

# Relationship between obesity and health problems in help-seeking military veterans

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## ABSTRACT

**Background** UK Armed Forces (UK AF) veterans may be particularly vulnerable to obesity and its comorbid physical and mental health problems.

**Aim** To examine the relationship between body mass index (BMI), physical health problems, mental health disorders and sociodemographic characteristics in UK AF veterans engaged in psychological treatment.

**Methods** Information regarding veteran BMI, demographic characteristics, physical health conditions and mental health problems was collected and analysed using univariate and multivariate regression analyses. Rates of veteran obesity were also compared with the UK general population.

**Results** Of the 384 help-seeking veterans, 37.5% (n=151) were overweight (BMI 26–30) and 35.5% (n=143) were obese. Obesity in help-seeking male veterans was two to four times higher than that of the general population of UK. Higher scores on measures of anger and common mental health problems were significantly associated with greater BMI. Problems with physical systemic functioning and mobility were also significantly associated with greater BMI.

**Conclusions** The results indicate that treatment-seeking UK AF veterans exhibit higher levels of obesity compared with the general population, and clinically significant physical and mental comorbidities. The findings highlight a need for mental health services to offer treatments that effectively integrate physical and mental healthcare in the treatment of people with mental health problems.

## INTRODUCTION

Obesity is a pressing global health concern. On an individual level, obesity is significantly associated with a higher risk of mortality and morbidity as well as various physical health problems, including diabetes, cancer, infertility and cardiovascular problems.<sup>1,2</sup> Obesity is also associated with significant mental health problems, such as depressive and anxiety disorders.<sup>3</sup> To be diagnosed as obese, one's body mass index (BMI) must be greater than 30.<sup>4</sup> The prevalence of obesity is rising and by 2030 it is estimated that 11 million more adults in the UK will be obese.<sup>5</sup> Over the next 20 years, obesity-attributable disease risks are projected to add 87 000–130 000 cases of cancer, 544 000–668 000 cases of diabetes and 331 000–461 000 cases of coronary heart disease and strokes in the UK.<sup>5</sup>

Obesity and its associated health disorders represent a significant burden to society due to increased healthcare costs and reduced productivity. Obese individuals have been found to have 30% higher medical costs compared with an individual with normal weight.<sup>6</sup> In the UK, the Science Foresight

## Key messages

- ▶ Military veterans may be vulnerable to obesity for a number of reasons; for example, there may be less opportunity to engage in physical exercise in their civilian roles.
- ▶ A comparison of body mass index between veterans and the UK general population indicates that obesity is more prevalent among psychological treatment-seeking veterans.
- ▶ The findings highlight the importance of addressing both physical and psychological health problems of veterans presenting to treatment centres.

Programme<sup>7</sup> projected that by 2050 the continuing rise in obesity will cost the NHS an additional £5.5 billion in medical costs. Several studies have also found substantial indirect costs of obesity, including increased work absenteeism, poorer productivity, increased mortality preretirement and disability pensions (see ref 5 for a review). Many risk factors for obesity in adulthood have been identified, including childhood obesity, poor sleep, poor diet and a sedentary lifestyle.<sup>8,9</sup> Studies have also found obesity to be linked to low socioeconomic status and unemployment, with higher rates of obesity found in low-income groups due to the relatively low cost of energy-dense foods.<sup>10</sup>

Given these risk factors, it is possible that Armed Forces (AF) veterans may be particularly vulnerable to obesity. For example, UK AF personnel are twice as likely to be unemployed compared with the general population.<sup>11</sup> Moreover, on leaving the AF, veteran's new civilian roles are often sedentary with less emphasis on physical fitness.<sup>11,12</sup> As such, UK AF veterans may be at increased risk of obesity and its comorbid physical and mental health problems. A thorough understanding of the relationship between obesity and physical and mental health problems is needed by health service providers, including the NHS and military charities, in order to provide appropriate care to this population. Therefore, the aim of this study was to examine the relationship between BMI, physical health problems, mental health disorders and sociodemographic characteristics in a subsample of UK AF veterans engaged in care.

## METHOD

This research received ethical approval from the Combat Stress Research Ethics Committee.



