The Tri-Service Food Insecurity Study

Northumbria University NEWCASTLE

ssafa the Armed Forces charity

THE ARMED FORCES COVENANT FUND TRUST

Matt Kiernan

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The Research Team

Professor Matthew Kiernan	Principal Investigator
Professor Marco Tomietto	Co-Investigator
Dr Amy Johnson	Senior Research Assistant
Giuseppe Serra M.D.	Visiting Scholar
Dr Helen King	Co-Investigator
Dr Ed Rollason	Co-Investigator

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Overview of Key Results

Prevalence of food insecurity and health status in the survey sample

- 16.9% of veterans and their families were in food insecure households and 12% of these had some element of hunger.
- The mean mental wellbeing score for survey respondents was 23.38 which was lower than the general population mean of 23.5.
- Less than half of the survey respondents reported having good health (37.7%).
- 49.4% of survey respondents reported having a long-standing medical condition not compensated by the Armed Forces Compensations Scheme and/or War Pension Scheme.

Cross Group Comparisons

The cross-groups comparisons identified the following groups as experiencing statistically significant higher levels of food insecurity:

- Younger survey respondents.
    - A further breakdown showed that those who were of working age (below 66 years old) had significantly higher rates of food insecurity.
- Survey respondents in rented accommodation, who were unemployed or reported 'other'.
- Survey respondents who were single or separated/divorced.
- Survey respondents who had lower mental wellbeing scores.
- Survey respondents who self-reported poor or very poor health.
- Survey respondents who self-reported having a long-standing medical condition.
- Veterans who were not commissioned officers.
    - Further analysis indicated that levels of food insecurity reduced as service leaver rank increased.
- Veterans who reported serving a shorter amount of time in the military.
- Survey respondents in receipt of financial support through the Armed Forces Compensation Scheme, through a service charity or from the Department of Work and Pensions

Regression Analysis

The regression analysis identified odd-ratios and key factors associated with food insecurity. The model explained 28.2% of the variance. Veterans with the factors identified below are more likely to be food insecure.

- Of working age (i.e. below 66 years old and therefore under the current statutory retirement age)
- Not being married
- Living in rented accommodation
- Non-officer rank at time of discharge
- Receiving other benefits

Geospatial Analysis

The geospatial analysis identified the geospatial distribution of survey respondents across the UK and key 'hot spots' of food insecurity. However the low sample size restricted the level of analysis available.

- The survey respondents who identified as food insecure were situated across 101 local authorities (LAs).
  - Colchester was high in both survey responses and count of responses reporting food insecurity.
  - Telford and Wrekin reported a high level of food insecurity, however had a low survey response.
  - Fife, Cornwall and Devon had a high survey response but low instances of food insecurity.
- There was a weak positive correlation where LAs with a geographical unit indicating high deprivation, were more likely to have higher responses of food insecurity.

Introduction

Food insecurity is defined as lacking access to reasonably priced, nutritious food of an adequate quality (Food and Agriculture Organization of the United Nations et al., 2015). It is considered a consequence of poverty, with individuals reporting reducing the quality and choice of food, restricting portion sizes or missing meals to prioritise essential bills, such as mortgages or rent (Pettifer & Patel, 2022). According to the World Health Organisation (n.d.), food insecurity is recognized as a social determinant of disease, and it has been linked to conditions such as depression, diabetes, hypertension, hyperlipidaemia, and overall increased cardiovascular risk (Liu & Eicher-Miller, 2021).

The prevalence of food insecure UK households varies between 8% to 17.7% (Department for Environment Food & Rural Affairs, 2021; Food Standards Agency & NatCen, 2019; The Food Foundation, 2023), however, key factors such as working age are continually shown to be more likely to be food insecure. Between 1st April 2022 and 31st March 2023, The Trussell Trust (2023) reported a 37% increase in the distribution of emergency food parcels across the United Kingdom, marking the highest amount within a single financial year. Independent food banks have reported an unprecedented need for emergency support, which they are struggling to meet due to supply issues (Independent Food Aid Network, 2023). If this continues, it is likely that the size of food parcels will need to be reduced to meet need (Independent Food Aid Network, 2022). Food insecurity is clearly rising and will continue to do so given the current economic situation and cost-of-living crisis. However, whilst the The Trussell Trust (2023) acknowledges these factors in the changing figures, they argue that the COVID-19 pandemic and the cost-of-living crisis have exasperated a pre-existing issue deriving from a weakened welfare system.

The prevalence of food insecurity varies across the UK, with some regions reporting a greater need and use of food banks, such as the Northeast of England (The Trussell Trust, 2023). Recent work by The University of Sheffield (2021) has highlighted the different instances of food insecurity across the UK, with high levels being reported in counties such as Buckinghamshire and Yorkshire. Whilst this work has provided a general pattern of food insecurity across the UK, there has been no exploration of food insecurity experienced by the veteran population at a geospatial level. Focusing specifically on the ex-Armed Forces, Kiernan et al. (2022) found that Scottish veterans were more likely to report requesting assistance with basic needs, such as food and living costs, from SSAFA, The Armed Forces Charity and were more likely to be located in areas of high deprivation. Despite this initial work, there has been no exploration of food insecurity experienced by the veteran population at a geospatial level.

Much of the previous research into food insecurity in the veteran population has been completed in the USA. Such work has shown that veterans were more likely to be food insecure if disabled, unemployed, working age, and female (Rabbitt & Smith, 2021). In response to this, veterans were more likely to buy cheaper, more filling and unhealthy food, be unable to afford meat products, and report a lower fruit intake (Becerra et al., 2017; Kamdar et al., 2022). Only two studies have explored food insecurity within UK veterans, Mann et al. (2021) explored the level of food security and health status of veterans receiving support from Hull 4 Heroes (a regional armed forces charity based in Kingston upon Hull) during the COVID-19 pandemic. Poor mental and physical health were reported as key concerns during the pandemic, with over 60% reporting fair or poor health. Over half of the sample reported instances of household food insecurity, with statistically higher levels being found in working age veterans and those living in rented accommodation. More recently, Stretesky and Defeyter (2022) found similar levels of food insecurity between UK veterans and non-veterans, estimating that 1 in 10 veterans were food insecure. Those presenting as food insecure were younger and receiving disability benefits.

Although these studies provide a valuable insight into prevalence and associated factors of food insecurity within the UK veteran population, there remains scope for further work particularly regarding risk factors. Additionally, there has been no previous work exploring the geospatial distribution of members of the ex-Armed Forces community who are experiencing instances of food insecurity. Understanding both the risk factors and location of those most at risk will facilitate survey providers to develop more targeted policies, interventions and allocation of resources for those at need before reaching crisis level.

Research Aims

This research project aimed to build upon initial work into levels of food security and health status of the UK ex-Armed Forces community. In doing so, this study aimed to:

- Identify levels of food security experienced by RNRM, Army, and RAF veterans and their families.
- Identify the health status and service-related injury of RNRM, Army, and RAF veterans who are in receipt of financial assistance from a service charity.
- To identify the variables associated with experiences of food insecurity in the UK veteran population.
- Identify areas of the UK in which food poverty is the most prevalent among the ex-Armed Forces veteran population; i.e. geospatial distribution.

Project Methodology

This is a cross-sectional study using an online survey to identify the self-reported instances of food insecurity and health status of UK veterans and their families. The dependent variable was household levels of food insecurity as determined by two levels: food secure and food insecure.

The first phase of the project aimed to identify the prevalence of food insecurity and the health status of the ex-Armed Forces community before identifying key variables associated with food insecurity via a regression analysis. The second phase investigated the geospatial distribution of survey recipients in comparison to data provided by the 2021 census along with most recent index of multiple deprivation (IMD). Focus is placed on areas of high relative deprivation and the location of survey respondents reporting instances of food insecurity and low/high levels of mental wellbeing.

Survey Instrument

This study received ethical approval from the Health and Life Sciences Ethics Department at Northumbria University (Reference Number: 1628).

Individual service surveys were created and disseminated to veterans and their families from the Royal Navy (RN), Royal Marine (RNRM), Army and Royal Air Force (RAF). To capture the specific demographics of the Army participants, an additional demographic question was included to identify the regiment and corps previously served. The survey was available through Joint Information Systems Committee (JISC) online surveys and live between 1st February and 31st March 2023. The Royal Naval Association, The Royal Marines Charity, and the RAF Association were asked to disseminate study information and the survey link to their membership. As there is no current singular Association for the Army, the survey was shared to Army Corps and Regimental Association members through a single point of contact from the Ministry of Defence. The survey link was also distributed via social media; Twitter, Facebook and LinkedIn.

Participating in the survey was voluntary and did not impact Association membership or any pre-existing support that was being received. Veterans and their families were invited to complete the online survey by selecting the link provided through their respective Associations or as advertised on social media. Participants were able to contact the research team with any questions. The survey included information about the study and a consent form. Questions focused on the following:

- Levels of food security
- Mental Wellbeing and self-reported general health
- Self-reported long-standing health conditions
- Receipt of financial benefits
- Key demographics

Veterans were directed to answer demographic questions relating to rank at end of service, regiment or corps (Army only), length of time served, and year discharged from service.

Participants

Participants were invited to complete the survey if they were a UK veteran or a family member of a UK veteran. There were 908 initial responses to the online survey. Eighteen participants declined to participate and 2 participants did not complete the survey. A further 7 responses were excluded due to still serving (Regulars and Reserves) at the time of survey completion, it being unclear whether they were a veteran/family member or were not UK veterans. Therefore 881 responses were included in the analysis (see table 1). Please note that for sensitive variables (e.g. ethnicity or gender), groups containing under 5 participants were removed to ensure confidentiality. Whilst these variables were anonymised, this can present as a privacy risk as it is possible that small numbers of cases can lead to identification (Information Commissioner's Office, 2012).

