Loneliness Among UK Treatment-Seeking Veterans: Associations with Quality of Life, Alcohol Misuse and Perceptions of Partner Drinking

Charlotte Williamson[1 *], Alice Wickersham[2,3], Marie-Louise Sharp[1], Danielle Dryden[2], Amos Simms[4,5], Nicola T Fear[1,4], Dominic Murphy[1,6], Laura Goodwin[7] and Daniel Leightley[1]

[1] *King's Centre for Military Health Research, King's College London, London, UK.*

[2] *Department of Psychological Medicine, King's College London, London, UK.*

[3] *Department of Child and Adolescent Psychiatry, King's College London, London, UK.*

[4] *Academic Department of Military Mental Health, King's College London, London, UK.*

[5] *British Army, London, UK.*

[6] *Combat Stress, Tyrwhitt House, Leatherhead, UK.*

[7] *Division of Health Research, Lancaster University, Lancaster, UK.*

ABSTRACT

Introduction

Loneliness occurs when there is a disparity between the quantity and quality of the social relationships we have and the ones we want. Research has shown that loneliness is negatively associated with quality of life and alcohol misuse; two common issues for military Veterans. Loneliness can also be affected by partner drinking, particularly if it does not match with Veterans' own drinking behavior. This study aimed 1) to explore the association between loneliness, quality of life, and alcohol misuse, and 2) to explore the association between perceived partner drinking and loneliness, in a sample of UK treatment-seeking Veterans.

Methods

163 UK treatment-seeking Veterans completed a self-report questionnaire via the DrinksRation app including socio-demographic characteristics, military characteristics, and mental health and wellbeing outcomes such as quality of life, alcohol misuse, and perceived

partner drinking. Loneliness was measured using the 3-item University of California, Los Angeles (UCLA) Loneliness Scale. Linear regressions explored associations between loneliness, quality of life and alcohol misuse. Logistic regressions explored associations between perceived partner drinking and loneliness.

Results

Almost two thirds of the sample reported feeling lonely (65.6%). Unadjusted linear regressions showed lonely Veterans had lower quality of life scores across all domains and higher alcohol misuse scores than non-lonely Veterans. After full adjustment, loneliness was only significantly associated with the physical health (Beta= -0.98, 95% CI= -1.68 to -0.29, p=0.006) and social relationships (Beta= -2.28, 95% CI= -3.25 to -1.31, p<0.001) quality of life domains. Logistic regressions revealed no significant associations between perceptions of partner drinking and loneliness.

Discussion

This study found that lonely treatment-seeking Veterans had poorer quality of life and higher alcohol misuse than their non-lonely counterparts. Innovative ways to reduce loneliness and improve social connectedness are needed in the Veteran population, particularly for those with mental health needs and who drink heavily.

LAY SUMMARY

Loneliness occurs when there is a difference between the number and quality of the social relationships we have, versus the ones we want. Research has shown that loneliness is negatively associated with quality of life and alcohol misuse; two common issues for military Veterans. Loneliness can also be affected by partner drinking, particularly if it does not match

with Veterans' own drinking behavior. The current study explored (1) the relationship between loneliness, quality of life and alcohol misuse, and (2) the relationship between loneliness and perceived partner drinking, among a sample of UK treatment-seeking military Veterans. In total, 163 UK treatment-seeking Veterans completed a survey via a mobile app, DrinksRation, which included questions about their health and wellbeing. A large percentage of the sample reported loneliness (66%). This study found that lonely treatment-seeking Veterans had poorer quality of life and higher alcohol misuse than non-lonely Veterans.

Keywords: treatment-seeking, Veterans, military, armed forces, quality of life, alcohol misuse, loneliness, partner drinking

INTRODUCTION

Loneliness has been defined as "a subjective, unwelcome feeling of lack or loss of companionship, which happens when there is a mismatch between the quantity and quality of the social relationships that we have, and those that we want".[1] Loneliness is a major public health concern and is associated with a higher risk of mental and physical health illnesses[2,3], including physical health symptoms such as high blood pressure[4] and poor sleep[5]; mental health symptoms such as depression[6] and suicidal ideation[7] and risky behaviors such as alcohol misuse[8]. Although loneliness is a recognized problem for the general population, Veterans present with unique experiences of loneliness.

Military communities have specific needs and experiences that may place them at greater risk of loneliness, particularly after leaving the supportive structure of the Armed Forces.[9] For instance increased number of transitions and losing touch with peers, which may mean they experience loneliness in a unique way.[10] In a survey conducted by the Royal British Legion, 25% of Veterans indicated that they felt lonely or socially isolated *always* or *often.*[11] Additionally, in the National Health and Resilience in Veterans study in the United States (US), 44% of older Veterans (≥60 years) reported feeling lonely at least *some of the time.*[12] Loneliness is one of the strongest predictors of social wellbeing in the Veteran community.[13] Although most Veterans transition well from military to civilian life, some may experience loneliness. It could be that after leaving service, Veterans no longer feel part of the military 'family', lose the camaraderie they were used to, and experience a shift in their sense of self. This is supported by existing qualitative research exploring United Kingdom (UK) Veterans' experience of loneliness where Veterans reported a sense of loss and difficulty connecting in civilian life.[14]

Loneliness has been identified as a prevalent issue in Veterans seeking help for mental health problems (i.e. treatment-seeking Veterans) (79%) and has been reported to be strongly associated with more severe mental health presentations among this population.[15] Alcohol misuse is also associated with loneliness, and although there is little clear evidence as to the direction of this relationship[16], research suggests that consuming alcohol at high levels is associated with loneliness.[17] Treatment-seeking Veterans report high levels of hazardous alcohol misuse and have different patterns of alcohol misuse than the general Armed Forces population.[18] When taken together, Veterans with multiple risk factors, such as mental health difficulties and alcohol misuse, may be more likely to experience negative outcomes such as loneliness.

