variables.

Results

Sample description

The comparisons of characteristics of service leavers and serving personnel are presented in Table 1. Of the 8264 regular personnel in this analysis, 25.6 per cent ($n = 1753$) had left the military at the time of the completion of the questionnaire. Service leavers were older on average than serving personnel and 20.5 per cent of the service leavers and 58.6 per cent of the serving personnel had been deployed by phase 2 of this study. The average length of service was 17.1 years among service leavers and 14.1 years among serving personnel.

Social integration comparisons

Table 2 shows that, in comparison to serving personnel, service leavers reported they participated in fewer social activities outside work, even after adjusting for social characteristics and other potential confounders (model 2). The predicted mean number of social activities outside work was 2.84 for service leavers and 3.28 for serving personnel in the fully adjusted model (not shown). Service leavers were also more likely to have smaller social networks, but this difference was attenuated in the fully adjusted model. Service leavers also

Table 1 *Description of service leavers and serving regular military personnel*

	Frequency[a] service leavers (n = 1753) (n, %)	Serving personnel (n = 6511) (n, %)	P-value[b]
Gender			
Male	1569 (90.4)	5836 (90.8)	
Female	184 (9.6)	675 (9.2)	0.66
Age at questionnaire completion (years), mean ($\pm$ SD)	38.1 years ($\pm$9.9)	32.7 years ($\pm$8.1)	< 0.0001
$\leq$ 25 years	154 (7.4)	1332 (15.3)	< 0.0001
25 to 29 years	346 (20.4)	1463 (21.4)	
30 to 34 years	234 (12.1)	1176 (18.9)	< 0.0001
35 to 39 years	154 (8.2)	1295 (22.8)	
$\geq$ 40 years	865 (51.8)	1245 (21.5)	
Rank			
Officer	313 (15.9)	1468 (20.2)	
Non-commissioned officer	1038 (62.1)	3590 (62.1)	< 0.0001
Other rank	402 (22.0)	1453 (17.6)	
Service branch			
Royal Marine	53 (2.2)	257 (3.1)	
Royal Navy	289 (17.7)	778 (13.4)	
Army	1031 (58.7)	4097 (63.1)	= 0.0001
Royal Air Force	380 (21.4)	1379 (20.4)	
Deployment status			
No deployment	1322 (79.5)	2460 (41.4)	
Deployed	431 (20.5)	4051 (58.6)	< 0.0001
Length of service (years) mean ($\pm$SD)	17.1 years ($\pm$9.1)	14.1 years ($\pm$8.3)	< 0.0001

Note: numbers may not add to totals due to missing data. [a] Percentages are adjusted to take account of the sample and response weights; [b] Pearson χ^2 test corrected for sample and response weights. Student's *t*-test used when testing for difference in mean age and length of service.

Table 2 *Identifying differences in social integration between service leavers and still serving personnel[a]*

Outcome	Model 1 B[b] (95% CI for B)	Model 2 B (95% CI for B)
Social participation (number of social activities)	−0.61 (−0.70 to −0.52)***	−0.44 (−0.55 to −0.34)***
Social network size	ORb (95% CI) 0.79 (0.71–0.89)***	OR (95% CI) 0.92 (0.81–1.05)
Mostly socialise with those who are still in the military	OR[b] (95% CI) 0.15 (0.13–0.17)***	OR (95% CI) 0.17 (0.15–0.20)***

Relationship status
  Single, not in long-term
  relationship
	RRR[b] (95% CI)
	1.00 (reference)
		RRR (95% CI)
		1.00 (reference)

In a long-term relationship	0.61 (0.47–0.79)***	0.78 (0.59–1.04)
Living with partner	2.44 (1.98–3.00)***	2.72 (2.15–3.45)***
Married	1.14 (0.97–1.32)	0.77 (0.63–0.95)*