Power calculations were completed to establish a suitable sample size for Phase One. Power calculations are used to identify an appropriate sample size to answer the research question (Jones et al., 2003). This reduces the risk of reporting a statistical difference where there is none, or vice versa. The sample size calculation was completed based on the regression analysis: to detect an OR of 1.3, alpha error of 0.05, and power 0.80, the total sample size calculated for the study was 721 participants (Faul et al., 2007). The regression model indicates that the sample size included in this study is sufficient to detect even small effects or changes.

Variables of Interest

Food Insecurity

Household food insecurity was assessed using The United States Department of Agriculture (USDA) Food Security Scale (Bickel et al., 2000). For the purposes of this study, 10 items

were selected from the initial 18 questions to fulfil the present research aims. The questions focused on experiences of food insecurity for an adult household within the previous 30 days.

Table 1 *Survey Respondents Characteristics (N=881)*

Variables	Total Number and Percentage
Age (n=862)	**Mean = 66.58 (SD = 10.75)**
Working Age (under 66 years)	366 (42.5%)
Non-Working Age (over 66 years)	496 (57.5%)
Gender (**n=868**)	
Male	727 (83.9%)
Female	140 (16.1%)
Service (N=881)	
Royal Navy and Royal Marines	296 (33.6%)
Army	443 (50.3%)
Royal Air Force	142 (16.1%)
Military Background (n=870)*	
Served in the Regulars	785 (90.2%)
Served in the Reserves	38 (4.4%)
Family member served in the Regular Forces	29 (3.3%)
Family member served in the Reserves Forces	2 (0.2%)
Other	16 (1.8%)
Military Rank (n=811)	
Non-Officer	626 (78.1%)
Officer	176 (21.9%)
Junior Rank Rate	93 (11.6%)
Junior Non-commissioned Officer	207 (25.8%)
Senior Non-commissioned Officer	326 (40.6%)
Junior Commissioned Officer	51 (6.4%)
Senior Commissioned Officer	125 (15.6%)
Length of Service (in years) (n=797)**	**Mean = 18.99 (SD = 10.85)**
Years since Discharge (n=790)	**Mean = 30.00 (SD = 15.36)**
Ethnicity (n=879)	
White	864 (98.3%)
Other	15 (1.7%)
Marital Status (n=881)	
Single	46 (5.3%)
Married/Co-habiting	645 (74.6%)
Separated/Divorced	83 (9.6%)
Widowed	91 (10.5%)

* Other responses included serving in both Regular Service and Reserves, serving in two services, and the participant and their spouse served.

** In the instance where survey respondents served in both the Regular Service and Reserves, a total length of time from both services is provided.

Responses are coded with affirmative responses indicating food insecurity and were summed to produce an overall score, these scores were then used to categorise the status of food security within that household. There are four categories; Food secure, Food Insecure Without Hunger, Food insecure with Hunger (Moderate), and Food Insecure with Hunger (Severe). For the purposes of analysis, these categories were further adapted to become binary variables where respondents were categorised as being food secure or food insecure. An additional binary variable assessed the prevalence level of hunger in the survey respondents. The USDA

was shown to have high internal consistency[1] with a Cronbach Alpha of .933 (see Appendix 2).

Mental Wellbeing

Mental Wellbeing was assessed using The Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS). The SWEMWBS (The University of Warwick, n.d) is a 7-item measure of mental wellbeing (eudemonic and hedonic, and psychological functioning and subjective wellbeing) assessed over the previous two weeks. Questions are rated on a 5-point Likert scale ranging from 'None of the time' to 'All of the time'. Items were scored from 1 to 5 and then transformed into metric scores. These metric scores are used as an overall measure of sample wellbeing, ranging from 7 to 35, which could be compared to the population mean of 23.5 (Ng Fat et al., 2016). A higher score indicates a higher reported level of wellbeing. Internal consistency for the present study was shown to be high with a Cronbach Alpha score of .907 (see Appendix 2).

Self-Reported Health Outcomes

Self-reported health status referred to the survey respondent's general health status and experiences of long-standing medical conditions. General health status was assessed on a 5-point Likert scale ranging from 'very good' to 'very poor'. Survey respondents were also asked about long-standing medical conditions that were not compensated under the Armed Forces Compensation Scheme[2] and/or the War Pension Scheme[3]. For the purposes of analysis, this was categorised as a binary variable as those who experienced and did not experience long-standing medical conditions.

[1] Internal consistency relates to how accurately and consistently a variable is measured by assessing the correlation between different questions on a questionnaire. Cronbach Alpha is a widely used measure of internal consistency and calculates a value between 0 and 1, with it commonly understood that 0.6/0.7 indicates acceptable consistency (Tavakol & Dennick, 2011; Ursachi et al., 2015).
[2] The Armed Forces Compensation Scheme replaced the initial War Pension Scheme and provides remuneration for service-related injury or death experienced by Regular and Reserves military personnel after 6th April (Ministry of Defence & Veterans UK, 2022a).
[3] The War Pension Scheme was financial compensation for ex-serving Armed Forces members who were injured or had an exacerbated injury due to their service (Ministry of Defence & Veterans UK, 2022b).

Military Demographics

Veterans and their families were invited to complete surveys dependent on their service. Due to the low response rate of the RM participants, these respondents were merged with those from the RN. Every participant was asked about their military background; i.e. previously served in the Regulars or Reserves, family member of an individual who served in the Regulars or Reserves, and other. Veteran participants were asked to provide the length of service and years since discharge. Family members were directed onto questions focusing on individual demographics.

Veterans were asked to provide their rank at time of discharge. Ranks were categorised as a binary variable, those who were officers and non-officers. These responses were further broken down into four levels; Junior Rank/Rate (i.e., those who left with starting rank), Junior Non-commissioned Officer (NCO) (e.g., Leading Hand, Corporal or Leading Aircraftman etc.), Senior NCO (e.g., Petty Officer, Sergeant, Flight Sergeant, Warrant Officer etc.), Junior Officer (e.g., Lieutenant Royal Navy, Captain, Flight Lieutenant etc.) and Senior Officer (ranks including and above Lieutenant Commander, Major, and Squadron Leader).

Individual Demographics

Participants were asked to provide individual demographics focusing on age, gender, ethnicity, marital status, their housing and living situations, and employment. All survey respondents were asked to provide their age, which was further categorised in accordance with the statutory retirement age of 66 years. Therefore, age was categorised as ‘Working age’ (those 65 years and below) and ‘Non-working age’ (those 66 years and above).

Binary variables included gender (i.e., ‘Male’ and ‘Female’), ethnicity (‘White’ and ‘Other’), and present living situation (i.e. living alone or living with others). The remaining variables were characterised into four categorises; marital status (‘Single, ‘Married/Co-habiting’, ‘Separated/Divorced’, and ‘Widowed’), housing situation (‘Owner Occupied’, ‘Rented’, ‘Comes with Occupation’, and ‘Other), and employment (‘Employed’, ‘Unemployed’, ‘Retired’, and ‘Other’).

Financial Benefits

Survey respondents were asked to state whether they were in receipt of any financial support through the Armed Forces Compensation Scheme, the war pension scheme, from a service

charity and the Department of Work and Pensions. These were classed as binary variables: i.e., in receipt or not in receipt of financial support.

Phase One: Identifying Variables Associated with Food Insecurity

To identify the incidence of food insecurity experienced by the UK ex-Armed Forces population, continuous (for instance, age) and categorical variables (e.g. employment status) were analysed. The software packages SPSS®28 (IBM Corp, 2021) and STATA®17 (StataCorp, 2021) were used for data analysis. Continuous variables were described as means and standard deviations, while categorical variables were described as absolute frequency and percentages.

First, confidence intervals[4] were computed for the main findings of the survey. Statistical differences between subgroups were assessed using the two-sample t-test for continuous variables, while the Chi-square test (McHugh, 2013) was employed for categorical variables. T-tests and chi-square tests provides the ability to analyse statistical differences between different groups (Field, 2013; McHugh, 2013). For Chi-square tests, in cases where any cell in a table had a count below 5 participants, the Fisher exact test was used with the Freeman-Halton extension.

A logistic regression analysis (Kleinbaum et al., 1982) was conducted to identify variables associated with food insecurity. A logistic regression provides the ability to identify associated factors or risk factors of a binary dependent variable, in this instance presence of food insecurity (Nick & Campbell, 2007). These variables were dichotomized based on existing knowledge. Odds Ratios[5] and confidence intervals for each variable were calculated via a univariate logistic regression. A Direct Acyclic Graph (DAG) allows researchers to identify possible sources of bias when addressing causal relationships (Digitale et al., 2022). In this instance, the DAG identified possible variables which may be related to food insecurity and other variables but are not of interest and is a spurious correlation.

All variables which were statistically significant in the univariate logistic regression were included in a subsequent multivariate logistic regression analysis. The variables ‘Living alone’ and ‘employment’ were removed due to their strong correlation with others included in the model. The variable “living alone” was strongly associated with marital status, as single/widowed people tend to live alone while married people tend to live with their spouse. The variable “employment” was strongly associated with age, as participants that were 66 and over were retired, while younger veterans, 65 and under, were employed or unemployed.