Relationships with partners can play an important role in experiences of loneliness as they can act as either a source of support or strain. One UK study found that Veterans who reported Covid-19 stressors of *difficulties with family or other social relationships* were more likely to report loneliness.[19] Partner drinking can also impact on levels of loneliness, particularly if it does not match with Veterans' own drinking behavior. Although partners may benefit from an increase in social interaction and time spent together when drinking, there may also be negative consequences. For instance, if both couple members drink hazardously, this could lead to poorer health and wellbeing. Despite the prevalence of alcohol misuse among military Veterans in the UK, there is limited evidence to suggest that hazardous alcohol consumption is a common outcome among military partners/spouses. Of the evidence that does exist, the majority is research based US.[20]

Research has shown that loneliness is associated with several negative outcomes, and that loneliness is a prevalent issue for military Veterans, especially treatment-seeking Veterans. By better understanding loneliness among treatment-seeking Veterans, specialized support can be implemented when leaving the Armed Forces, and treatment services for Veterans can be better aligned with their needs. The aims of this exploratory study were 1) to investigate the association between loneliness, quality of life, and alcohol misuse, and 2) to explore the association between perceived partner drinking and loneliness, among UK treatment-seeking Veterans.

METHODS

Setting

This is a secondary analysis using cross-sectional baseline data from the *I*Ration study, a randomized controlled trial (RCT) assessing the efficacy of a novel smartphone application at reducing alcohol consumption among UK military Veterans.[21-24] Prior to conducting the RCT, a pilot study was conducted to test the usability of the app.[25] The DrinksRation RCT findings are available elsewhere.[26] This study was approved by the local ethics committee of King's College London (registration number: HR-19/20-17438).

Participant Sample

Participants were recruited between October 2020 and April 2021. Recruitment took place via 1) partner organizations, e.g. Combat Stress (a UK Veterans mental health charity) and the King's Centre for Military Health Research Health and Wellbeing study cohort[27], or 2) social media and Facebook advertising (see Williamson *et al* for further information regarding participant recruitment[28]). Participant eligibility criteria included: 1) being a Veteran of the UK Armed Forces, 2) owning a smartphone, and 3) having sought help for a mental health disorder in a clinical setting (treatment-seeking). A Veteran in the UK is defined as an individual who has served a minimum of one day in the UK Armed Forces but no longer serves.[29]. In total, 163 participants met eligibility criteria.

Procedure

Participants were asked to download the DrinksRation app onto their smartphones, and to complete baseline and follow-up questionnaires when prompted. Questionnaire prompts were

via personalized notifications.[30] The DrinksRation app was designed to support, manage and reduce alcohol consumption. Participants could choose to use the app as often or as little as they found useful. For the current study, data was restricted to measures completed at baseline.

Materials and Measures

Baseline data was collected directly through the DrinksRation app and was completed when the participant signed up to the app. Baseline measures included socio-demographic characteristics (e.g. age, gender, ethnicity and marital status), military characteristics (e.g. serving status and length), and mental health and wellbeing outcomes (e.g. loneliness, quality of life, and alcohol use). Participants who self-reported being 'married or in a relationship' were categorized as having a partner.

Loneliness was measured using the 3-item University of California, Los Angeles (UCLA) Loneliness Scale.[31] Each question was scored from 1 to 3, meaning the maximum total score was 9, and a score of 6 or more indicated loneliness as recommended by Hughes *et al.*[31] Quality of life was measured using The World Health Organization Quality of Life-BREF (WHOQOL-BREF).[32] This 26-item, self-report questionnaire evaluates the context of an individual's culture, value systems, personal goals, standards, and concerns. It comprises of four domains: 1) physical health, 2) psychological, 3) social relationships, and 4) environment. A higher score indicates better quality of life in that domain.

Alcohol consumption data was collected via the ten-item Alcohol Use Disorder Identification Test (AUDIT-10).[33] Questions 1-8 included questions such as 'how often do you have a drink containing alcohol?' and 'how often during the last year have you had a feeling of guilt or remorse after drinking?' and were scored from 0 to 4 (never/ less than monthly/ monthly/ weekly/ daily or almost daily). Questions 9-10 asked 'have you or someone else been injured as a result of your drinking?' and 'has a relative or friend or doctor or other health worker been concerned about your drinking or suggested you cut down?' and were scored 0 (no), 2 (yes, but not in the last year) or 4 (yes, in the last year). The maximum score was 40, and a score of 7 or less indicated low risk drinking, 8 to 15 indicated hazardous or harmful drinking, and 16 or more indicated high-risk drinking (harmful or dependent drinking).

