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## **Dementia in veterans and non-veterans in England: a cross-sectional survey**

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## **Abstract**

**Background:** Concerns have been raised that military veterans are at greater risk of dementia due to increased rates of depression, Post-traumatic stress disorder (PTSD) and Traumatic Brain Injury (TBI) found in this population. The prevalence of dementia in English veterans and whether this is different to non-veterans however, is currently unknown.

**Aims:** To study the risk of dementia in the English veteran population, we aimed to calculate the prevalence of dementia in a group of veterans and compare this with a similar group, with no history of military service.

**Methods:** Male veterans and non-veterans aged over 64 years old were identified from the 2007 Adult Psychiatric Morbidity Survey, a national survey of community dwelling adults in England. This survey was conducted via face-to-face interviews and incorporated questions on previous military service. Dementia was screened for using the modified Telephone Interview of Cognitive Status (TICS-M).

**Results:** 496 male veterans and 294 non-veterans were identified. TICS-M scores indicated possible dementia in 24% of veterans and 26% non-veterans; after adjusting for age, the odds of possible dementia was significantly lower in veterans than non-veterans (adjusted OR 0.56; 95% CI 0.38, 0.84,  $P < 0.01$ ).

**Conclusions:** English male veterans were less likely to have dementia than similar male non-veterans. This study did not find any evidence to support the view that dementia is more common in veterans than non-veterans.

**Key words:** Dementia; Veterans; Military; Survey; Depression; PTSD; Occupational Health

## **Introduction**

Dementia is a syndrome characterised by difficulties with memory, language, thinking and problem solving, caused by a number of diseases including Alzheimer's Disease, Vascular Dementia and Lewy Body Dementia [1]. It is progressive and fatal, with evidence suggesting that it is the leading cause of death in females and the second most common cause of death in males in England [2]. Epidemiological data estimate the prevalence of dementia in the UK in the 65 plus age group to be 7.1% [3], equating to around 850,000 people in 2015 [3]. This number is projected to rise to 1 million cases by 2025 and over 2 million by 2050 [3].

There remains no effective treatment. Instead, prevention, through identifying and modifying those risk factors amenable, remains key to managing this condition. Two recent studies have identified ten risk factors for developing dementia or Alzheimer's disease [4, 5]. A number of these are modifiable, including benzodiazepine use, depression, frequency of social contacts [4] and head injury [5]. As improved understanding of the risk factors associated with the development of dementia emerges, groups at particular risk of developing the condition are being identified.

There is evidence of increased rates of common mental disorders [6], depression [7] and Post-traumatic Stress Disorder (PTSD) [8], in military populations, though not in all studies [9]. This has led to the suggestion that this group may be at particular risk of developing dementia [10, 11]. Similarly, rates of Traumatic Brain Injury (TBI) are higher in the military populations [12] and TBI in veterans has been demonstrated to increase the risk of dementia [13].

Specific information regarding the prevalence of dementia within the English veteran population does not currently exist. Evidence from studies on US veterans however, generally find prevalence rates of dementia similar to those seen in the general population, approximately 5-8% [11, 14]. Direct comparisons of prevalence rates of dementia between veterans and non-veterans is also limited; though one

such study found that veteran Mini-Mental State Exam (MMSE) [15] scores decreased more quickly than non-veteran scores over the study period [16].

In 2014 there were approximately 2.6 million veterans, from across the Armed Forces, living in the UK [17]. The majority of these were male, and over 50% were over the age of 75 years and therefore at increased risk of developing dementia [17]. Despite the concerns, it is currently unclear if these veterans are at greater risk of developing dementia than the general population, and whether this risk is related to their military service. Clarifying this, is essential to inform planning for their future health and social care needs [10]. We therefore aimed to determine the prevalence rate of dementia in a subsample of veterans and compare this with a similar group of non-veterans, using data from a national survey of community dwelling adults living in England.

## **Methods**

We carried out a secondary analysis of data from the 2007 Adult Psychiatric Morbidity Survey (APMS). APMS is a population-based survey of community dwelling adults (16 years and older) living in England [18]. This survey comprised a two stage, stratified design, with a sampling frame of addresses from which a random sample of adults was obtained. 13,171 eligible private households were identified, and one person per household was randomly selected to take part. It was carried out by face-to-face interviews between October 2006 and December 2007. Phase-one interviews were conducted by experienced National Centre for Social Research interviewers, trained, and supervised throughout the administration of the survey. They took approximately ninety minutes to complete, involving computer assisted interviewing and self-completion sections. Phase two interviews were carried out by clinically trained research interviewers using a subsample of phase one interviewees, based on the probability of their having either psychosis,

Asperger's Syndrome, borderline personality disorder or antisocial personality disorder [19].

Ethical approval for the 2007 APMS was obtained from the Royal Free Hospital and Medical School Research Ethics Committee. The raw data from the survey is held by UK data service and is freely available to researchers.

Using the original data set, all males over the age of 64 years were identified for our study. Similar to other studies on the British veteran population, women were excluded as they were not included in conscription and compulsory national service, and non-white ethnic groups were excluded as previous studies have shown that the British veteran population is predominantly white [9]. Proxy interviews were also excluded.