Covariates considered to be potential priori confounders (gender and service) were retained even though they were not significant in the univariate model. The decision to retain these

[4] Confidence intervals provide a range of estimates where participants will score (Field, 2013)
[5] Similar to confidence intervals, odds ratios provide an estimate, or probability, as to the relationship between variables and how other variables affect this relationship (Bland & Altman, 2000).

variables was based on significant anecdotal beliefs within the veterans sector that the armed service you served in (Royal Navy, Army etc.) was associated with poor post military service outcome and the findings from the Stretesky and Defeyter (2022) study, which suggested that female veterans were at an increased risk of food insecurity. Whilst different categorisations were explored to classify the included variables, there were no significant changes in the results. All analyses were performed with a confidence level of 95%.

Results

Instances of Food Insecurity

83.1% of survey respondents were living in food secure households (see Table 2). In contrast, 16.9% of veterans and families were in food insecure households, with 12% being categorised as being food insecure with hunger. Of note, the mean SWEWBS score for survey respondents was 23.38 which is slightly lower than the population mean of 23.5.

Only a small percentage of the sample were in receipt of benefits. Regarding military benefits, 6.4% of survey respondents received The Armed Forces Compensation Scheme and 18.7% received a War Pension. Those who reported receiving The Armed Forces Compensation Scheme were unable to provide table or levels numbers, as a result it is impossible to determine the extent of injuries and the resultant benefits received. 24.7% were receiving financial support from the Department of Work and Pensions and 3.2% had financial assistance from a service charity.

Cross-Groups Comparison

Table 3 presents the chi-tests and t-tests assessing characteristics by level of food security. Survey respondents who reported levels of food insecurity were statistically significantly younger (mean=60.86) than those who were food secure (mean=67.75), $t(860) = 7.273, p < .001$. This was further reflected when considering working and non-working age; i.e. those who were 66 years and above and those who were 65 years and below (the current age of statutory retirement in the UK is 66). Survey respondents who were non-working age, were more likely to be food secure and therefore less likely to experience food insecurity, compared to those of working age, $X^2 (1, N=862) = 30.395, p<.001$.

In terms of military rank, veterans who were officers at time of discharge were less likely to be food insecure compared to those who were not officers $X^2 (1, N=802) = 26.260, p<.001$. When

Table 2 *Phase One Main Findings*

Variables	Percentage (95% Confidence Interval)
Food Secure (N=881)	83.1% (81.8-84.4)
Food Insecure (N=881)	16.9% (15.6-18.2)
Food Insecure with hunger (N=881)	12% (10.9-13.1)
Level of Mental Wellbeing (n=857)	Mean = 23.38 (23.05-23.71)
Reported Health Status (n=876)	
Very Good	15.9% (14.7-17.1)
Good	37.7% (36.1-39.3)
Fair	29.7% (28.2-31.2)
Poor	11.1% (10-12.2)
Very Poor	5% (4.3-5.7)
Long-Standing Medical Conditions (not compensated under Armed Forces Compensation Scheme and/or the War Pension Scheme) (n=845)	49.4% (47.7-51.1)
Housing Situation (n=877)	
Owner occupied (mortgage or owned outright)	79.1% (77.7-80.5)
Rented (Housing Association, private landlord or local authority)	17.6% (16.3-18.9)
Comes with Occupation (or service family home)	0.9% (0.6-1.2)
Other	1.9% (1.4-2.4)
Living alone (n=845)	19.9% (18.5-21.3)
Employment Status (n=878)	
Employed	32.3% (30.7-33.9)
Unemployed	1.8% (1.4-2.2)
Retired	56.1% (54.4-57.8)
Other	9.4% (8.4-10.4)
In Receipt of Benefits	
Armed Forces Compensation Scheme (n=864)	6.4% (5.6-7.2)
War Pension (n=865)	18.7% (17.4-20)
Financial Assistance from Service Charity (n=879)	3.2% (2.6-3.8)
Benefits from the Department of Work and Pensions (n=869)	24.7% (23.2-26.2)

breaking this down further, the rate of food insecurity decreased as the level of service leaver rank increased. 39.8% of those who were junior rank rate were food insecure compared to 2.4% of senior officers. Consequently, levels of food security increased with the level of service rank, X^2 *(4, N=802) = 76.468, p<.001*. The length of time serving in the military was statistically significant with veterans who were food secure reported serving longer (mean=20.07) than those who were food insecure (mean=9.18), *t(795) = 6.481, p <.001*.

Survey respondents who reported instances of food insecurity had lower mental wellbeing (mean=17.86) compared to those who were food secure (mean=25.48), *t(855) = 16.741, p <.001*. This demonstrates that those who are experiencing instances of food insecurity scored lower than the general population for mental wellbeing. Fewer survey respondents who reported very good or good health experienced food insecurity (2.9%/6.6%) than those who reported poor or very poor health (42.9%/59.1%), X^2 *(4, N=876) = 149.744, p<.001*. Similarly,

Table 3 *Characteristics by the Level of Food Security.*

Variable	Food Secure	Food Insecure	T Value/Chi-Square	P Value
Age (n=862)	Mean=67.75 (SD=10.38)	Mean=60.86 (SD=10.75)	7.273	<.001*
Working Age	274 (74.9%)	92 (25.1%)	30.395	<.001*
Non-Working Age	442 (89.1%)	54 (10.9%)		
Gender (n=867)				
Male	611 (84.0%)	116 (16.0%)	1.908	.167
Female	111 (79.3%)	29 (20.7%)		
Service (N=881)				
Royal Navy and Royal Marines (n=296)	243 (82.1%)	53 (17.9%)	4.875	.087
Army (n=443)	362 (81.7%)	81 (18.3%)		
Royal Air Force (n=142)	127 (89.4%)	15 (10.6%)		
Military Background (n=870)*				
Served in the Regulars	655 (83.4%)	130 (16.6%)	1.495	.813
Served in the Reserves	30 (78.9%)	8 (21.1%)		
Family member served in the Regulars	23 (79.3%)	6 (20.7%)		
Family member served in the Reserves	2 (100.0%)	0 (0.0%)		
Other	13 (81.3%)	3 (18.8%)		
Military Rank (n=811)				
Non-Officer	499 (79.7%)	127 (20.3%)	26.260	<.001*
Officer	169 (96.0%)	7 (4.0%)		
Junior Rank Rate	56 (60.2%)	37 (39.8%)	76.468	<.001*
Junior Non-commissioned Officer	153 (73.9%)	54 (26.1%)		
Senior NCO	290 (89.0%)	36 (11.0%)		
Junior Officer	47 (92.2%)	4 (7.8%)		
Senior Officer	122 (97.6%)	3 (2.4%)		
Length of Service (in years) (n=797)	Mean=20.07 (SD=10.84)	Mean=13.53 (SD=9.18)	6.481	<.001*
Years since discharge (n=790)	Mean=29.87 (SD=15.65)	Mean=30.67 (SD=13.87)	-.540	.589
Ethnicity (n=879)				
White	720 (83.3%)	144 (16.7%)	.118	.726
Other	12 (80.0%)	3 (20.0%)		
Marital Status (n=881)				
Single	26 (56.6%)	20 (43.5%)	47.698	<.001*
Married/Co-habiting	565 (87.6%)	80 (12.4%)		
Separated/Divorced	56 (67.5%)	27 (32.5%)		
Widowed	73 (80.2%)	18 (19.8%)		

Mental Wellbeing (n=857)	Mean=24.48 (SD=4.51)	Mean=17.86 (SD=3.15)	16.741	<.001*
Reported Health Status (n=876)				
Very Good	136 (97.1%)	4 (2.9%)	149.744	<.001*
Good	310 (93.4%)	22 (6.6%)		
Fair	207 (79.0%)	55 (21.0%)		
Poor	56 (57.1%)	42 (42.9%)		
Very Poor	18 (40.9%)	26 (59.1%)		
Sufferers of Long-Standing Medical Conditions (not compensated) (n=435)	332 (76.3%)	103 (23.7%)	29.098	<.001*
Non-Suffers of Long-Standing Medical Conditions (not compensated) (n=410)	370 (90.2%)	40 (9.8%)		
Housing Situation (n=877)				
Owner occupied (mortgage or owned outright)	624 (89.5%)	73 (10.5%)	86.468	<.001*
Rented (Housing Association, private landlord or local authority)	90 (58.1%)	65 (41.9%)		
Comes with Occupation (or service family home)	6 (75.0%)	2 (25.0%)		
Other	9 (52.9%)	8 (47.1%)		
Living Alone (n=169)	133 (78.7%)	36 (21.3%)	3.619	.057
Living with Others (n=676)	573 (84.8%)	103 (15.2%)		
Employment Status (n=878)				
Employed	237 (83.2%)	48 (16.8%)	63.389	<.001*
Unemployed	9 (56.3%)	7 (43.8%)		
Retired	437 (88.5%)	57 (11.5%)		
Other	46 (55.4%)	37 (44.6%)		
Benefits				
In receipt of Armed Forces Compensation Scheme (n=56)	40 (71.4%)	16 (28.6%)	5.811	.016*
Not in receipt of Armed Forces Compensation Scheme (n=808)	678 (83.9%)	130 (16.1%)		
In receipt of War Pension (n=165)	130 (78.8%)	35 (21.2%)	2.893	.089
Not in receipt of War Pension (n=700)	590 (84.3%)	110 (15.7%)		
Received Financial Assistance from Service Charity (n=28)	10 (35.7%)	18 (64.3%)	46.501	<.001*
Did not receive Financial Assistance from Service Charity (n=851)	721 (84.7%)	130 (15.3%)		
Received benefits from the Department of Work and Pensions (n=218)	140 (64.2%)	78 (35.8%)	74.987	<.001*
Did not receive benefits from the Department of Work and Pensions (n=651)	583 (89.6%)	68 (10.4%)		

*Statistically significant result

a higher percentage who reported experiencing a long-standing medical condition had higher levels of food insecurity than those who did not, X^2 *(1, N=845) = 29.098, p<.001*.