*$P < 0.01$; ***$P < 0.001$. a service leavers = 1; [b]B, linear regression coefficient; RRR = relative risk ratios from multinomial logistic regression; OR = proportional odds ratios of comparing service leavers with serving personnel on social network size using ordered logistic regression and odds ratio of comparison for majority military social network from binary logistic regression. Model 1 is unadjusted; model 2 includes adjustments for gender, age (as continuous variable), rank, service, length of service and deployment status

had social networks with fewer members still serving in the Armed Forces, with a predicted probability of 18.4 per cent for service leavers and 56.7 per cent for serving personnel in the fully adjusted model. In comparison to being single and not in a relationship, service leavers were more likely to report living with a partner (predicted probability of 22.1 per cent for service leavers and 7.9 per cent for serving personnel) and less likely to report being married than serving personnel (predicted probability of 50.4 per cent for service leavers and 63.6 per cent for serving personnel) in the fully adjusted model.

Social integration and mental health outcomes

Service leaver status was associated with CMD in Table 3. The predicted probability of CMD for service leavers was 22.1 and 18.9 per cent for serving personnel in model 1, with no notable change in model 2 (not shown). This association was fully attenuated by the social integration indicators in model 3. Less engagement in social activities outside work and a smaller social network size were associated with CMD in the fully adjusted model. The predicted probability of CMD was 38.3 per cent for those reporting no social network members, 28.1 per cent for those reporting one to two members, 18.5 per cent for those reporting three to five members and 13.1 per cent for those reporting six or more members (not shown). Moreover, there was evidence of a gradient for social network size ($P < 0.001$). In comparison to those not in a relationship, being in a relationship of any kind decreased the likelihood of CMD in model 3. The predicted probabilities for CMD was 23.3 per cent for those not in a relationship, 19.8 per cent for those in a long-term relationship, 18.5 per cent for those living with a partner and 15.2 per cent for those who reported being married (not shown). Only the inverse association between being married and CMD persisted in model 4. There was no association between having a network with most members in the military and CMD in model 3, but the significant interaction term added to model 4

Table 3 *Social networks and symptoms of common mental disorder among service leavers and serving personnel*

	Common mental disorder[a]			
	Model 1	Model 2	Model 3	Model 4
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[b]	Adjusted OR (95% CI)[b]	Adjusted OR (95% CI)[b]
Service status (1 = service leaver)	1.21 (1.05–1.41)**	1.28 (1.08–1.51)**	1.12 (0.92–1.35)	1.67 (0.94–2.96)
Social participation (no. of social activities)			0.85 (0.81–0.89)***	0.86 (0.82–0.91)***
Social network size				
None			4.02 (2.84–5.70)***	3.38 (2.21–5.17)***
1–2			2.65 (2.17–3.23)***	2.73 (2.18–3.41)***
3–5			1.48 (1.25–1.75)***	1.55 (1.28–1.86)***
6 or more			1.00 (reference)	1.00 (reference)
Mostly socialise with those who are still in the military				
Yes			0.93 (0.80–1.07)	0.86 (0.74–1.01)
No			1.00 (reference)	1.00 (reference)
Relationship status				
Single, not in long-term relationship			1.00 (reference)	1.00 (reference)
In a long-term relationship			0.76 (0.60–0.96)*	0.82 (0.64–1.05)
Living with partner			0.70 (0.55–0.89)**	0.76 (0.56–1.03)
Married			0.57 (0.48–0.68)***	0.63 (0.51–0.77)***
Interactions				
Service leaver × social participation				0.94 (0.84–1.06)
Service leaver × no social network				1.56 (0.72–3.40)
Service leaver × 1–2 social network size				0.89 (0.56–1.43)
Service leaver × 3–5 social network size				0.84 (0.56–1.26)

Table 3 *(Continued)*

| | Common mental disorder[a] | | | |
| | Model 1 | Model 2 | Model 3 | Model 4 |
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[b]	Adjusted OR (95% CI)[b]	Adjusted OR (95% CI)[b]
Service leaver × military social network				1.50 (1.01–2.23)*
Service leaver × long-term relationship				0.67 (0.34–1.33)
Service leaver × living with partner				0.71 (0.42–1.20)
Service leaver × married				0.69 (0.47–1.03)

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$. Odds ratios (OR) and 95% confidence intervals (CI) take account of sample and response weights. [a]Common mental disorder defined by a total GHQ-12 score of 4 or more. [b]Models 2–4 include further adjustments for gender, age (as continuous variable), rank, service, length of service and deployment status

indicated that service leavers with a network in which most members were in the military had increased odds of CMD in comparison to serving personnel ($P = 0.046$). This association was not found in subsequent stratified analysis (not shown).