Perceptions of partner drinking were measured via a three-item scale constructed specifically for this study based on questions 1 and 10 from the AUDIT-10 measure. The constructed partner drinking measure asked the Veteran participants: 1) has your partner expressed concerns about your drinking, or suggested that you cut down (yes/ no), 2) how often does your partner have a drink containing alcohol (no/ monthly or less/ 2 to 4 times a month/ 2 to 3 times a week/ 4+ times a week), and 3) how often do you and your partner have a drink containing alcohol together(no/ monthly or less/ 2 to 4 times a month/ 2 to 3 times a week/ 4+ times a week). In the analyses the answer options for questions 2 and 3 were recategorized due to low numbers: no/ monthly or less became *hardly ever*, 2-4 times a month became *sometimes,* and 2-3 times a week/ 4+ times a week became *often.*

Analysis

Socio-demographic characteristics were summarized using frequencies and unweighted percentages (categorical variables) or means and 95% confidence intervals (CI) (continuous variables), stratified by loneliness. A Pearson's correlation analysis was initially performed to explore the association between loneliness and quality of life domains. Linear regressions were then conducted to explore this further, with loneliness as the exposure variable to explore its relationship with quality of life domains and alcohol misuse (outcome variables). Model 1 explored the unadjusted association between loneliness and each outcome. Model 2 adjusted for both age and gender. Model 3 further adjusted for the other outcome variables (alcohol misuse and the remaining quality of life domains). These variables are commonly adjusted for each other in the literature.[34]

The sample was then restricted to those who had a marital status of married or in a relationship. Logistic regressions were conducted to explore the relationship between perceived partner drinking (exposure) and loneliness (outcome). Missing data were not included in analyses (complete case analysis). Statistical significance was defined as $p < 0.05$. Data processing was performed in Python version 3.5 and all analyses were performed using STATA MP 17.

RESULTS

In total 163 participants met the eligibility criteria for this study. **Table 1** summarizes the socio-demographic characteristics, military characteristics and mental health outcomes of the participant sample. Most participants were male (92.6% vs 7.4% female), were married or in a relationship (74.4% vs 22.6% single/ separated/ divorced/ widowed), consumed alcohol at hazardous/ harmful or high risk/ dependent levels (78.5% vs 21.5% low risk) and the majority reported loneliness (65.6% vs 34.4% not lonely). The mean length of military service of the sample was 14.2 years (95% CI: 12.8-15.5 years).

Table 1 also presents perceived partner drinking for the participants who reported being married or in a relationship (*n*=125). Overall, 63.2% of participants reported that their partner expressed concerns about their drinking. Participants perceived their partner to drink *often* (48.0%) vs *sometimes* (28.0%) or *hardly ever* (24.0%) and reported drinking with their partner *often* (51.2%) vs *sometimes* (25.6%) or *hardly ever* (23.2%).

[Table 1]

The results from the Pearson's correlation analyses are reported in **Supplementary Table 1**. There were moderate to strong negative correlations between loneliness and all quality of life domains. The strongest negative correlations were observed between loneliness and the psychological domain ($r(161)= -0.54$, $p < 0.001$) and between loneliness and the social relationships domain ($r(161)= -0.57$, $p < 0.001$).

Table 2 displays the associations between loneliness, quality of life, and alcohol misuse. The results of the unadjusted linear regressions showed that those who were lonely reported significantly lower quality of life scores in all domains compared to those who were not lonely. Further, those who were lonely had a higher alcohol misuse score than those who were not lonely (average difference = 5.99; beta = 0.33; CI: 3.33 to 8.65). After adjusting for age and gender, these associations persisted. However, after further adjusting each model for the other outcome variables (alcohol misuse and the remaining quality of life domains), only the associations between loneliness and the quality of life physical health domain (average difference = -0.98; beta = -0.18; CI: -1.68 to -0.19) and social relationships domain (average difference = -2.28; beta = -0.30; CI: -3.25 to -1.31) remained statistically significant.

[Table 2]

Table 3 presents the associations between perceived partner drinking and loneliness among participants who reported being married or in a relationship (*n*=125). The results of the unadjusted logistic regressions showed no statistically significant associations between perceived partner drinking and loneliness. After adjusting for age and gender, these findings persisted.

[Table 3]

DISCUSSION

This study examined the associations between loneliness, quality of life and alcohol misuse, and between perceived partner drinking and loneliness, among a sample of UK treatment-seeking Veterans. Overall, the present study found that Veterans who were lonely reported lower quality of life scores, particularly in the physical health and social relationships domains (after full adjustment), and higher alcohol misuse scores, than non-lonely Veterans. The study revealed no significant associations between perceived partner drinking and loneliness.

Loneliness was highly prevalent among the present sample of UK treatment-seeking veterans (65.9%). This figure appears to be lower than that reported in another study of UK treatment-seeking Veterans (79.1%[15]) but higher than in studies of non-treatment seeking populations (e.g. 27.0% [UK general population[35]], 27.4% [UK community Veterans[19]]), all conducted at a similar timepoint. An explanation for this could have been the different data collection periods within the Covid-19 pandemic. Whilst these high levels of loneliness are perhaps not unexpected given the relationship between mental health difficulties and loneliness[36,37], it highlights the importance of including support to increase social connectedness within mental health treatments.

The high rates of loneliness among the present sample might potentially be explained by the challenging transition from military to civilian life where some Veterans find it difficult to integrate into civilian life and no longer feel part of the military 'family'. Previous work has highlighted a strong association between loneliness and more severe mental health presentations, although the direction of this relationship remains unclear.[15] Those with mental

health difficulties may limit their social relationships as a way to mitigate potential stigma, which then leads to social isolation and loneliness. Alternatively, it might be that loneliness is exacerbating the mental health symptoms.