A higher number of survey respondents who reported receiving support through the Armed Forces Compensation Scheme reported instances of food insecurity, X^2 *(1, N=864) = 5.811, p<.016*. Similar results were seen in those who received financial assistance from a service charity and benefits from the Department of Work and Pensions, X^2 *(1, N=879) = 46.501, p<.001*; X^2 *(1, N=869) = 74.987, p<.001*.

In terms of demographic data, survey respondents who were single or separated/divorced reported higher levels of food insecurity, compared to those married/co-habiting, X^2 *(3, N=865) = 47.698, p<.001*. In contrast, widowed respondents reported low levels of food insecurity. Higher reported food insecurity was reported in those who in rented accommodation, unemployed or reported 'other', X^2 *(3, N=877) = 86.468, p<.001, p<.001;* X^2 *(3, N=878) = 63.389, p<.001*. Whilst not directly statistically significant, there was a statistical trend with survey respondents who lived alone reporting higher levels of food insecurity compared to those who were living with others, X^2 *(1, N=845) = 3.619, p=.057*. There were no further significant results.

Regression Analysis

The results of the logistic univariate and multivariate regression model are presented in Table 4. There was a significant relationship between working age (OR = 2.75, 95% CI = 1.9 - 3.97, p < 0.001), non-officer rank (OR = 4.9, 95% CI = 2.23 - 10.8, p < 0.001), not being married (OR = 2.96, 95% CI = 2.04 - 4.3, p < 0.001), having at least one medical condition (OR = 2.87, 95% CI = 1.94 - 4.26, p < 0.001), living in a rented housing (OR = 6.17, 95% CI = 4.14 - 9.22, p < 0.001), and receiving other benefits (OR = 2.06, 95% CI = 1.39 - 3.05, p < 0.001) with an increased risk of food insecurity.

Working age (OR = 5.93, 95% CI = 3.08 - 11.41, p < 0.001), non-officer rank (OR = 4.29, 95% CI = 1.62 - 11.37, p = 0.003), not being married (OR = 3.36, 95% CI = 1.74 - 6.5, p < 0.001), having at least one medical condition (OR = 3.93, 95% CI = 2.1 - 7.34, p < 0.001), living in a rented housing (OR = 3.5, 95% CI = 1.84 - 6.67, p < 0.001), and receiving other benefits (OR = 2.19, 95% CI = 1.2 - 4.01, p = 0.011) remained significantly associated with food insecurity in the multivariate model. This model explains 28.2% of the variance.

There was not a significant relationship between food insecurity and gender or service in either regression model.

Table 4 *Logistic Regression Identifying Factors Associated with Food Insecurity.*

	Univariate model			Multivariate model		
Risk factor	**Odds Ratio**	**95% CI**	**p**	**Odds Ratio**	**95% CI**	**p**
		Age			**Age**	
Non-Working Age	1			1		
Working Age	2.75	1.9 - 3.97	0.000	5.93	3.08 - 11.41	0.000
		Gender			**Gender**	
Male	1			1		
Female	1.38	0.87 - 2.17	0.168	1.2	0.55 - 2.65	0.648
		Service			**Service**	
Army	1			1		
RAF	0.53	0.29 - 0.95	0.033	0.91	0.39 - 2.12	0.835
Royal Navy	0.97	0.66 - 1.43	0.896	1.53	0.79 - 2.97	0.206
		Rank			**Rank**	
Officer	1			1		
Non-Officer	4.9	2.23 - 10.8	0.000	4.29	1.62 - 11.37	0.003
		Marital status			**Marital status**	
Married	1			1		
Not Married	2.96	2.04 - 4.3	0.000	3.36	1.74 - 6.5	0.000
		Chronic conditions			**Chronic conditions**	
No medical condition	1			1		
At least 1 medical condition	2.87	1.94 - 4.26	0.000	3.93	2.1 - 7.34	0.000
		Housing			**Housing**	
House Owner	1			1		
Rented Accommodation	6.17	4.14 - 9.22	0.000	3.5	1.84 - 6.67	0.000
		Living alone			**Living alone**	
Living with Others	1			1		
Living Alone	1.51	0.99 - 2.3	0.058			
		Employment			**Employment**	
Retired	1			1		
Employed	1.55	1.03 - 2.35	0.038			
Unemployed	5.96	2.14 - 16.63	0.001			
		Other benefits			**Other benefits**	
Does not receive benefits	1			1		
Receives benefits	2.06	1.39 - 3.05	0.000	2.19	1.2 - 4.01	0.011

Summary

To summarise, the findings of this study suggest that those veterans who are **working age**, **non-officer rank**, **single**, having at least one **medical condition**, live in **rented housing**, and receive other **benefits** are at an increased risk of food insecurity. Each one of these factors carries its own risk, however it should be noted that each risk factor multiplies with the others, therefore the more concurrent factors they have the greater the risk for food insecurity.

Phase Two: Geospatial Analysis

Phase 2 focused on investigating the geospatial distribution of survey respondents and instances of food insecurity in relation to areas of multiple deprivation. The location of survey respondents with high and low mental wellbeing was also analysed.

The online survey collected data at the outward postcode level, e.g. NE21, which was equated to a Postcode District boundary. There are 3,114 Postcode Districts in the UK. The Office for National Statistics provide 'lookup tables' that support mapping between different types of geographical boundaries and the aggregation of data up to larger geographic boundaries. For the purposes of this study, Postcode Districts have been aggregated to 2021 Local Authority (LA) boundaries (including unitary district authorities), of which there are 374 in the UK, following the methodology outlined by the Office for National Statistics (2016). A count of the number of respondents, number reporting food insecurity and an average wellbeing value was generated within each LA. National Statistics Postcode Lookup Table (NSPL) provides Postcode District area codes, a majority rule has been used to assign a postcode district where they are found within more than one LA.

In total, 881 records were included in the geospatial analysis, with 36 removed due to incomplete postcode supplied by respondents.

For the geospatial analysis of survey results, data by 2021 LA boundaries have been collated for two sets of data:

1. Census 2021 data providing a count of respondents that have previously served in UK Armed forces (England and Wales only).
2. Index of Multiple Deprivation by Country (UK).

Census Data: Previously Served in the UK Armed Forces (TS071)

For the first time, the 2021 Census collected data related to veterans however, at this time, this information is only available for England and Wales. Consequently, there are now counts of individuals who have previously served in the armed regular and/or reserve forces over a range of geographic scales. For the purposes of this analysis, the total number that have served in both armed regular and reserved forces are categorised as a veteran in relation to the usual resident population.

One way of quantifying the concentration and uniqueness of a particular industry, cluster, occupation, or demographic characteristic in a region, when compared at a national scale, is via a Location Quotient (LQ). A LQ will identify where there is a higher proportion of veterans

by a given local scale when compared at a national scale for England and Wales (E&W). When using LA as the geographic scale the formula is:

$$LQ = \frac{No.of\ Veterans\ in\ LA/Total\ No.of\ Veterans\ (E\&W)}{No.Usual\ Residents\ in\ LA/Total\ No.of\ Usual\ residents\ (E\&W)}$$

If the LQ is greater than 1, the LA has a higher-than-average concentration of residents classed as veterans compared to the national average. For example, the total percentage of all usual residents in England and Wales classified as veterans is 3.82%. For Richmondshire LA, 9.5% of all usual residents are classed as veterans. The LQ of Veterans in Richmondshire as compared to the Nation is *9.5/3.6 = 2.5*, indicating that veterans are 2.5 times more concentrated in Richmondshire compared to the whole of England and Wales.

Indices of Multiple Deprivation

Indices of Multiple Deprivation (IMD) are reported by Country at a comparable geographic scale and represents an area with a relatively comparable population, using boundaries as of 2011 (see Table 5). Each country's IMD is calculated according to slightly different criteria, and relative to each given country. In all cases, the most deprived area has the lowest rank (1) and the least deprived area has the highest rank. IMD is reported commonly as deciles, where decile 1 represents an area that is in the most deprived 10% relative to each given country.

Table 5 *Summary of Index of Multiple Deprivation collated by Geographic Unit type by Country (UK)*

Country	Date	Geographic Unit (GU) (2011)	Number
England	2019	Lower Super Output Areas (LSOA)	32,844
Wales	2019	Lower Super Output Areas	1,909
Scotland	2020	Data Zones (DZ)	6976
Northern Ireland	2017	Super Output Areas (SOA)	890

As the spatial scale of survey responses is at a Postcode District geography, it is not possible to determine a direct correlation with reported deprivation for the lowest scale of reporting. Instead, data has to be aggregated to a higher level geographical areas, in this case LAs. As such the following hypothesis was tested: the higher the number of survey responses of food insecurity or a lower wellbeing average, the greater the proportion of geographic units (GU) in a LA that are in the most deprived deciles. This assumes that veterans reporting food insecurity are more likely to live in deprived areas. However, the authors acknowledge that this is not always the case and therefore the results of analysis need to take this into consideration as a caveat.