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## Setting

This study was conducted at Combat Stress (CS), a national charity providing psychological interventions for UK AF veterans.

## Participants

Between January 2015 and February 2016, a total of 3335 veterans attended at least one treatment-related appointment with CS. Of these, a random subsample of 20% ( $n=667$ ) were randomly selected for the present study. Sixty-seven individuals were excluded because of insufficient address information or dying prior to data collection. Six hundred people were contacted and invited to participate, and 403 of the remaining 600 (67.2%) returned completed questionnaires.<sup>13</sup> To better understand the relationship between BMI and health problems in UK AF veterans, we compare the rates of BMI in help-seeking veterans with a nationally representative sample of the general population of UK adults.<sup>14</sup>

## Materials

Data were collected using a questionnaire where participants were asked to provide information regarding demographic, physical and mental health. Participants were sent the questionnaire via mail three times. Following this, the research team attempted to contact non-responders three times via telephone to give all individuals the opportunity to participate.

## Demographics

Sociodemographic information including preservice (eg, age participants joined the military), service (eg, were participants early service leavers, reason for leaving the AF, length of service) and postservice factors (eg, current relationship status, employment status, age, financial problems and time taken to seek formal support) was collected.

## Mental health

Problematic alcohol use was assessed using the Alcohol Use Disorders Identification Test,<sup>15</sup> with a score of  $\geq 16$  used to indicate a high level of alcohol use problems.<sup>15</sup> Post-traumatic stress disorder (PTSD) was assessed using the Post-traumatic stress disorder Checklist for DSM-5.<sup>16</sup> A cut-off score of  $\geq 38$  was used to indicate a likely PTSD diagnosis. The General Health Questionnaire-12<sup>17</sup> was used to assess common mental health problems (eg, depressive and anxiety symptoms). A cut-off score of  $>4$  was used for the present study. The Dimension of Anger Reactions (DAR-5) scale was used to assess anger.<sup>18</sup> The DAR-5 is a five-item Likert scale ranging from 0 'not at all' to 4 'very much' and a cut-off score of  $>12$  was used to indicate anger problems. The Work and Social Adjustment Scale<sup>19</sup> was used to assess participants' perceived functional impairment associated with a health problem. The five-item scale measures the impairment dimensions of: (1) work; (2) relationships with others; (3) home management; (4) private leisure activities; and (5) social leisure activities.

## Physical health

Participants were asked to provide information regarding their height and weight which was used to calculate their BMI. Participants were also asked if they smoked. The presence of traumatic brain injuries (TBI) was assessed using the Brain Injury Screening Index<sup>20</sup> which asked participants if they had ever experienced a serious blow to the head. If participants answered yes, they were then asked three additional questions: (1) if the event left them

dazed, (2) if it left them with a gap in their memory of over an hour, and (3) if they were left unconscious. For the purpose of this study, a positive response to any of the follow-up questions indicated the participant had experienced a brain injury. Participants were also asked to state which, if any, health problems they had and provide information regarding any other conditions not included in the questionnaire. These health conditions were grouped by mobility (chronic pain, amputation, poor mobility), sensory (hearing impairment, communication problems, sight impairment) and systemic problems (BP, heart, diabetes, respiratory, neurological, liver or kidney, digestive problems). Those who reported least one condition fitting into these categories were classed as having a health problem. The total number of physical conditions was also summed, and results divided into binary stratifications of 'high' (top tertile) and 'low' (bottom two tertiles).

## Analysis

Univariate regression models were used to explore the relationship between BMI, physical/mental health problems and sociodemographic characteristics. Due to the modest sample size, BMI was analysed as a continuous variable. The first stage of the analysis was to explore the relationship between demographic characteristics and BMI. Variables included: age, gender, relationship status, employment status, time taken to seek help (categorised as less than or greater than 5 years) and perceived financial difficulties. Following this, models were fitted to explore the relationship between physical and mental health and BMI, controlling for demographic characteristics. Alcohol consumption, TBI, physical conditions (eg, heart problems, poor mobility, respiratory problems) and mental health problems (eg, PTSD, common mental health disorders) were examined. All analyses were conducted using STATA V.13.0.