The present study found that those who were lonely reported lower scores on all quality of life domains, particularly on the physical health and social relationships domains. This aligns with previous research which reported a significant correlation between quality of life and loneliness.[38] The relationship between physical health and loneliness is multifaceted. While poor physical health can increase the risk of loneliness due to problems with mobility, pain and distressing symptoms[39], there is now also significant evidence that loneliness is a risk factor for several physical health symptoms, including high blood pressure[4] and poor sleep[5]. Alongside physical health, the association between social relationships and loneliness has also been explored in previous literature. Experiences of adverse social relationships, such as stressful interpersonal incidents, can have long-term impacts on the individual including on their later-life social relationships which either increase or reduce the risk of loneliness.[40]

In line with the findings of the present study, previous research has shown that loneliness is associated with alcohol use disorder.[17,41] One US study reported 63.0% of adults aged 45 years or older with a diagnosis of drug or alcohol use disorder were lonely.[42] Alcohol dependence and alcohol-related harm are more common among UK treatment-seeking Veterans, and the rates of alcohol misuse are higher than in the UK general population.[18] Research suggests that some UK Armed Forces personnel drink to cope with distressing thoughts and because of loneliness.[17] Given that the sample used in the present study had signed up to test an alcohol reduction intervention and therefore were drinking above the

recommended guidelines of 14 units per week, this may begin to explain the elevated levels of alcohol misuse, and therefore loneliness, in this sample.

The present study found no significant associations between perceived partner drinking and loneliness. This is an underexplored area within existing literature Despite the abundance of literature on the prevalence of alcohol misuse among Veterans, there is limited evidence about alcohol use/misuse among partners of military personnel and Veterans.[20] Of the evidence that does exist, which is dominated by research from the US, female partners of military personnel are more than twice as likely than female partners in the general population to exhibit hazardous alcohol consumption and regular binge drinking episodes.[20] However, there are substantial differences in the structure and processes of the US and UK Armed Forces and therefore this cannot be generalized cross-culturally to the UK context. Military partners and families face unique challenges, such as frequently moving location and coping with the stress and separation caused by deployment. Many partners and families cope well with these challenges, however, if they are struggling to manage them, alcohol may be used as a coping strategy.

Alcohol misuse is high among Veterans, and there is a concordance of alcohol consumption between couple members.[43] One UK study reported that when compared to those who drink with military friends, military serving and ex-serving personnel who drink with a partner had significantly higher odds of frequent binge drinking.[17] Therefore, it is important to explore perceived partner drinking in a military context, particularly among dual-serving military relationships (i.e. where both parties serve in the military), as it may present as an additional risk factor for negative outcomes, such as loneliness.

Implications

The high prevalence of loneliness highlights the need for specialized support when leaving the Armed Forces, in particular, during the challenging transition out of the military to civilian life. As with the general population, innovative ways to tackle loneliness and increase social connectedness are needed, especially in light of the Covid-19 pandemic, and should have a particular focus on those with mental health needs. As comorbidity appears to be the norm rather than the exception among treatment-seeking Veterans[15], clinicians and support workers should take a holistic approach by considering a range of health difficulties and environments that might also be at play (e.g. alcohol misuse and quality of life) rather than focusing on tackling loneliness in isolation. Individuals experiencing physical and mental health difficulties and alcohol misuse could be targeted for social prescribing measures to combat loneliness by encouraging them to access appropriate support such as community activities and social groups. Healthcare workers should consider on a case-by-case basis whether mainstream civilian services or specific Armed Forces services will best meet the needs of Veterans.

Future research should seek to replicate our findings in other treatment-seeking and non-treatment-seeking samples, and should explore the associations in different military services (e.g. Royal Navy, Army and Royal Air Force) and serving status (e.g. serving personnel). It is suggested that future work should be conducted to explore the impacts of partner drinking on Veterans, particularly in the UK context. Future research should also consider further exploring the interplay between physical health, mental health and loneliness.

Limitations

Limitations include the small sample size, limited number of female participants and lack of ethnic diversity, meaning the generalizability of the findings is limited. Additionally, the data was collected during the Covid-19 pandemic, including periods of lockdown and social distancing, which may have impacted on the experience of loneliness. It is important to consider that the models used in this study may be subject to overadjustment bias if covariates adjusted for are on the causal pathway. For instance, it's plausible that quality of life explains the association between loneliness and alcohol misuse. However, these longitudinal pathways cannot be explored due to the cross-sectional nature of these data.

The measure for perceived partner drinking was constructed specifically for this study and therefore is not a validated measure making it difficult to compare with other research in the field. The measure records Veterans' perceptions of their partners drinking rather than the actual levels which may influence the statistical relationship. All participants in the study were treatment-seeking Veterans therefore the results cannot necessarily be generalized to non-treatment seeking populations or to non-Veteran populations. Further, the use of treatment-seeking Veterans only means it is important to consider if a participant has or has not completed mental health treatment as this might have impacted on the findings.