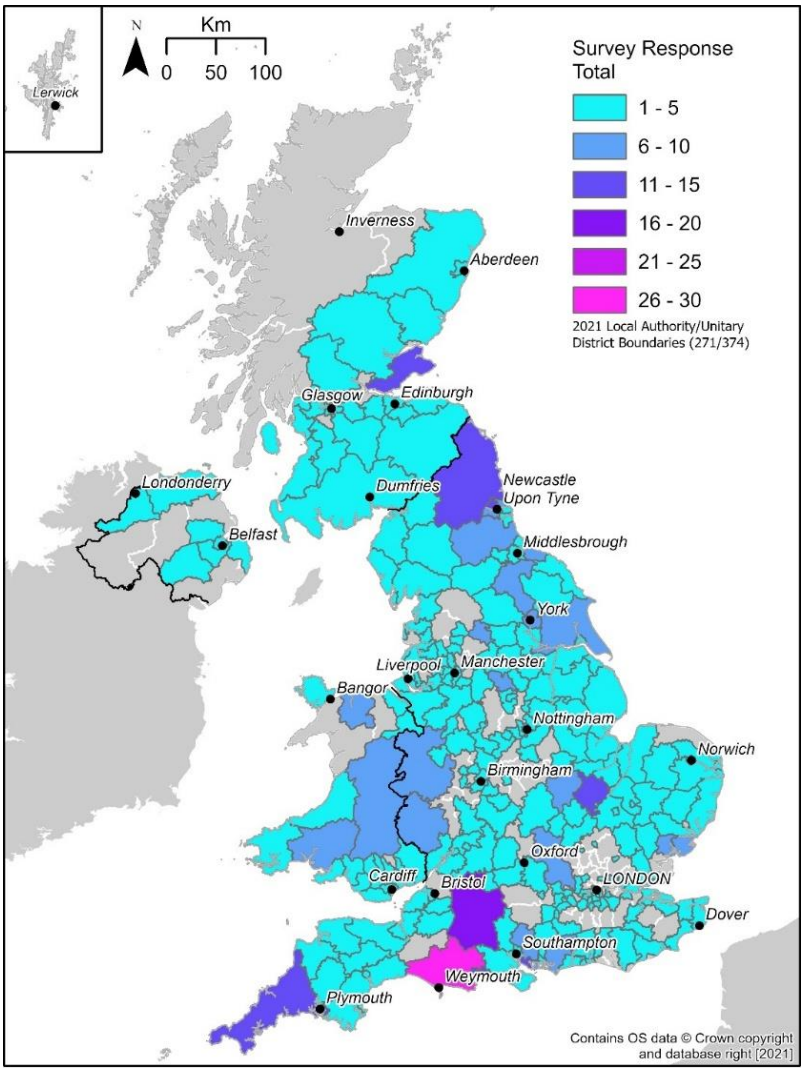
Lookup tables, provided by Office for National Statistics, have been used to assign each individual lowest scale GU to 2021 LA boundaries, accounting for changes in LA boundaries between 2017 and 2021. For each LA, the total number of GUs, and the number of those in decile 1, 2 and 3 have been used to identify the proportion of a given LA, with the lowest GU in the most deprived 10%, 20% and 30% by country.

Results

Spatial Representation of Survey Recipients

Figure 1 shows the distribution of the number of responses to the survey by Local Authority. With a total number of survey responses of 845, 271 out 374 LA UK wide have 1 or more response, with a maximum of 30 and an average of 2.34 (SD = 3.11).

Figure 1 *Spatial distribution of responses to survey.*



Using 2021 Census data reporting the total number of respondents who have previously served in the armed forces, it is possible to determine if survey responses provided a representative sample relative to the total veteran population (see Figure 2A). The analysis is based on survey results and data provided for England and Wales only. The total number of responses to the survey for LAs in England Wales is 776, with 243 out of 331 LAs having 1 or more response (see Figure 2B). A Pearson product-moment correlation coefficient[6] was applied to determine if the number of veteran survey responses corresponded to the available survey population of veterans by LA. There was a strong significant positive correlation, r = 0.681, N=331, (p = <.001). Therefore, a higher number of responses to the survey within a LA correlates with a higher number of veterans found within the given LA, indicating that the survey results are spatially representative of veteran populations and where they are found in England and Wales.

Food Insecurity and Wellbeing

Out of the 845 total survey responses, 138 (16.33%) reported as food insecure. These responses are spread over 101 LAs (out of the 271 total LAs reporting a response to the survey). The maximum count of responses by LA does not reach 5. A quintile classified bivariate plot[7] of the total number of survey responses, with the count responding as food insecure, was adopted to show the spatial distribution without being able to identify single responses by LA (Figure 3A). Only 1 LA, Colchester, is high in both survey responses and count of responses reporting food insecurity. Notable LAs with a high survey response but a low count responding as food insecure are Fife, Cornwall and Devon. Only 1 LA, Telford and Wrekin, has a high count responding as food insecure with a low overall survey response.

[6] A measure of the strength of a linear association between two variables and is denoted by r. A Pearson product-moment correlation attempts to draw a line of best fit through the data of two variables, and the Pearson correlation coefficient, r, indicates how far away all these data points are to this line of best fit (i.e., how well the data points fit this new model/line of best fit).

[7] A bivariate plot graphs the relationship between two variables that have been measured on a single sample of subjects

Figure 2 *Spatial distribution by Local Authority of A) Census 2021 Location Quotient of total numbers of Veterans compared Nationally and B) number of survey responses of Veterans, for England and Wales.*

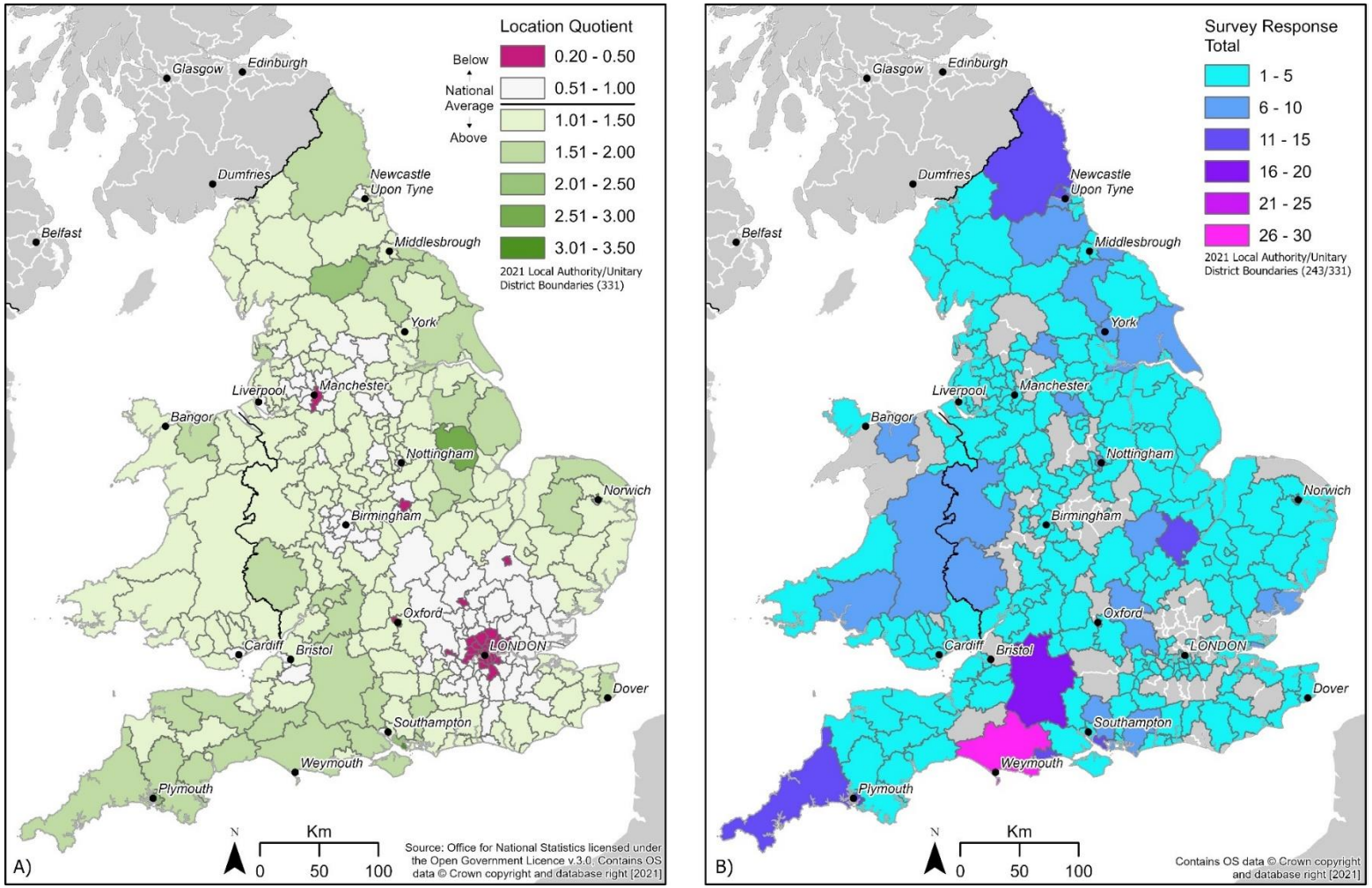
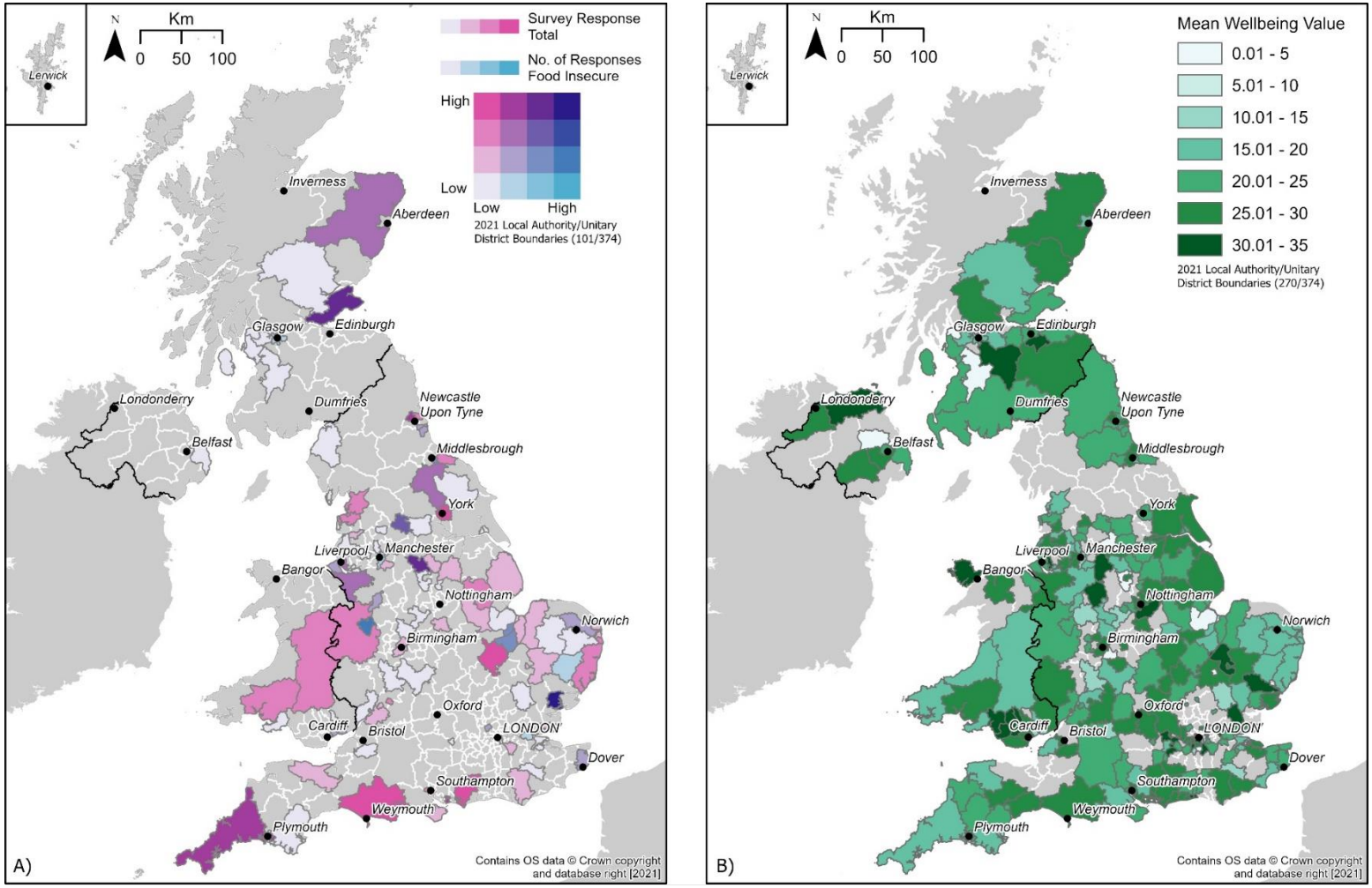