Service leavers were more likely than serving personnel to have higher PTSD symptom scores (Table 4). The predicted probability of higher PTSD symptom scores was 8.5 per cent for service leavers and 6.2 per cent for serving personnel in model 1 (not shown). This association was not attenuated in models 2 and 3. However, the predicted probability of higher PTSD symptoms decreased in model 3 after adjustment for social integration factors to 7.6 per cent for service leavers and 5.8 per cent for serving personnel (not shown). In model 3 social participation and social networks size were inversely associated with this outcome and there was evidence of gradients across categories for social network size ($P < 0.001$, respectively). The predicted probability of higher PTSD symptoms was 11.8 per cent for those who reported having no network members, 8.4 per cent for those with one to two members, 6.3 per cent for those with three to five members and 5.0 per cent for those with six or more members (not shown). However, there was no association between having a social network in which most members were still serving in the military and higher PTSD symptom scores. Further, being in a relationship was associated with lower PTSD symptom scores. The predicted probabilities for higher PTSD symptoms was 7.7 per cent for those not in a relationship, 6.6 per cent for those in a long-term relationship, 6.3 per cent for those living with a partner and 5.7 per cent for those who reported being married (not shown). In model 4, service leavers with lower social participation ($P < 0.001$), a network with most members in the military ($P = 0.049$) or being in a long-term relationship ($P = 0.043$) were more likely to have higher PTSD symptom scores than serving personnel. With the exception of relationship status, subsequent stratified analysis confirmed these findings (not shown).

There was no difference between service leavers and serving personnel with regard to alcohol misuse in the model 1 (Table 5). After adjusting for social and other potential confounders in model 2, service leaver status was associated with alcohol misuse. Age, deployment status and length of service each contributed to this association. The predicted probability for alcohol misuse was 15.1 per cent for service leavers and 11.4 per cent for serving personnel in model 2, with little reduction in the respective predictive probabilities following adjustment for social integration indicators in model 3 (not shown). Social participation was inversely associated with alcohol misuse in model 3, whereas there was no relationship between social network size and alcohol misuse. Having a social network in which most members continued to serve in the military was associated with increased odds of alcohol misuse in model 3, but there was no difference between service leavers and serving personnel. The predicted probability of alcohol misuse was 13.2 per cent for those who reported a social network in which most members were still serving, compared to 10.2 per cent for those who did not report a social network with this characteristic (not shown). In addition, all categories indicating that being in a relationship decreased the odds of alcohol misuse in comparison to those who reported being single. The predicted probabilities for alcohol misuse was 19.5 per cent for those not in a relationship, 13.7 per cent for those in a long-term relationship, 11.4 per cent for those living with a partner and 8.9 per cent for those who reported being married (not shown). Finally, the association between serving status and alcohol misuse was fully attenuated in model 4, but being in a long-term relationship appears to moderate the relationship between serving status and alcohol misuse ($P = 0.009$). Subsequent stratified analysis indicated that long-term relationships were protective for alcohol misuse among serving personnel only (not shown).