More than 2,700 individuals were invited to take part in the main study (from which that data was drawn and analyzed), with the majority not taking part. It is not possible to ascertain why these individuals chose not to take part. However, reasons could potentially include that data was collected via a smartphone or that data was collected during the Covid-19 pandemic. Additionally, all participants self-reported their military and treatment-seeking status, it was

not possible to verify their status. Finally, all participants were Veterans who had signed up to test a digital alcohol intervention app, therefore may only reflect those who were trying to reduce their alcohol consumption.

CONCLUSIONS

To conclude, this study found that loneliness was associated with poorer quality of life (particularly physical health and social relationship domains) and higher alcohol misuse. Innovative ways to reduce loneliness and improve social connectedness are needed in the Veteran population, particularly for those with mental health needs.

REFERENCES

1. Perlman D, Peplau AL. Toward a Social Psychology of Loneliness. In: Gilmour R, Duck S, editors. Personal Relationships. London: Academic Press; 1981. p. 31–56.

2. Leigh-Hunt N, Bagguley D, Bash K, Turner V, Turnbull S, Valtorta N, et al. An overview of systematic reviews on the public health consequences of social isolation and loneliness. Public Health. 2017 Nov 1;152:157–71.

3. Heron P, Spanakis P, Crosland S, Johnston G, Newbronner E, Wadman R, et al. Loneliness among people with severe mental illness during the COVID-19 pandemic: Results from a linked UK population cohort study. PLoS One [Internet]. 2022 Jan 1 [cited 2022 May 6];17(1). Available from: https://pubmed.ncbi.nlm.nih.gov/35025915/

4. Hawkley LC, Masi CM, Berry JD, Cacioppo JT. Loneliness is a unique predictor of age-related differences in systolic blood pressure. Psychol Aging [Internet]. 2006 Mar;21(1):152–64. Available from: http://doi.apa.org/getdoi.cfm?doi=10.1037/0882-7974.21.1.152

5. Hom MA, Chu C, Rogers ML, Joiner TE. A Meta-Analysis of the Relationship Between Sleep Problems and Loneliness: https://doi.org/101177/2167702620922969 [Internet]. 2020 Jul 29 [cited 2021 Jul 16];8(5):799–824. Available from: https://journals.sagepub.com/doi/abs/10.1177/2167702620922969

6. Cacioppo JT, Hughes ME, Waite LJ, Hawkley LC, Thisted RA. Loneliness as a specific risk factor for depressive symptoms: Cross-sectional and longitudinal analyses. Psychol Aging [Internet]. 2006 Mar;21(1):140–51. Available from: http://doi.apa.org/getdoi.cfm?doi=10.1037/0882-7974.21.1.140

7. Stickley A, Koyanagi A. Loneliness, common mental disorders and suicidal behavior:

Findings from a general population survey. J Affect Disord. 2016 Jun 1;197:81–7.

8. Canham SL, Mauro PM, Kaufmann CN, Sixsmith A. Association of Alcohol Use and Loneliness Frequency Among Middle-Aged and Older Adult Drinkers: http://dx.doi.org/101177/0898264315589579 [Internet]. 2015 Jun 16 [cited 2021 Jul 16];28(2):267–84. Available from: https://journals.sagepub.com/doi/abs/10.1177/0898264315589579

9. Armed Forces Covenant Fund Trust. Tackling Armed Forces Loneliness: Evaluation of the Armed Forces Covenant Fund Trust's Tackling Loneliness Programme [Internet]. 2022. Available from: https://covenantfund.org.uk/wp-content/uploads/2022/10/Tackling-Loneliness-Report-Final-Share-5-October.pdf

10. Leslie C, McGill G, Kiernan MD, Wilson G. Social isolation and loneliness of UK veterans: a Delphi study. Occup Med (Chic Ill) [Internet]. 2020 Sep 9 [cited 2022 Apr 13];70(6):407–14. Available from: https://academic.oup.com/occmed/article/70/6/407/5864575

11. Royal British Legion. Loneliness and Social Isolation Research [Internet]. Royal Brisih Legion Website. 2018 [cited 2021 Jul 14]. Available from: https://www.britishlegion.org.uk/get-involved/things-to-do/campaigns-policy-and-research/campaigns/loneliness-and-social-isolation

12. Kuwert P, Knaevelsrud C, Pietrzak RH. Loneliness Among Older Veterans in the United States: Results from the National Health and Resilience in Veterans Study. Am J Geriatr Psychiatry. 2014 Jun 1;22(6):564–9.

13. Royal British Legion. A UK Household Survey of the Ex-Service Community 2014 [Internet]. 2014 [cited 2021 Jul 19]. Available from: www.compasspartnership.co.uk

14. Guthrie-Gower S, Wilson-Menzfeld G. Ex-military personnel's experiences of loneliness and social isolation from discharge, through transition, to the present day. PLoS One [Internet]. 2022 Jun 1 [cited 2022 Nov 3];17(6):e0269678. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0269678

15. Williamson C, Baumann J, Murphy D. Exploring the health and well-being of a national sample of U.K. treatment-seeking veterans. Psychol Trauma Theory, Res Pract Policy [Internet]. 2022 Oct 10; Available from: http://doi.apa.org/getdoi.cfm?doi=10.1037/tra0001356

16. Wootton RE, Greenstone HSR, Abdellaoui A, Denys D, Verweij KJH, Munafò MR, et al. Bidirectional effects between loneliness, smoking and alcohol use: evidence from a Mendelian randomization study. Addiction [Internet]. 2021 Feb 1 [cited 2021 Aug 4];116(2):400–6. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/add.15142

17. Irizar P, Leightley D, Stevelink S, Rona R, Jones N, Gouni K, et al. Drinking motivations in UK serving and ex-serving military personnel. Occup Med (Chic Ill) [Internet]. 2020 Jun 20 [cited 2021 Jul 13];70(4):259–67. Available from: https://academic.oup.com/occmed/article/70/4/259/5713396

18. Murphy D, Turgoose D. Exploring patterns of alcohol misuse in treatment-seeking UK veterans: A cross-sectional study. Addict Behav. 2019 May 1;92:14–9.