Figure 3

Spatial distribution by Local Authority of A) instances of Food Insecurity compared with survey response totals and B) average wellbeing value.



Due to the small sample size, it is not possible to complete spatial statistics to identify 'hot spots' of food insecurity. Where a nil return is larger than 5% of the total sample, filling methodologies to support running of spatial statistics are not recommended (Butler and Buckley (2017). A correlation of total count indicating food insecurity by LA with the proportion of the smallest GU in the 10%, 20% and 30% deprivation decile does show a weak positive correlation for all three categories at 95% confidence interval (Table 6), the strongest with the proportion of a LA with a GU in the 10% decile (High Deprivation).

Table 6 *Correlations of food insecurity counts by Local Authority with the percentage of GUs found in 10%, 20% and 30% deprivation deciles.*

Geographical unit	Correlation (N=101)	P value
10%	.196	.049*
20%	.176	.078
30%	.170	.089

* Statistically significant (p<.05)

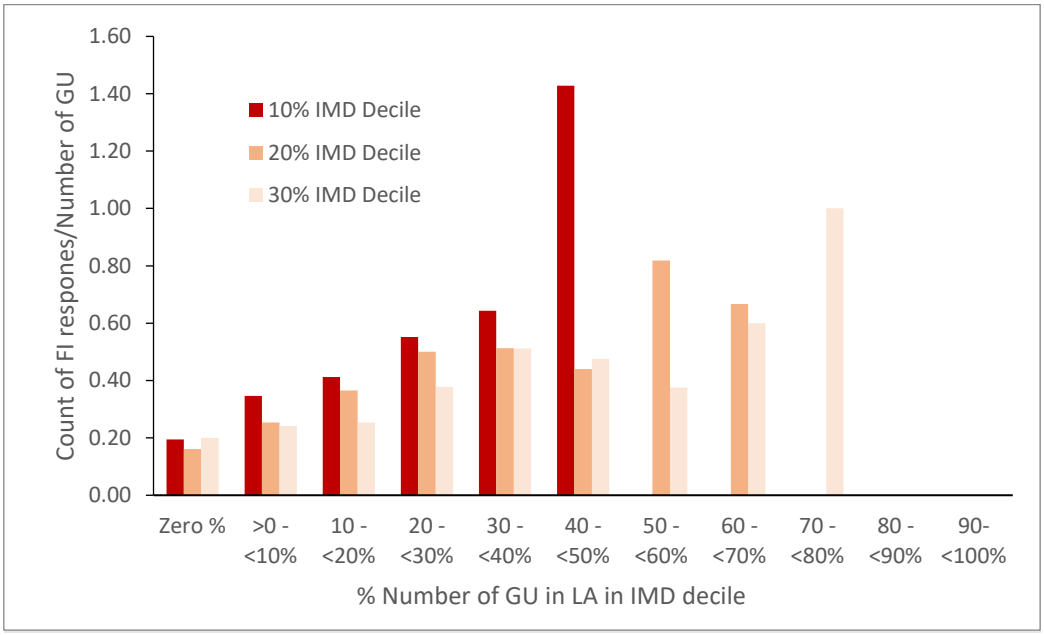
By categorising the percentage of geographical unit within a LA in each decile and providing a relative comparison based on the change in the number of geographical units found in each category (Table 7), the numbers reporting food insecurity increases with the highest percentages of LA in all three IMD deciles (Figure 4).

Table 7 *Percentage of geographical units (GU) within a Local Authority in the 10%, 20% and 30% decile alongside corresponding number of responses indicating food insecurity.*

	10% IMD Decile			20% IMD Decile			30% IMD Decile		
%GU in LA	**No. FI**	**No. LA**	**Ratio 10%**	**No. FI**	**No. LA**	**Ratio 20%**	**No. FI**	**No. LA**	**Ratio 30%**
Zero %	27	123	0.22	12	56	0.21	5	20	0.25
>0 - <10%	53	150	0.35	31	118	0.26	24	91	0.26
10 - <20%	22	51	0.43	27	74	0.36	18	71	0.25
20 - <30%	17	29	0.59	25	48	0.52	21	53	0.40
30 - <40%	9	14	0.64	20	39	0.51	23	43	0.53
40 - <50%	10	7	1.43	12	25	0.48	20	42	0.48
50 - <60%				9	11	0.82	13	32	0.41
60 - <70%				2	3	0.67	9	15	0.60
70 - <80%							5	5	1.00
80 - <90%								2	0.00
90- <100%									
Total	**138**	**374**		**138**	**374**		**138**	**374**	

LA = Local Authority, FI = Food Insecurity, GU = Geographical Unit, IMD = Index of Multiple Deprivation

Figure 4 *Ratio of the count of Food insecurity responses with number of Geographical Unit by the Percentage of Geographical Unit within a Local Authority in the 10%, 20% and 30% deprivation decile, where percentage of Geographical Unit within a Local Authority is presented in 10% intervals.*



Out of 271 LAs reporting a response to the survey, only 1 LA is missing an average wellbeing value. There is no obvious visual spatial pattern in the average wellbeing reported (Figure 3B). Thirteen LAs have an average of 30 and above, but high values are associated with a small total survey response. Again, hotspot analysis is not possible due to sample size issues. A quintile classified bivariate plot of the total number of survey responses by mean wellbeing (Figure 5) has Aberdeenshire, North Kesteven, Buckinghamshire, and Dorset with both a high survey response rate and a high mean wellbeing. A mean of wellbeing value LA with the proportion of the smallest GU in the 10%, 20% and 30% shows a very weak negative correlation for all three categories but it is not statistically significant (Table 8), as wellbeing increases, the proportion of LAs in each IMD decile increases. This occurs for all 270 LAs with a wellbeing value and when compared with the wellbeing mean recalculated for only those LAs that returned a response of food insecurity.