## RESULTS

### Demographic information

Completed questionnaires were returned by 403 participants (response rate 67.2%). Although people aged 45 and over were more likely to respond to the survey, no other differences were found between responders and non-responders.<sup>13</sup> Data from the 384 participants who provided their height and weight are reported here. In terms of BMI, 22.3% ( $n=90$ ) met criteria for normal BMI (18.5–25), 37.5% ( $n=151$ ) were overweight (BMI 26–30) and 35.5% ( $n=143$ ) were obese. Table 1 presents relevant demographic information, split by BMI category. Females (4.4%) and people aged under 35 (12.0%) were under-represented in the sample. A majority of participants were in a relationship (67.7%), not employed (69.0%) and not experiencing financial difficulties (73.4%).

Table 2 shows the prevalence of overweight and obesity, stratified by age, in samples of the general population of the UK (taken from ref 14 and the help-seeking veterans in this sample). Given the low proportion of female veterans in the CS sample, data are shown for males only. Although the percentage of overweight males in each age category is generally similar, more help-seeking male veterans aged 71 years and over are overweight compared with the general population. The prevalence of obesity in help-seeking male veterans is two to four times higher than that of the general population of UK males in every age category.

Univariate regression analyses of the CS data indicated that only older age was significantly associated with higher BMI ( $F(3, 380)=2.88$ ,  $p=0.036$ ), particularly for those aged 45 and over. As this was also the case for a multivariate regression in which

**Table 1** Demographic characteristics of the sample, split by BMI category

| Characteristic                   | n           |           |         | Total (%)  |
|----------------------------------|-------------|-----------|---------|------------|
|                                  | BMI 18.5–25 | BMI 26–30 | BMI >30 |            |
| <b>Age (years)</b>               |             |           |         |            |
| <35                              | 19          | 15        | 12      | 46 (12.0)  |
| 35–44                            | 22          | 37        | 32      | 91 (23.7)  |
| 45–55                            | 20          | 41        | 45      | 106 (27.6) |
| >55                              | 29          | 58        | 54      | 141 (36.7) |
| <b>Gender</b>                    |             |           |         |            |
| Male                             | 86          | 144       | 137     | 367 (95.6) |
| Female                           | 4           | 7         | 6       | 17 (4.4)   |
| <b>Relationship status</b>       |             |           |         |            |
| In a relationship                | 55          | 103       | 102     | 260 (67.7) |
| Not in a relationship            | 35          | 48        | 41      | 124 (32.3) |
| <b>Employment status</b>         |             |           |         |            |
| Employed                         | 27          | 50        | 42      | 119 (31.0) |
| Not employed                     | 63          | 101       | 101     | 265 (69.0) |
| <b>Time to seek help (years)</b> |             |           |         |            |
| <5                               | 53          | 84        | 64      | 201 (52.3) |
| ≥5                               | 37          | 67        | 79      | 183 (47.7) |
| <b>Financial difficulties</b>    |             |           |         |            |
| No                               | 61          | 119       | 102     | 282 (73.4) |
| Yes                              | 29          | 32        | 41      | 102 (26.6) |

BMI, body mass index.

all demographic variables were entered simultaneously, only age was controlled for in subsequent analyses.

### Mental health problems

Table 3 presents the results of regression analyses examining associations between mental health problems and BMI. When controlling for age, higher scores on measures of anger ( $F(2, 376)=8.03$ ,  $p=0.000$ ), common mental health problems ( $F(2, 378)=5.86$ ,  $p=0.003$ ) and difficulties with work and social adjustment ( $F(2, 381)=6.68$ ,  $p=0.001$ ) were significantly associated with higher BMI.

### Physical health problems

The results of regressions analysing the relationship between physical health problems and BMI, adjusting for age, are shown in Table 4. Problems with systemic functioning ( $F(2, 381)=8.87$ ,  $p=0.000$ ) and mobility ( $F(2, 381)=8.04$ ,  $p=0.000$ ) were associated with higher BMI.