19. Sharp M-L, Serfioti D, Jones M, Burdett H, Pernet D, Hull L, et al. UK veterans' mental health and well-being before and during the COVID-19 pandemic: a longitudinal cohort study. BMJ Open [Internet]. 2021 Aug 27 [cited 2021 Oct 1];11(8):e049815. Available from: https://pubmed.ncbi.nlm.nih.gov/34452965/

20. Gribble R, Thandi GK, Goodwin L, Fear NT. Hazardous alcohol consumption among

spouses or partners of military service personnel: a systematic review of the literature. J R Army Med Corps [Internet]. 2018 [cited 2022 Jan 10];164:380–8. Available from: http://jramc.bmj.com/

21. Leightley D, Puddephatt J-A, Jones N, Mahmoodi T, Chui Z, Field M, et al. A Smartphone App and Personalized Text Messaging Framework (InDEx) to Monitor and Reduce Alcohol Use in Ex-Serving Personnel: Development and Feasibility Study. JMIR mHealth uHealth [Internet]. 2018 Sep 11;6(9):e10074. Available from: http://mhealth.jmir.org/2018/9/e10074/

22. Leightley D, Puddephatt J-A, Goodwin L, Rona R, Fear NT. InDEx: Open Source iOS and Android Software for Self-Reporting and Monitoring of Alcohol Consumption. J Open Res Softw [Internet]. 2018 Mar 23;6. Available from: http://openresearchsoftware.metajnl.com/articles/10.5334/jors.207/

23. Puddephatt J-A, Leightley D, Palmer L, Jones N, Mahmoodi T, Drummond C, et al. A Qualitative Evaluation of the Acceptability of a Tailored Smartphone Alcohol Intervention for a Military Population: Information About Drinking for Ex-Serving Personnel (InDEx) App. JMIR mHealth uHealth [Internet]. 2019 May 24;7(5):e12267. Available from: http://mhealth.jmir.org/2019/5/e12267/

24. Leightley D, Rona RJ, Shearer J, Williamson C, Gunasinghe C, Simms A, et al. Evaluating the Efficacy of a Mobile App (Drinks:Ration) and Personalized Text and Push Messaging to Reduce Alcohol Consumption in a Veteran Population: Protocol for a Randomized Controlled Trial. JMIR Res Protoc [Internet]. 2020 Oct 2;9(10):e19720. Available from: https://www.researchprotocols.org/2020/10/e19720

25. Williamson C, Dryden D, Palmer L, Rona R, Simms A, Fear NT, et al. An Expert and Veteran User Assessment of the Usability of an Alcohol Reduction App for Military

Veterans, Drinks: Ration: A Mixed-Methods Pilot Study. Mil Behav Heal [Internet]. 2022 Dec 6;1–14. Available from: https://www.tandfonline.com/doi/full/10.1080/21635781.2022.2151532

26. Leightley D, Williamson C, Rona R, Carr E, Shearer J, D. Davis J, et al. Evaluating the efficacy of a mobile app (Drinks:Ration) to reduce alcohol consumption in a help-seeking military veteran population: Randomised Controlled Trial (Preprint). JMIR mHealth uHealth [Internet]. 2022 Apr 25 [cited 2022 Jun 7]; Available from: http://preprints.jmir.org/preprint/38991/accepted

27. Stevelink SAM, Jones M, Hull L, Pernet D, Maccrimmon S, Goodwin L, et al. Mental health outcomes at the end of the British involvement in the Iraq and Afghanistan conflicts: A cohort study. Br J Psychiatry [Internet]. 2018 Dec 1 [cited 2021 Jul 7];213(6):690–7. Available from: https://pubmed.ncbi.nlm.nih.gov/30295216/

28. Williamson C, Rona RJ, Simms A, Fear NT, Goodwin L, Murphy D, et al. Recruiting Military Veterans into Alcohol Misuse Research: The Role of Social Media and Facebook Advertising. Telemed e-Health [Internet]. 2022 May 11;0(0). Available from: https://www.liebertpub.com/doi/10.1089/tmj.2021.0587

29. Ministry of Defence. Veterans: Key Facts [Internet]. 2017 [cited 2021 Nov 1]. Available from: www.armedforcescovenant.gov.uk

30. Williamson C, White K, Rona RJ, Simms A, Fear NT, Goodwin L, et al. Smartphone-based alcohol interventions: A systematic review on the role of notifications in changing behaviors toward alcohol. Subst Abus [Internet]. 2022 Dec 1;43(1):1231–44. Available from: https://www.tandfonline.com/doi/full/10.1080/08897077.2022.2074595