The APMS survey comprised structured assessments designed to allow International Classification of Diseases-10 (ICD-10) [20] diagnostic criteria to be applied. It also incorporated screening instruments and questions on topics of general health, service use, risk factors and demographics.

Veterans were defined as all those who had answered 'yes' to the question 'ever served in Armed Forces'. Possible dementia was screened for using the Telephone-Interview of Cognitive Status – modified version (TICS-M) [21] which was administered during the phase one interviews. It has a reported sensitivity of 73.3% and specificity of 67.1% in identifying dementia in community dwelling adults [22]. TICS-M is usually scored out of a maximum of 39 but for our study one point was unavailable, because it contained a patient identifier, so the maximum possible score was 38. A score of 20 or under is usually used to identify possible cases of dementia [23]. We used a score of 19 or under to reduce the likelihood of false positives.

The Clinical Interview Schedule – Revised (CIS-R) [24] was used to derive ICD-10 based diagnoses of mild, moderate, and severe depression. From these, a binary depression variable was created, where "yes" corresponded with an ICD-10

score suggesting symptoms of possible mild, moderate, or severe depression in the last week.

A history of trauma was determined by the response to the question 'Has a traumatic event or experience ever happened to you at any time in your life?', with a variable derived identifying where an event had occurred since the age of 16. The meaning of traumatic event or experience was explained as 'something like a major natural disaster, a serious automobile accident, being raped, seeing someone killed or seriously injured, having a loved one die by murder or suicide, or any other experience that either put you or someone close to you at risk of serious harm or death' [19].

The Trauma Screening Questionnaire (TSQ) [25], was used to gather prevalence data on PTSD. This is a screening tool designed to identify cases of likely current PTSD. The TSQ has been recommended for use by the National Institute of Clinical Excellence in primary care and gives a 'screen positive' result, though the 2007 APMS authors noted that this is likely to yield an over-estimation of current morbidity [19].

We also collected demographic information and data on other factors associated with developing dementia. A new three-way variable for marital status was created, grouping individuals as "married/cohabiting", "single" or "widowed/divorced". Educational status was grouped into three categories "yes", "no", and "don't know", where yes corresponded to having a degree, teaching, or nursing qualification, A-Levels, GCSEs or foreign or other qualification.

Smoking status was recorded as "yes" or "no" based on whether an interviewee answered 'yes' to the question '... ever smoked a cigarette'. To assess perceived social support, participants were asked seven questions which followed the stem statement, 'There are people I know amongst my family and friends who...', for example, 'do things to make me feel happy' [19]. Answers were scored 1-3, giving total scores ranging from 7 to 21. These were combined to create a new binary

variable, with the categories “severe lack social support” and “adequate social support”.

Analysis was undertaken using Stata/IC, version 15. Veteran and non-veteran groups were assessed for socio-demographic differences using cross tabulations and Pearson’s  $X^2$  tests, with Rao and Scott second order corrections for survey design. Associations between a probable diagnosis of dementia, PTSD and depression, and veteran status were examined using logistic regression.

Analyses accounted for the weighting, clustering, and stratification inherent in the survey design. Weights were already calculated by the APMS team and were designed to ensure the survey was representative of the household population in England aged 16 years and over. They included adjustments to account for the fact that only one person per household was selected to complete the survey, reducing the chance of being chosen if you lived in a large household, higher response rates where houses were owner occupied, and where there was no physical barrier to entering the property [19]. Models were adjusted for factors associated both with being a veteran, and with the outcome being analysed, that were not considered to be on the causal pathway between veteran status and outcome.

## **Results**

Fifty seven percent of those eligible to take part in the 2007 Adult Psychiatric Morbidity Survey, did so, producing 7461 productive phase-one interviews [19]. Following the application of our exclusion criteria, 790 white males aged 65 years and over were identified for further analysis. Of these 496 (63%) were veterans and 294 (37%) were non-veterans. Fig. 1.

*Insert: Fig. 1.*

Veterans tended to be older ( $P < 0.001$ ) and were more likely to have experienced trauma than non-veterans ( $P < 0.05$ ). There were no other significant

differences in the other socio-demographic characteristics between the two groups (Table 1).

*Insert: Table 1.*

Twenty four percent of veterans and 26% of non-veterans were identified by TICS-M as having possible dementia (Table 2). After adjusting for age (which was significantly different between the two groups), veterans were found to be significantly less likely to screen positive for possible dementia than non-veterans (adjusted OR 0.56; 95% CI 0.38, 0.84,  $P < 0.01$ ).

Six of the 496 veterans screened positive for depression in the last week, and two had symptoms of likely current PTSD. These were not significantly different to the numbers identified in the non-veteran group (Table 2).

*Insert: Table 2.*

## **Discussion**

Almost a quarter of white male veterans aged 65 years and over, living in the community in England, screened positive for possible dementia. These veterans were less likely to have possible dementia than a similar group of non-veterans. Rates of current depression or PTSD were similar between veterans and non-veterans.