**Table 2** Prevalence of overweight and obesity in males, stratified by age and veteran status

| Age (years) | UK general public* |           | Help-seeking veterans |           |
|-------------|--------------------|-----------|-----------------------|-----------|
|             | Overweight (%)     | Obese (%) | Overweight (%)        | Obese (%) |
| 21–30       | 33.4               | 8.8       | 27.3                  | 27.3      |
| 31–40       | 39.3               | 14.1      | 41.5                  | 32.1      |
| 41–50       | 39.7               | 17.3      | 38.8                  | 37.9      |
| 51–60       | 39.8               | 11.6      | 34.9                  | 45.3      |
| 61–70       | 41.4               | 16.2      | 43.6                  | 33.9      |
| 71+         | 38.7               | 12.1      | 56.0                  | 28.0      |

\*UK general public data taken from Wells *et al.*<sup>14</sup>

**Table 3** Associations between mental health factors and BMI, adjusted for age

| Mental health measure                  | Number of participants meeting cut-off score (%)* | $\beta$ (95% CI)†           | P value |
|--|---|-----------------------------|---------|
| AUDIT (alcohol misuse)                 | 158 (41.1)  | −0.099<br>(−1.231 to 1.033) | 0.863   |
| PCL-5 (PTSD)                           | 317 (82.6)  | 0.449<br>(−0.993 to 1.890)  | 0.541   |
| GHQ-12 (common mental health problems) | 276 (72.4)  | 1.539<br>(0.323 to 2.755)   | 0.013   |
| DAR-5 (anger)                          | 282 (74.4)  | 2.031<br>(0.788 to 3.275)   | 0.001   |
| WSAS (work and social adjustment)      | 268 (66.9)  | 1.702<br>(0.549 to 2.855)   | 0.004   |

\*Not all of the 384 participants provided data for the GHQ-12 and the DAR-5. The percentage calculations are therefore based on a sample n of 381 for the GHQ-12 and 379 for the DAR-5.

†Adjusted for age.

AUDIT, Alcohol Use Disorders Identification Test; BMI, body mass index; DAR-5, Dimension of Anger Reactions-5; GHQ-12, General Health Questionnaire-12; PCL-5, Post-traumatic stress disorder Checklist for DSM-5; PTSD, post-traumatic stress disorder; WSAS, Work and Social Adjustment Scale.

## DISCUSSION

This research sought to investigate the relationships between BMI and mental and physical health in a sample of UK AF veterans seeking care from a mental health charity. The results provide information about the comorbidities present in the veteran population and their interrelated effects on health and well-being.

A comparison of BMI in the treatment-seeking veterans in this study and the general population of the UK suggests that obesity is far more prevalent among veterans seeking support for mental health difficulties. This finding concurs with similar studies that have assessed obesity in samples of people with mental disorders (eg, ref 21), suggesting that problems with weight gain may be more severe among people with mental health difficulties, including veterans. While there may be several reasons for this, including illness-related factors (eg, feeling too exhausted to exercise), lifestyle factors (eg, lacking a nutritious diet), or the effects of particular medications which may contribute to weight gain, such as psychotropics,<sup>22</sup> there is nevertheless a need for treatment services to acknowledge and support both the physical and mental health needs of their clients.

The results of this study indicate that veterans engaged in care have a range of comorbid physical and mental health difficulties. The veterans in this sample evidenced symptoms of

**Table 4** Associations between physical health factors and BMI, adjusted for age

| Physical health measure                   | Number of participants meeting cut-off score (%) | $\beta$ (95% CI)*        | P value |
|---|--|--------------------------|---------|
| BISI (traumatic brain injury)             | 183 (47.7)                                       | 0.017 (−0.136 to 0.171)  | 0.825   |
| Mobility problems (eg, limb amputation)   | 194 (50.5)                                       | 0.275 (0.122 to 0.427)   | 0.000   |
| Sensory problems (eg, hearing impairment) | 146 (38.0)                                       | −0.028 (−0.192 to 0.135) | 0.375   |
| Systemic problems (eg, heart problems)    | 229 (59.6)                                       | 0.280 (0.113 to 0.446)   | 0.001   |

\*Adjusted for age.

BISI, Brain Injury Screening Index; BMI, body mass index.

common mental health problems alongside problems with anger, poor work and social functioning, mobility issues and systemic complications such as cardiovascular and respiratory problems, each of which was significantly associated with increased BMI.