31. Hughes ME, Waite LJ, Hawkley LC, Cacioppo JT. A Short Scale for Measuring

Loneliness in Large Surveys. Res Aging [Internet]. 2004 Nov 19;26(6):655–72. Available from: http://journals.sagepub.com/doi/10.1177/0164027504268574

32. THE WHOQOL GROUP. Development of the World Health Organization WHOQOL-BREF Quality of Life Assessment. Psychol Med [Internet]. 1998 May 1;28(3):551–8. Available from: https://www.cambridge.org/core/product/identifier/S0033291798006667/type/journal_article

33. Saunders JB, Aasland OG, Babor TF, De La Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption-II. Addiction [Internet]. 1993 Jun;88(6):791–804. Available from: http://doi.wiley.com/10.1111/j.1360-0443.1993.tb02093.x

34. Leightley D, Williamson C, Simms MA, Fear NT, Goodwin L, Murphy D. Associations between Post-Traumatic Stress Disorder, Quality of Life and Alcohol Misuse among UK Veterans. Mil Behav Heal [Internet]. 2022 Oct 2;10(4):444–50. Available from: https://www.tandfonline.com/doi/full/10.1080/21635781.2022.2123414

35. Groarke JM, Berry E, Graham-Wisener L, McKenna-Plumley PE, McGlinchey E, Armour C. Loneliness in the UK during the COVID-19 pandemic: Cross-sectional results from the COVID-19 Psychological Wellbeing Study. PLoS One [Internet]. 2020 Sep 1 [cited 2022 May 6];15(9):e0239698. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0239698

36. Nuyen J, Tuithof M, de Graaf R, van Dorsselaer S, Kleinjan M, Have M ten. The bidirectional relationship between loneliness and common mental disorders in adults:

findings from a longitudinal population-based cohort study. Soc Psychiatry Psychiatr Epidemiol [Internet]. 2020 Oct 1 [cited 2022 May 16];55(10):1297–310. Available from: https://link.springer.com/article/10.1007/s00127-019-01778-8

37. Ren L, Mo B, Liu J, Li D. A cross-lagged regression analysis of loneliness and depression: A two-year trace. https://doi.org/101080/1740562920201865146 [Internet]. 2020 [cited 2022 May 16];19(2):198–212. Available from: https://www.tandfonline.com/doi/abs/10.1080/17405629.2020.1865146

38. Zhu Y, Liu J, Qu B, Yi Z. Quality of life, loneliness and health-related characteristics among older people in Liaoning province, China: a cross-sectional study. BMJ Open [Internet]. 2018 Nov 1 [cited 2021 Jul 23];8(11):e021822. Available from: https://bmjopen.bmj.com/content/8/11/e021822

39. Shankar A. Loneliness and Health. Oxford Res Encycl Psychol [Internet]. 2017 Jun 28 [cited 2022 Apr 13]; Available from: https://oxfordre.com/psychology/view/10.1093/acrefore/9780190236557.001.0001/acrefore-9780190236557-e-122

40. Ejlskov L, Boggild H, Kuh D, Stafford M. Social relationship adversities throughout the lifecourse and risk of loneliness in later life. Ageing Soc [Internet]. 2020 Aug 1 [cited 2022 Apr 13];40(8):1718–34. Available from: https://www.cambridge.org/core/journals/ageing-and-society/article/social-relationship-adversities-throughout-the-lifecourse-and-risk-of-loneliness-in-later-life/D46215D05189D19C9B8CC020F151267B

41. Akerlind I, Hörnquist J. Loneliness and alcohol abuse: a review of evidences of an interplay. Soc Sci Med [Internet]. 1992 [cited 2021 Jul 23];34(4):405–14. Available from: https://pubmed.ncbi.nlm.nih.gov/1566121/

42. Wilson C, Moulton B. Loneliness among Older Adults: A National Survey of Adults 45+ [Internet]. Washington DC; 2010. Available from: https://assets.aarp.org/rgcenter/general/loneliness_2010.pdf

43. McLeod JD. Spouse Concordance for Alcohol Dependence and Heavy Drinking: Evidence from a Community Sample. Alcohol Clin Exp Res [Internet]. 1993 Nov 1 [cited 2022 Jan 12];17(6):1146–55. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/j.1530-0277.1993.tb05220.x

Table 1. Socio-demographic and clinical characteristics stratified by loneliness

	Overall (N=163)	**Not lonely**[1] **(n=58)**	**Lonely**[1] **(n=107)**
Age (years), mean (95% CI)	47.6 (45.6 to 49.6)	50.7 (47.6 to 53.9)	48.2 (46.3 to 50.0)
Gender, n (%)			
Male	151 (92.6)	48 (85.7)	103 (96.3)
Female	12 (7.4)	8 (14.3)	4 (3.7)
Marital Status, n (%)			
Married/In a relationship	125 (74.4)	47 (83.9)	78 (72.9)
Single/separated	23 (13.7)	2 (3.6)	21 (19.6)
Divorced/widowed	15 (8.9)	7 (12.5)	8 (7.5)
Length of Service, mean (95% CI)	14.2 (12.8 to 15.5)	14.0 (11.6 to 16.1)	14.3 (12.6 to 15.9)
Alcohol misuse caseness, n (%)			
Low risk	35 (21.5)	22 (39.3)	13 (12.2)
Hazardous/harmful	55 (33.7)	19 (33.9)	36 (33.6)
High risk/dependent	73 (44.8)	15 (26.8)	58 (54.2)
AUDIT score, mean (95% CI)	15.2 (13.9 to 16.6)	11.3 (9.4 to 13.2)	17.3 (15.6 to 18.9)
Quality of life, mean (95% CI)			
Physical health	12.4 (12.0 to 12.8)	14.1 (13.5 to 14.7)	11.4 (11.0 to 11.9)
Psychosocial	11.1 (10.7 to 11.5)	12.9 (12.2 to 13.5)	10.2 (9.8 to 10.5)
Social relationships	10.7 (10.2 to 11.3)	13.6 (12.7 to 14.5)	9.2 (8.7 to 9.8)
Environment	14.1 (13.6 to 14.5)	15.6 (15.1 to 16.2)	13.2 (12.7 to 13.8)
	Overall (N=125)	**Not lonely**[1] **(n=47)**	**Lonely**[1] **(n=78)**
Partner expressed concerns about drinking, n (%)[2]			

