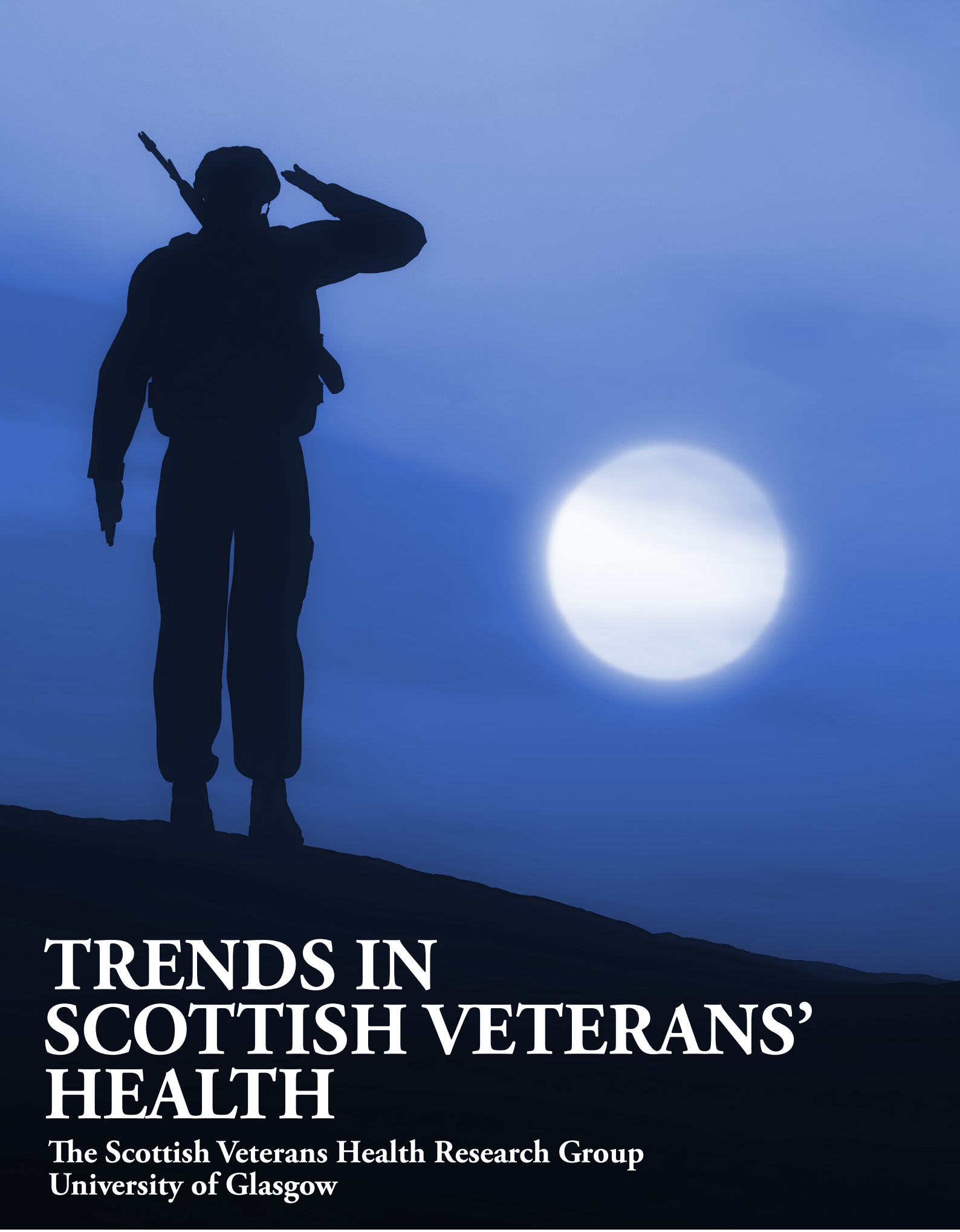

TRENDS IN SCOTTISH VETERANS' HEALTH

The Scottish Veterans Health Research Group
University of Glasgow

University of Glasgow
SCOTTISH VETERANS HEALTH RESEARCH GROUP
FiMT forces in mind trust
COMMUNITY FUND

The Scottish Veterans Health Research Group was established in 2018 within the Public Health Unit of the Institute of Health and Wellbeing at the University of Glasgow, formalising the work on veterans' health which had been under way since 2012. It aims to provide high-quality evidence-based information on the long-term health of military veterans, to act as an evidence base for policy makers, planners and service providers and to counter the potentially damaging myths and misconceptions about veterans' health which have developed. Research is also conducted on the health of serving personnel, especially in areas where there may be an impact on long-term health extending into life as a veteran, in order to inform planning for preventive strategies.

The logo symbolises the ethos of the Scottish Veterans Health Research Group. The owl represents the knowledge and wisdom that comes from scientific research. It is standing on, and therefore vanquishing, the 'snake in the grass' of uninformed opinion and speculation that can be so damaging to veterans. But the snake is also wrapped around a branch, and therefore calls to mind the 'Staff of Aesculapius', the symbol of the Classical god of Medicine, whose daughter Hygeia was the goddess of Health. The colours on the banner represent (L-R) Scotland, the Royal Navy, the Army and the Royal Air Force, whilst the gold lettering symbolises the inestimable value of service in the Armed Forces.

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August 2022

Foreword

Keith Brown MSP
Cabinet Secretary
for Justice and Veterans

Veterans make a huge contribution not only to local communities but to our wider Scottish society. The Scottish Government is committed to ensuring that veterans who live in Scotland, together with their families, are able to access the best possible care and support, including safe, effective and person-centred healthcare. Research such as this updated report on Trends in Scottish Veterans' Health plays an important part in helping this aim be realised. It gives a valuable insight into the health of our veterans and how this might differ from the population who have not served.