Figure 5 *A spatial comparison of the total number of survey responses by mean wellbeing scores*

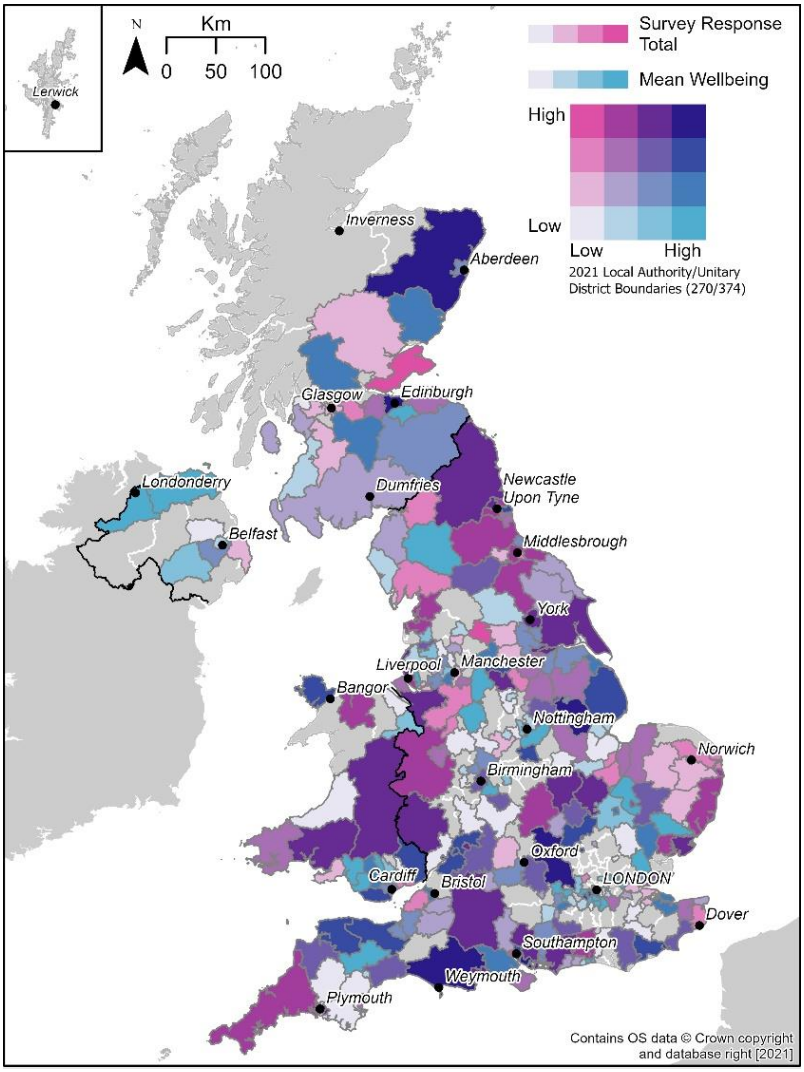


Table 8 *Correlations of mean mental wellbeing score by Local Authority and mean mental wellbeing for only those Local Authorities reporting food insecurity with the percentage of Geographical Units found in 10%, 20% and 30% deprivation deciles.*

Geographical unit	Mean wellbeing correlation (N=270)	P value	Mean wellbeing for LAs reporting food insecurity correlation (N=101)	P value
10%	-.090	.140	-.057	.570
20%	-.093	.127	-.064	.523
30%	-.077	.204	-.078	.440

By categorising the percentage of GUs within a LA in each decile and providing a relative comparison based on the change in the number of GUs found in each category (Table 9), there is no obvious pattern in mean wellbeing as you report a higher percentage of LA in all three IMD deciles (Figure 6). Non-parametric tests confirm that the distribution of mean values across the categories show no variation.

Summary

A strong positive relationship is found between the number of survey responses reported and high percentages of veteran populations by LA as reported in Census 2021 in England and Wales. This indicates that the results from the survey are spatially representative of veteran populations and where they are found. Therefore, this supported the spatial analysis of instances of food insecurity and wellness. A weak significant positive relationship has been identified that indicates that LAs containing survey responses from veterans indicating food insecurity have a high percentage of the lowest scale of geographic unit found in 10% IMD decile (high deprivation). However, there was no significant relationship identified between low wellness scores and high percentages of the lowest scale of geographic unit found in 10%, 20% or 30% IMD decile of deprivation.

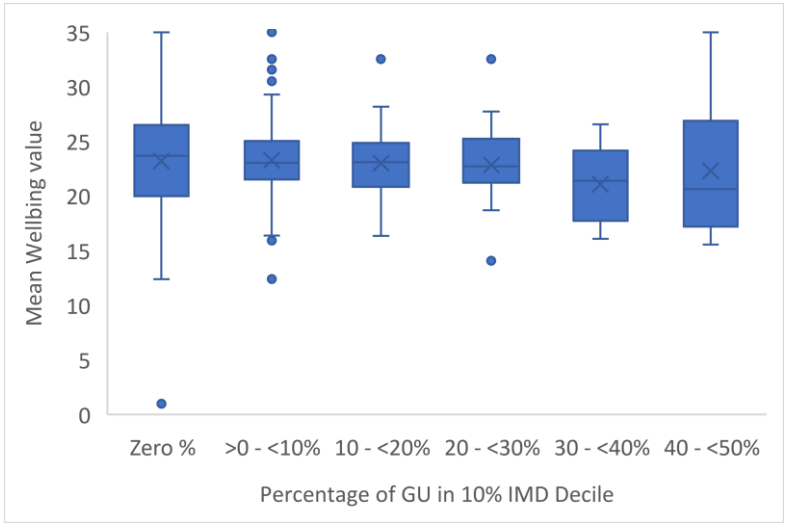
Table 9 *Percentage of geographical units within a Local Authority in the 10%, 20% and 30% decile alongside mean wellbeing score.*

	10% IMD Decile					20% IMD Decile					30% IMD Decile				
%GU in LA	**Mean**	**SDEV**	**Max**	**Min**	**No. LA**	**Mean**	**SDEV**	**Max**	**Min**	**No. LA**	**Mean**	**SDEV**	**Max**	**Min**	**No. LA**
Zero %	23.19	5.20	35.00	0.99	80	22.70	5.84	35.00	0.99	38	21.86	4.81	29.42	15.84	14
>0 - <10%	23.28	3.65	35.00	12.40	107	23.66	4.31	35.00	12.40	79	23.69	4.27	35.00	12.40	58
10 - <20%	23.02	3.27	32.55	16.36	42	23.31	2.87	32.55	17.43	55	23.19	4.99	35.00	0.99	51
20 - <30%	22.84	3.60	32.55	14.08	23	22.72	3.94	35.00	15.93	36	23.43	3.29	31.57	16.38	41
30 - <40%	21.08	3.62	26.58	16.09	12	22.96	3.56	32.55	16.36	34	23.04	4.36	35.00	15.93	33
40 - <50%	22.30	6.89	35.00	15.56	6	21.83	3.71	27.74	14.08	18	22.58	2.95	32.55	16.88	35
50 - <60%						20.37	3.51	24.52	15.56	8	22.50	4.09	32.55	14.08	25
60 - <70%						28.16	9.68	35.00	21.31	2.00	22.85	5.15	35.00	17.43	11
70 - <80%											18.44	4.07	21.31	15.56	2
80 - <90%															
90- <100%															
Average/Total	**22.62**	**4.37**			**270**	**23.21**	**4.68**			**270**	**22.40**	**4.22**			**270**

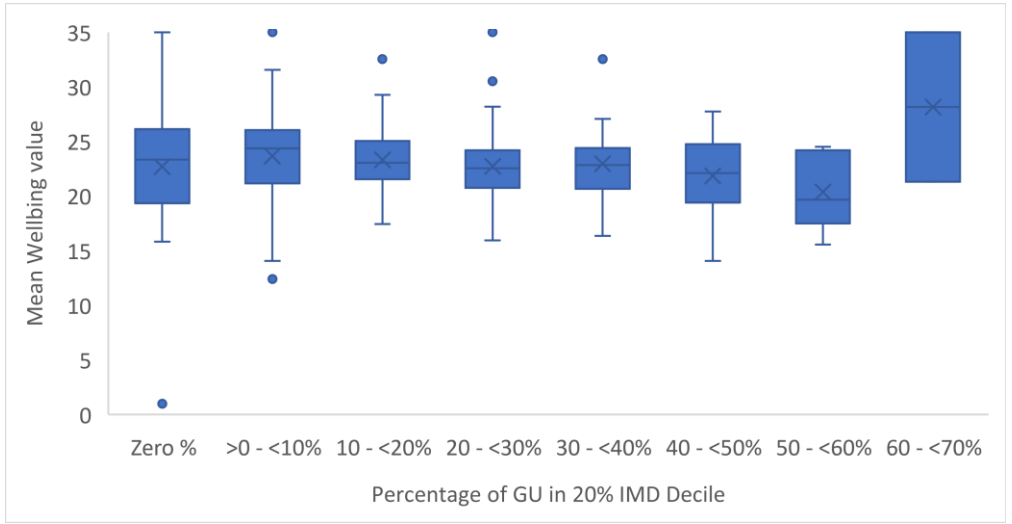
LA = Local Authority, GU = Geographical Unit, IMD = Index of Multiple Deprivation

Figure 6 *Mean Wellbeing of Geographical Units found in A) 10%, B) 20% and C) 30% deprivation decile where percentage of Geographical Units within a Local Authority is presented in 10% intervals*

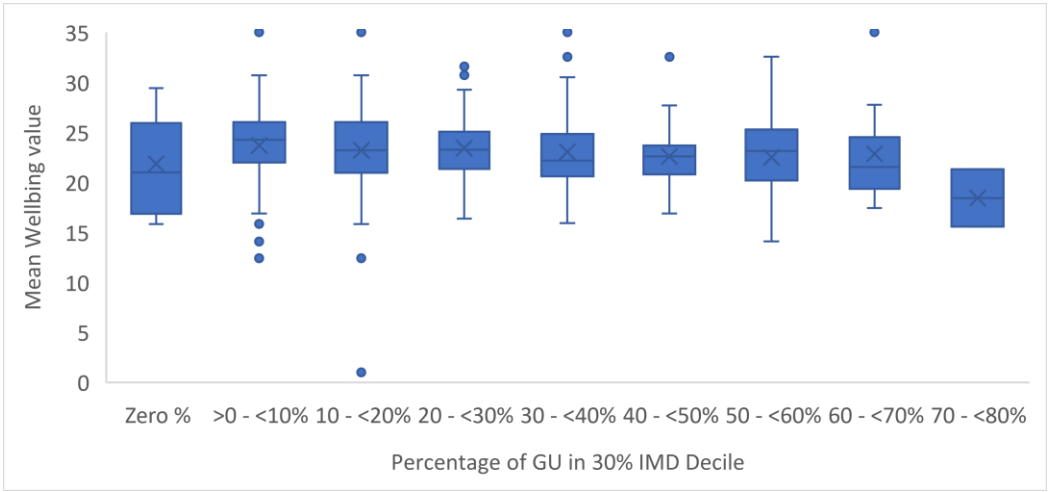
A)



B)



C)



Discussion

The present study aimed to investigate the incidence of food insecurity and current health status of the UK ex-Armed Forces population, in this instance UK veterans and their families. Following this, this study identified associated risk factors of food insecurity among this population. The second phase of analysis investigated the geospatial distribution of where food insecurity and high/low mental wellbeing was most ubiquitous through geospatial analysis through comparison with the UK census data.