Previous research with a sample of civilian UK adults seeking treatment for schizophrenia reported similar links between BMI and cardiovascular and respiratory diseases.<sup>21</sup> Systematic reviews synthesising international research in this area support these findings, and also note significant associations between BMI and musculoskeletal problems that can impair mobility in people with severe mental illness.<sup>22</sup> Taken together, these findings indicate that help-seeking veterans exhibit similar risk factors and comorbidities to the broader population of people engaged in mental health treatment. There is therefore a need for healthcare professionals who treat veterans of the AF to be aware of these relationships, and how they might influence treatment and recovery prospects.

The results of this research indicate the importance of understanding the factors that are associated with a high BMI in people who seek treatment for their mental health. This knowledge can inform the delivery of integrated service provision that addresses complex healthcare needs in a holistic manner. For example, healthcare professionals treating physical health problems (eg, occupational therapists, dietitians) should understand how the mental health problems, and their pharmacological treatments, can influence the management of systemic diseases (eg, how depressive symptoms can reduce exercise frequency and thus have little effect on a high BMI). Similarly, mental health professionals should account for the impact of comorbid physical health problems when discussing treatment options with clients (eg, mobility issues that may affect attendance at psychotherapy sessions). A thorough consideration of these issues is particularly needed for military veterans, who appear likely to present to services with multiple mental health problems, accompanied by both physical and social health difficulties.<sup>13</sup> As these comorbidities often require multidisciplinary care, organisations with specialist expertise, such as military mental health charities, could consider diversifying their practices to include case management and coordinated care services for veterans who present to their treatment centres.

This study is one of the first to elucidate the associations between BMI and mental and physical health problems in UK AF veterans engaged in treatment. The study's random sampling procedure, relatively high response rate and minimal differences between responders and non-responders contribute to the validity of the conclusions. Despite this, there are several limitations of the research. First, respondents were recipients of services from one military mental health charity in the UK, which specialises in the treatment of PTSD. Veterans completing this survey may not be representative of all treatment-seeking veterans in the UK and may differ from veterans seeking treatment from other mental health services. However, given that CS has a nationwide presence, receives approximately 2500 referrals each year<sup>23</sup> and is an NHS-recognised treatment pathway for veteran mental health problems,<sup>13</sup> the study's results are likely to have reasonable validity. Second, a small number of female participants means that the results can only be generalised to treatment-seeking male veterans. Female members of the UK AF may have a lower risk of mental health problems,<sup>24</sup> meaning they do not require mental health services as often, or particular factors may affect their access to or engagement with professional care. Future research should attempt to assess the associations between BMI, mental health and physical health in treatment-seeking female veterans to better understand the relationships between these

factors in this particular group and compare whether and how support services should be tailored for male and female veterans. Lastly, although BMI is a widely used measure of overweight and obesity in population studies, it is unable to distinguish between fat and muscle. It may therefore overestimate the prevalence of overweight and obesity in groups with higher proportions of muscle mass, such as athletes and military personnel. However, in a study comparing levels of agreement between BMI, waist circumference, waist circumference/height and skin folds in a sample of 386 UK Army personnel, BMI was found to be a reasonably accurate measure of obesity, showing good concordance with waist circumference.<sup>25</sup> Although it is likely that in this sample of veterans a high BMI reflects overweight and obesity rather than a high proportion of muscle mass, this cannot be definitively ascertained. Future research in this area could attempt to source more accurate measures of body mass composition to better assess the physical health of veterans, and associated risk factors.

Our results suggest that treatment-seeking veterans, like other people experiencing mental health problems, exhibit high levels of obesity compared with the general population, and a concomitant range of clinically significant physical and mental comorbidities. The data presented indicate a need for mental health services to offer treatments that address all aspects of their client's functioning and well-being in a holistic way. Specialist services such as veteran's mental health charities, who have a thorough understanding of the particular risk factors and presentations associated with their client base, should consider altering or expanding their practices to include forms of multidisciplinary care and case management services for veterans with complex presentations that include diseases associated with overweight and obesity. These changes in service provision should be rigorously evaluated and broadly disseminated to enable other organisations, practitioners, researchers and policy-makers to learn more about how to effectively integrate physical and mental healthcare in the treatment of people with mental health problems.

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