Table 4 *Social networks and post-traumatic stress disorder (PTSD[a]) symptoms among service leavers and serving personnel*

	Model 1 Unadjusted IRR (95% CI)	Model 2 Adjusted IRR (95% CI)[b]	Model 3 Adjusted IRR (95% CI)[b]	Model 4 Adjusted IRR (95% CI)[b]
Service status (1 = service leaver)	1.37 (1.25–1.49)***	1.40 (1.27–1.55)***	1.31 (1.18–1.45)***	1.79 (1.31–2.43)***
Social participation (no. of social activities)			0.95 (0.92–0.97)***	0.97 (0.94–0.99)*
Social network size				
None			2.35 (1.95–2.83)***	2.16 (1.70–2.74)***
1–2			1.67 (1.49–1.86)***	1.69 (1.49–1.90)***
3–5			1.26 (1.15–1.38)***	1.24 (1.12–1.38)***
6 or more			1.00 (reference)	1.00 (reference)
Mostly socialise with those who are still in the military				
Yes			1.06 (0.98–1.15)	1.03 (0.94–1.13)
No			1.00 (reference)	1.00 (reference)
Relationship status				
Single, not in long-term relationship			1.00 (reference)	1.00 (reference)
In a long-term relationship			0.85 (0.75–0.97)**	0.82 (0.71–0.94)**
Living with partner			0.81 (0.71–0.93)**	0.87 (0.73–1.03)
Married			0.73 (0.66–0.80)***	0.76 (0.68–0.85)***
Interactions				
Service leaver × social participation				0.90 (0.84–0.95)***
Service leaver × no social network				1.21 (0.81–1.79)
Service leaver × 1–2 social network size				0.96 (0.75–1.25)

Table 4 *(Continued)*

	Model 1	Model 2	Model 3	Model 4
	Unadjusted IRR (95% CI)	Adjusted IRR (95% CI)[b]	Adjusted IRR (95% CI)[b]	Adjusted IRR (95% CI)[b]
Service leaver × 3–5 social network size				1.03 (0.83–1.29)
Service leaver × military social network				1.23 (1.00–1.51)*
Service leaver × long-term relationship				1.36 (1.01–1.82)*
Service leaver × living with partner				0.81 (0.61–1.08)
Service leaver × married				0.89 (0.73–1.10)

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$. Incidence rate ratios (IRR) and 95% confidence intervals (CI) take account of sample and response weights [a]Probable post-traumatic stress disorder continuous score. [b]Models 2–4 includes further adjustments for gender, age (as continuous variable), rank, service, length of service and deployment status

Table 5 *Social networks and alcohol misuse*[a] *among service leavers and serving personnel*

	Model 1 Unadjusted OR (95% CI)	Model 2 Adjusted OR (95% CI)[b]	Model 3 Adjusted OR (95% CI)[b]	Model 4 Adjusted OR (95% CI)[b]
Service status (1 = service leaver)	1.00 (0.84–1.20)	1.45 (1.18–1.77)***	1.55 (1.23–1.95)***	1.08 (0.56–2.09)
Social participation (no. of social activities)			0.94 (0.89–0.99)**	0.95 (0.90–1.01)
Social network size				
None			1.31 (0.84–2.04)	1.18 (0.68–2.07)
1–2			0.89 (0.70–1.14)	0.87 (0.66–1.14)
3–5			0.87 (0.73–1.04)	0.81 (0.67–0.99)*
6 or more			1.00 (reference)	1.00 (reference)
Mostly socialise with those who are still in the military				
Yes			1.33 (1.11–1.58)**	1.25 (1.04–1.51)*
No			1.00 (reference)	1.00 (reference)
Relationship status				
Single, not in long-term relationship			1.00 (reference)	1.00 (reference)
In a long-term relationship			0.69 (0.55–0.86)***	0.58 (0.45–0.74)***
Living with partner			0.55 (0.42–0.71)***	0.53 (0.38–0.72)***
Married			0.41 (0.34–0.51)***	0.38 (0.30–0.47)***
Interactions				
Service leaver × social participation				0.93 (0.82–1.07)
Service leaver × no social network				1.31 (0.52–3.31)
Service leaver × 1–2 social network size				1.12 (0.62–2.01)
Service leaver × 3–5 social network size				1.34 (0.86–2.08)
Service leaver × military social network				1.37 (0.86–2.17)
Service leaver × long-term relationship				2.33 (1.24–4.37)**
Service leaver × living with partner				1.30 (0.72–2.32)
Service leaver × married				1.53 (0.95–2.47)