The prevalence of food insecurity amongst the current sample was 16.9%, with 12% of these respondents experiencing some element of hunger. A YouGov survey by the Food Foundation, a food poverty charity, found that in June 2023, 17.0% of households in the UK population were 'food insecure' (ate less or went a day without eating because they couldn't access or afford food), up from 8.8% in January 2022 and 7.4% in January 2021. This would suggest that food insecurity within the veteran's population reflects a similar level of food insecurity in the general population. This is higher than previous research would indicate for food insecurity within the UK veteran population. (Mann et al., 2021; Stretesky & Defeyter, 2022). A possible explanation for this could relate to the higher sample size included in this study and the current UK economic context. For instance, one study took place during the COVID-19 pandemic and nationwide lockdowns (Mann et al., 2021), a time where factors such as stock shortages and loss of income could have impacted food insecurity (Loopstra, 2020). Whilst this initial upsurge has reduced with the culmination of preventative measures regarding COVID-19, the reported increase of emergency food parcels and unexpected request for support (Independent Food Aid Network, 2023; The Trussell Trust, 2023) continues to suggest that food insecurity is a growing issue. The similarity between the prevalence of food insecurity in the current survey sample and the UK population could suggest that food insecurity is not specific to the veteran population.

The results of the multivariate logistic regression analysis revealed several significant associations between various risk factors and the risk of food insecurity. The findings suggest that age, having a long-term medical condition, living in rented accommodation, being in receipt of benefits, rank, and marital status are associated with food insecurity, potentially acting as causal factors. The identification of the risk factors of food insecurity can aid the creation of support tailored to individuals and therefore ensure that these interventions are catered to those more at risk. In doing so, service provision could be provided to those before reaching 'crisis' and enable the early allocation of resources.

Higher instances of food insecurity were identified in younger survey respondents, particularly those who were working-age, supporting previous literature among the veteran population

(Brostow et al., 2017; Mann et al., 2021; Pooler et al., 2021; Rabbitt & Smith, 2021; Stretesky & Defeyter, 2022). Working age was found to be a key variable and risk factor associated with food insecurity, indicating that individuals in their working years may face increased financial pressures, leading to a higher risk of food insecurity. This association could be attributed to factors such as limited employment opportunities, low wages, or unstable employment arrangements as opposed to older people generally having a pension as a stable source of income. In terms of military specific factors, it is possible that some of the sample were a recipient of an earlier military pension scheme. For instance, The 1975 Armed Forces Pension Scheme (AFPS) provided service leavers with immediate access to their military pension, provided they had served the minimum necessary time for their rank; 16 years as an officer and 22 years for non-officer (Ministry of Defence, 2020a, 2022). A benefit that has been discontinued with more recent AFPS (Ministry of Defence, 2020b, 2020c, 2020d).

Other associated risk factors with food insecurity were marital status (i.e. those who were not married), living in rented accommodation and in receipt of benefits. Again, these factors are reflected in previous literature (Mann et al., 2021; Rabbitt & Smith, 2021; Stretesky & Defeyter, 2022; Widome et al., 2015) and it is possible that they can be directly linked with economic resources. For example, individuals who are not married or co-habiting are likely to be part of a single income household. Being in receipt of benefits could indicate lower income levels due to possible unemployment or presence of a health condition that could impede employment. Due to these factors, it is possible that these individuals may prioritise essential bills, such as housing, over purchasing higher quality food of an adequate amount (Pettifer & Patel, 2022).

The cross-groups comparison identified links between food insecurity and lower mental wellbeing, poor/very poor health and having a long-term medical condition, supporting previous literature (Brostow et al., 2017; Pooler et al., 2021; Wang et al., 2015). Despite the relationship between food insecurity and medical conditions, the direction of causality is not clear. It is possible that individuals with poorer health, including long-term conditions, could be less likely to be in full-time employment, which could reduce their financial capability. Alternatively, food insecurity could contribute to the development or exacerbation of medical conditions due to inadequate access to proper nutrition. Further research is needed to elucidate the underlying mechanisms and establish the temporal sequence of this association. Utilising a longitudinal approach may facilitate further exploration of underlying dynamics and identify additional preventative policies.

Non-officers were at a higher risk of food insecurity compared to officers. Assessing service leaver's rank at discharge can be indicative of education status, with officers typically having higher levels of education, which in turn can reduce access to financial resources for those with lower educational attainment, leading to employment in less specialised or low wage jobs.

The officer and non-officer rank can be an indication to the level of AFPS of which they are entitled and, with regards to the 1975 AFPS (Ministry of Defence, 2020, 2022), when they were able to retire. Given that officers were able to retire earlier under this scheme, this could provide more chances for additional employment alongside the pension being received.

Although previous work has explored the location of UK veterans in receipt of financial compensation via service charities (Kiernan et al., 2022), this is the first study to directly focus on locations of veterans experiencing levels of food insecurity. The geospatial analysis, completed in Phase Two, found that, despite the small number of responses, there was a positive correlation between instances of food insecurity and LAs that have a high percentage of smaller geographic units in the 10% decile of deprivation. It must be noted however that this correlation is weak and caution should be taken with regards to this finding due to the larger geographical collation of survey responses at the Local Authority scale. It is of note, that Colchester, which was high in survey responses and reported high levels of food insecurity, has a high density of service and ex-service personnel, likely due to being an established military garrison. Future work could continue to build on this initial finding to fully explore the geospatial distribution of veterans experiencing elements of food insecurity, potentially focusing on those with military connections.

Strengths and Limitations

This study builds upon the limited evidence base and identifies the risk factors associated with food insecurity in the ex-Armed Forces population. It is the first to directly consider the influence of different services and rank on instances of food insecurity, whilst providing insight into the variables associated with food insecurity, along with odd ratios. It is also the first study to directly explore the locations of veterans experiencing some level of food insecurity via Geospatial analysis. The geospatial analysis revealed that, despite the small sample size of 845, the higher response rate collated by LA area is positively correlated with a higher proportion of veterans forming part of the usual resident population for LAs in England and Wales.

However, there are limitations to consider. Whilst the size and strength of the sample included within Phase One exceeded the initial estimates for Power analysis, and therefore indicates a strong sample, the number of responses per service was heterogeneous which could influence findings. For instance, the representation from RAF respondents was much lower than the Army or the RNRM. Regarding Phase two, the small number of responses aggregated by LA limits geospatial analysis in relation to associated variables, such as IMD. For example, this equates to comparing the response of a maximum of 30 individuals living in a Local Authority

area with a total population of ~380k. Without a full postcode it is not possible to identify stronger associations with reports of food insecurity with IMD at LSOA level with an average population of ~1,600. In any future analysis, a higher response rate and a collection of data at full postcode, with full GDPR protocols in place, will support a more detailed investigation of any trends of survey response to situational context such as food insecurity responses commonly being reported in areas with a high deprivation. However, despite the small sample size, these findings have the potential to identify areas related to the risk factors identified in Phase one through further analysis of the census data. This could further guide policy decisions and the provisions of resources.

In the first phase of this study, odds ratios were used to measure the association between exposure and outcome. Odds ratios are commonly interpreted as relative risks, but this equivalence is only accurate when the outcome is rare, and the odds ratios are close to one. In our case, neither of these conditions were met. Thus, the authors acknowledge that the odds ratios are an overestimate of the true relative risks, and therefore they should be interpreted with this limitation in mind.

Finally, as with all survey-based research, a limitation is the reliance on self-reported outcomes which can be inaccurate. Caution should be taken with the 'living alone' result due to initial discrepancies in responses. For instance, survey respondents not including themselves in these responses, despite being directed to by the question. Whilst these were resolved where possible, a more accurate measurement of this variable could indicate whether this is a significant variable associated with food insecurity. Additionally, social desirability may influence responses based on attempts to reflect perceived social norms. Despite this, it is important to note that the high Cronbach's level indicates that reliability in measurements of food insecurity and mental wellbeing.

Conclusion

To conclude, whilst there are instances of food insecurity within the ex-Armed Forces population, this appears to represent that of the general population. The findings of Phase one indicate the complexity of the different factors associated with food insecurity and their relationship with socio-demographic factors. By understanding the factors associated with food insecurity, service providers can develop targeted interventions and support for individuals at significant risk as opposed to solely supporting those already in crisis. Whilst the sample size for the geospatial analysis reduced the possibility for an intensive analysis, the ability to further analyse the census data could provide more opportunity to identify those with the risk factors relating to food insecurity.

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