The main strength of this study is that the data presented is based on a large, randomly selected national sample, using validated tools to measure outcomes. There are limitations, however. Due to the survey design, the maximum score on TICS-M available was lower than usual, and adjustments were made to the score for identifying dementia to compensate for this. The 2007 APMS surveyed community-dwelling adults living in England. The cognitive demands of taking part in the survey, and the exclusion of those in nursing and residential care, will have excluded those with moderate to severe dementia. It may be a greater proportion of these cases

came from the veteran population. This would limit the generalisability of the result to all veterans and to all adults aged 65 years and over. Lastly, the observational cross-sectional design does not allow for inferences of causality.

The main aim of the study was to determine the prevalence of dementia in an English veteran population and compare this with a similar non-veteran group. The finding that veteran status was associated with lower rates of possible dementia was unexpected. Depression, PTSD and TBI are risk factors found to be associated with an increased risk of developing dementia [4, 5, 26]. Rates of these have been found to be higher in the military population [6, 8, 12], contributing to a hypothesised increased risk of developing dementia in veterans [10, 11].

Whilst increased rates of these risk factors for dementia have been found in military populations, the evidence is conflicting [9, 27]. In a previous study of the UK military population, evidence of increased rates of mental illness in veterans was not found [9], and a recent meta-analysis of US veterans found prevalence of PTSD and depression was similar to community estimates [27]. It may be that whilst serving military personnel are at increased risk of depression, PTSD and TBI, this does not always translate to an increased risk in the veteran population. Though a recent study of UK military personnel did find higher rates of PTSD in ex-service personnel than serving personnel [28]. In our study, we did not find a significant difference in the numbers of those screening positive for symptoms of PTSD and depression between the two groups, though the large odds ratios and evidence from other studies [28] suggests that this is an area that requires further evaluation.

Veterans in this study were significantly older than their non-veteran counterparts. This echoes the findings of other demographic studies of UK veteran populations and reflects the effect of National Service, which ended in 1960 [17].

The prevalence of possible dementia identified in both veterans and non-veterans in this study is higher than other recent estimates [29, 30]. A study using a different version of the Telephone Interview of Cognitive Status found the prevalence

of dementia to be 8.8% in adults over 60 years of age living in England [29]. Similarly, results from the second Cognitive Function and Ageing study put the prevalence of dementia in adults over 65 in England and Wales at 6.5% [30]. Data from this study is likely to be particularly accurate as they use a comprehensive two-stage screening and assessment process to identify cases of dementia.

The version of the TICS-M used for this study, has a relatively low specificity and sensitivity [22]. This limits its validity as a screening tool, to indicating the presence of 'possible' dementia, as opposed to probable dementia, which may be concluded when using other screening tools. Our results however are similar to another study using the 2007 APMS raw data, which found the prevalence rate of 21.2% of dementia in those over 60 years using the TICS-M scores, based on a score of 20 or under [23]. The disparity between what we found and other reported prevalence rates of dementia in English populations is most likely a result of the different screening tools used.

Instead of increasing the risk of dementia, it may be that there are protective factors associated with veteran status. The veterans in this study were predominantly conscripted during national service. Compared with their non-veteran peers they may have been physically and mentally fitter when they joined the military. This could have protected them against the possible negative effects of military service [9]. Whilst this study did not examine the prevalence of physical health conditions within the subsample, other studies using the data from the 2007 APMS found no differences in the physical health since the age of 16, or in the last year, between veterans and non-veterans [9].

Future research should aim to clarify the rates of dementia seen in other veteran populations, as well as the presence of common mental illnesses, and other potential modifiable risk factors for dementia in this group. In addition, there should be a focus on identifying any potential protective factors against dementia seen

within military veterans, which could be promoted by policy and healthcare professionals working with this population.

In conclusion, whilst previous research has suggested that military veterans may be at increased risk of developing dementia, our study found the prevalence rates of possible dementia were lower in older, white, male veterans living in the community in England, than similar white English males, with no history of military service. Concerns that military veteran populations are at greater risk of developing dementia are not supported by this study. The results suggest that the association between veteran status, mental illness and dementia needs further investigation.

**Key learning points:**

**What is already known about this subject:**

- Depression and head injury are modifiable risk factors associated with developing dementia
- There are concerns that military veterans are at increased risk of developing dementia because of increased rates of these and other risk factors seen in this population
- The prevalence of dementia in the English veteran population, and whether this is different to the prevalence in English non-veterans, is currently unknown

**What this study adds:**

- This is the first study to give an estimate of the prevalence of dementia in a community dwelling, veteran population living in England, with comparable estimates for the non-veteran population
- Almost a quarter of English male veterans screened positive for possible dementia
- Veterans were less likely to have possible dementia than non-veterans

**What impact this study may have on practice or policy:**

- Concerns that military veteran populations are at greater risk of developing dementia are not supported by this study
- There may be protective factors related to military service, that need to be identified and maximised
- The results suggest that the association between veteran status, mental illness and dementia needs further investigation

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