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$. Odds ratios (OR) and 95% confidence intervals (CI) are shown. All odds ratios also take account of sample and response weights. [a]Alcohol misuse defined as a score of 16 or more on the World Health Organization alcohol use disorders identification test questionnaire. [b]Models 2–4 includes further adjustments for gender, age (as continuous variable), rank, service, length of service, deployment status

Discussion

Using data from a UK military cohort, the findings suggest that there are differences in social integration between service leavers and still serving personnel and that aspects of these differences are related to some of the poor mental health outcomes. There was less social participation outside work, more social isolation and an apparent disengagement with military social contacts among service leavers in comparison to serving personnel. Service leavers were more likely to report CMD and PTSD symptoms. The increased risk of CMD but not PTSD symptoms, was partially accounted for by the reduced levels of social integration amongst service leavers. Participation in fewer social activities and maintaining smaller social networks were associated with CMD and PTSD symptoms, while being in a relationship appears to be protective against CMD and PTSD symptoms. With the exception of those with a moderately sized social network, social participation and social network size were not associated with alcohol misuse. Finally, maintaining a social network in which most members were still in the military was associated with CMD and PTSD symptoms for service leavers in comparison to serving personnel. In contrast, this social network characteristic was related to alcohol misuse for both groups.

Before discussing these findings in further detail, the limitations of this study are addressed. Firstly, data were cross-sectional in nature and therefore it is difficult to confirm the direction of the relationship, that is, whether or not current mental health symptoms were a barrier to establishing and maintaining social ties or influenced the quality of relationships. Secondly, despite achieving a 56 per cent response rate through extensive efforts using multiple tracing methods (Fear *et al.* 2010), there is likely to be some bias in our sample. In particular, we are aware that there was less participation in the survey by younger men of lower ranks, but we have taken this into account by conducting an appropriately weighted analysis. Thirdly, we acknowledge that the mental health measures rely on self-reports, but they have been validated and widely used (Babor *et al.* 2001, Goldberg and Williams 1988, Weathers *et al.* 1994). Finally, we have not captured detailed information on the reasons for participants leaving service or the extent of the mix of civilian and military or ex-military social ties, nor the perceived quality, strength or density of the social network ties with either civilian or military members. These contextual details would have given us a better opportunity to understand how the characteristics of the transition are related to mental health outcomes (Wheaton 1990). Reasons for leaving the service, details about whether or not the transition was expected or not, whether it was perceived as positive or negative and whether it had improved or worsened circumstances would have provided important contextual information. For those exiting a perceived negative situation, leaving the service may act as a protective mechanism for mental health. In contrast, an undesired transition leading to worse circumstances and a series of interrelated changes (for example, chronic unemployment and unstable housing) would be more likely to have poor mental health consequences (Wheaton 1990).

Unlike most military health studies, this study focused on the structural aspects of social integration. With an average length of service of 17.1 and 14.1 years, respectively, we are confident that both groups would have been well integrated into the military way of life. This is particularly important for service leavers before their transitioning into civilian life at the point of leaving. By definition, serving personnel were still embedded in the military, which was likely to influence the nature of their social activities and ties. After establishing differences in social integration and mental health between service leavers and serving personnel, we found similar patterns of associations with few exceptions.

Two key findings deserve further consideration. Firstly, the structural factors of social integration have varying effects on poor mental health outcomes, with particular relevance for CMD and PTSD symptoms. We showed evidence of gradients across social network size categories and these outcomes for both service leavers and serving personnel. We have also identified the impact of social isolation, as indicated by social network size, on mental health among both groups. It should be noted that the differences in the predicted probabilities for CMD were greater than for PTSD symptoms. These findings could help identify high-risk groups that could be targeted by service providers, such as state and charitable providers of support and care to both serving and ex-service personnel.