No	46 (36.8)	19 (40.4)	27 (34.6)
Yes	79 (63.2)	28 (59.6)	51(65.4)
Perceived frequency of partner's drinking, n (%)[2]			
Hardly ever	30 (24.0)	8 (17.0)	22 (28.2)
Sometimes	35 (28.0)	15 (31.9)	20 (25.6)
Often	60 (48.0)	24 (51.1)	36 (46.2)
Drinking with partner, n (%)[2]			
Hardly ever	29 (23.2)	8 (17.0)	21 (26.9)
Sometimes	32 (25.6)	14 (29.8)	18 (23.1)
Often	64 (51.2)	25 (53.2)	39 (50.0)

[1] As measured by the 3-item UCLA Loneliness Scale
[2]Restricted to those who were married/ in a relationship

Table 2. Associations between loneliness (exposure), quality of life domains, and alcohol misuse (outcomes) (N=163)

	Model 1 **Average difference** **(Beta; 95% CI; *p* value)**	**Model 2** **Average difference** **(Beta; 95% CI; *p* value)**	**Model 3** **Average difference** **(Beta; 95% CI, *p* value)**
Quality of life domains			
Physical health	-2.66 (-0.48; -3.41 to -1.91; ***p*<.001**)	-2.73 (-0.50; -3.49 to -1.96; ***p*<.001**)	-0.98 (-0.18; -1.68 to -0.29; ***p*=0.006**)
Psychosocial	-2.68 (-0.53; -3.34 to -2.03; ***p*<.001**)	-2.73 (-0.55; -3.39 to -2.06; ***p*<.001**)	-0.23 (-0.46; -0.80 to 0.33; *p*=0.421)
Social relationships	-4.31 (0.57, -5.29 to -3.34; ***p*<.001**)	-4.43 (-0.58; -5.42 to -3.44; ***p*<.001**)	-2.28 (-0.30; -3.25 to -1.31; ***p*<.001**)
Environment	-2.40 (0.40; -3.25 to -1.55; ***p*<.001**)	-2.30 (-0.39; -3.16 to -1.45; ***p*<.001**)	0.52 (0.09; -0.32 to 1.35); *p*=0.223)
Alcohol misuse score	5.99 (0.33; 3.33 to 8.65; ***p*<.001**)	5.64 (0.31; 2.93 to 8.36; ***p*<.001**)	2.44 (0.13; -0.99 to 5.87; *p*=0.163)

Notes. CI: Confidence Interval; Betas are standardised coefficients
Model 1: Unadjusted association between loneliness and each outcome variable
Model 2. Adjusted for age and gender
Model 3. Further adjusted for alcohol misuse and all remaining quality of life domains

Table 3. Associations between perceptions of partner drinking (exposure), and loneliness (outcome) (N=125)

	Model 1	**Model 2**
	OR (95% CI, *p* value)	**AOR (95% CI, *p* value)**
Partner expressed concerns about drinking		
No	Reference	Reference
Yes	1.28 (0.61 to 2.70; *p*=0.514)	1.34 (0.61 to 2.92; *p*=0.467)
Perceived frequency of partner drinking		
Hardly ever	Reference	Reference
Sometimes	0.48 (1.70 to 1.39; *p*=0.177)	0.47 (0.16 to 1.40; *p*=0.176)
Often	0.55 (0.21 to 1.42; *p*=0.216)	0.63 (0.23 to 1.72; *p*=0.364)
Drinking with partner		
Hardly ever	Reference	Reference
Sometimes	0.49 (0.17 to 1.43; *p*=0.192)	0.45 (0.15 to 1.36; *p*=0.157)
Often	0.59 (0.23 to 1.55; *p*=0.286)	0.69 (0.25 to 1.88; *p*=0.468)

Notes. Restricted to those married/ in a relationship. OR: Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval
Model 1: Unadjusted association between perceived partner drinking and loneliness
Model 2. Adjusted for age and gender

Supplementary Materials

Supplementary Table 1. Pearson's correlations between loneliness and quality of life domains

Variable	Lonely	Physical Health	Psychosocial	Social Relationships	Environment
Lonely	1.00				
Physical Health	-0.48*	1.00			
Psychosocial	-0.54*	0.71*	1.00		
Social Relationships	-0.57*	0.45*	0.69*	1.00	
Environment	-0.40*	0.61*	0.65*	0.58*	1.00

*$p<0.001$