The variation in how service leavers are defined across countries (see Dandeker *et al.* 2006) makes it difficult to make comparisons with findings from other studies. For example, veterans' status in most US studies includes personnel who have returned from any deployment, whether serving or ex-serving. However, our findings are consistent with evidence from a longitudinal study on US veterans who were users of ambulatory care at the service leavers' health administration and no longer serving (Ren *et al.* 1999). Our findings are also consistent with other non-military studies that have consistently shown that social integration has a protective role against poor mental health (House *et al.* 1988, Kawachi and Berkman 2001, Lin *et al.* 1999) and mortality (Holt-Lunstad *et al.* 2010).

Secondly, our findings suggest that failing to form and participate in social networks outside the Armed Forces is not only an important way of gauging the success of re-integration into civilian life for service leavers, but also appears to have a differential impact on mental health. Our findings suggest that maintaining military social networks is associated with alcohol misuse for both groups but the persistence of these networks after transitioning out of service is associated with CMD and higher PTSD symptoms. With adjustments in our model for a range of variables previously identified as important confounders, with the exception of the reason for leaving service among leavers, we are confident that these associations are robust. However, we did not expect these differences a priori and did not ask for more detailed information on the nature of the social ties with those who were still serving. There may be an unidentified factor that may be associated with mental health outcomes, such as the quality of the relationships (for example, the weakening of social ties following the transition) in networks that are shared among those who choose to continue maintaining strong ties with those still serving in the military. The replication of this finding for alcohol misuse among still serving personnel does somewhat support the notion that there is a culture of drinking in the still serving military population (Jones and Fear 2011).

More detailed assessments are needed before more definitive statements can be made about how continued links with military colleagues after leaving the services may be linked to mental health. For example, we were not able to look at key subgroups that have previously been shown to be at risk of mental health problems, such as early service leavers (that is, those who completed less than 4 years of services in the UK) due to an inadequate sample size (*n* = 41) (Woodhead *et al.* 2011). Findings from a cross-sectional, nationally representative sample in England showed no difference between post-national service leavers and non-service leavers in terms of perceived social support and mental health, but early service leavers were more likely to engage in heavy alcohol use (Woodhead *et al.* 2011).

Overall, these findings highlight the importance of the nature of social networks, particularly on the importance of capturing attributes such as perceived social similarity or homophily; that is, stronger ties that are more characteristic of social contacts with those with similar attributes (Brissette *et al.* 2000, Goldenberg, 1984, McPherson *et al.* 2001) and how individuals adopt their behaviour to reinforce their similarity to reference groups

(Feld and Grofman 2009). In social institutions such as the military, these factors are likely to strengthen links in social networks and increase behavioural and cultural influences before and after transitions to civilian life. These findings also apply more generally to role transitions that follow long periods of positioning in highly structured institutions, such as other specialised occupations (for example, medical doctors). We have demonstrated that the structural aspects of social integration (that is, social participation and social networks) that underpin social support are important for understanding the experiences of service leavers and still serving personnel, with some variation in their benefits and risks across mental health outcomes. These findings suggest that, in addition to providing assistance with other social services (for example, employment and housing), efforts to improve the experiences of service leavers and serving personnel should aim to identify groups that are more socially isolated than others by enquiring about their social participation and their social networks outside work and the military. Furthermore, there should be some consideration of the potential differential influences of military and civilian network members on mental health while serving and following re-entry to civilian life.

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Acknowledgements

Notes

1 Veterans and service leavers are not necessarily synonymous terms. There are notable differences in the definition of what constitutes a veteran across countries, ranging from the receipt of 1 day's pay to a full career that may include participation in an operational deployment and combat (see Dandeker *et al.* 2006). Varying definitions in other countries include characteristics such as serving status, that is, still serving or left service (USA and Canada); the completion of training (Canada); the completion of a minimum service period and release with at least an honourable discharge irrespective of deployment (USA) or serving in an active deployment overseas from the host country (Australia). The term veteran, is also used to refer to those in the Forces from an older generation (for example, those who served in World War II or Korea). It can be linked to a given conflict or deployment (for example, one can be a Gulf veteran and still serving) rather than used as a generic term. These definitions help to identify the population of service leavers and to understand their experiences and needs.

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