Building and consolidating available evidence helps Scotland to take a forward look on issues that may have an impact on health in the longer term. This also helps shape our understanding and dispel some misconceptions in relation to the health of our veteran community.

Veterans' health and wellbeing are already a priority for the Scottish Government and our partners. The findings from this study and wider evidence help us by building on a significant body of work, including efforts to support the better identification of veterans within our health and social care systems. This in turn will help direct resources to meet the specific physical and mental health needs of our veterans, as well as our serving armed forces personnel.

My sincere thanks go to the team at The Scottish Veterans Health Research Group for the impact that this research will have in helping to identify the likelihood of veteran ill health and the services that might be needed to keep them well. As always, of course, our gratitude goes too to the veterans community who have given so much.

Foreword

Tom McBarnet
Chief Executive (Acting)
Forces in Mind Trust

Few discussions of the support needs of veterans take place without fairly quickly coming round to addressing their wider health and wellbeing. Very often that discussion can be skewed by unrepresentative views on the health impact of Service life upon those who have served, generating misplaced perceptions that are not only detrimental to the aspirations of those wanting to join up and pursue an Armed Forces career, but also detrimental to those wanting to transition to civilian life without prejudice or pre-judgement of any consequence their former career has imparted. Amongst all the positive attributes we see in our veterans, what could be more important than to also understand the legacy on their health? For that reason, Forces in Mind Trust was pleased to fund the follow-up to the first Scottish Veterans Health Study and to examine a further five years of health data to compare the findings with those of the original study to detect emerging trends in ill-health over time, to assess the implications for service provision and to evaluate the effectiveness of recent interventions, especially initiatives arising from the Armed Forces Covenant.

The original Scottish Veterans Health Study (2012-2015) provided an unprecedented insight into long-term conditions, both physical and mental, in veterans who served as far back as 1960. The aims of this follow-up study were to build on the earlier work to see not only how older veterans are faring as they age, and also to look at emerging problems in younger veterans who have served on recent operations. Fortunately attitudes to smoking, alcohol, lifestyle and personal fitness have changed in the Armed Forces as they have in society at large. The report clearly illustrates the impact of those changes across the different age groups, thus providing a unique evaluation of how policy can influence health in the long term. It also shows the complexity of understanding mental health vulnerability, and that mental health issues in veterans should not automatically be put down to a legacy of their service. Equally important is to understand the circumstances in which some veterans came to serve, the juxtaposition of age, actual Service experience of the individual, common social behaviours and gender as well as cultural factors within the Armed Forces at the time.

This is therefore an important study. Not only does it objectively assess the health implications of Service, the report also shows where knowledge of the Armed Forces community and a deeper understanding of more prevalent vulnerabilities could lead to better targeted and more holistic prevention and treatment. The fact that this study has been possible at all is also the most compelling vindication of Scotland's laudable approach to health data gathering, where computerised health records have been collected for over 40 years. If nothing else, this is a lesson to learn for all other healthcare providers in order to be better able to target investment in veteran healthcare.

Within the Trust's overall mission of enabling successful and sustainable transition, our health programme vision aspires to all veterans and their families enjoying a state of positive physical and mental health and wellbeing, enabling them to contribute to and benefit from wider society. This report should support that vision as a valuable resource to expand knowledge among health practitioners. But it should also support a comprehensive approach to both health policy and service provision for the veteran community in Scotland, recognising not only where vulnerability still exists and where future improvement can take place, but also where much has been achieved in recent years.

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Acknowledgements

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The NHS Central Registry, Dumfries has played a major role, from the inception of the first study, both in selecting the data and also as a constant source of advice. We greatly appreciate their contribution.

Grateful thanks also go to Col (retd) Simon Miller L/RAMC, former Army Parkes Professor of Preventive Medicine, for commenting on the draft, and especially for his eagle-eyed proof-reading. The lead author takes full responsibility for any residual errors.

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Glossary and Abbreviations

COPD	Chronic obstructive pulmonary disease
eDRIS	Electronic Data Research and Innovation Service
ESL	Early Service Leaver
ICD	International Classification of Diseases
MND	Motor Neurone Disease
MS	Multiple Sclerosis
NHS	National Health Service
NHS CR	National Health Service Central Registry
NRS	National Records of Scotland
ONS	Office for National Statistics
OPCS	Office of Population Censuses and Surveys
PAD	Peripheral arterial disease
PTSD	Post-traumatic stress disorder
SIMD	Scottish Index of Multiple Deprivation

Preface

Military operations have been a constant accompaniment of civilisation throughout recorded history. But military service, especially on combat operations, can come at a price. As the first decade of the 21st century drew to a close, an increasing number of media reports focussed on veterans whose health, both mental and physical, had been affected by their service. Whilst this increased public awareness of those to whom the country owed a debt, as enshrined in the Armed Forces Covenant, it also began to impact on the public perception of all veterans as 'damaged', and the pejorative phrase "mad, bad or sad" began to gain currency. Whilst initially well-intentioned and aimed at increasing support for those in need, this image was in stark contrast to the majority of veterans who had made a successful transition into building a new life as a veteran. It was also distracting attention away from other important issues affecting veterans' health. There was an urgent need to present a more balanced view, ideally based on science.

Comprehensive information on the health of serving personnel had been collected and published since the inception of the Annual Health Reports in 1861, but no such data collection had been undertaken in respect of veterans. Hence there was a knowledge gap within which misinformation could flourish. In 2009, the then Military Medical Liaison Officer to the Scottish Government, the lead author of this report, began to explore whether Scottish computerised health records could shed light on veterans' long-term health, especially in comparison with the non-veteran population. With the support of the then Registrar General, the National Health Service Central Registry at Dumfries, and the Information Services Division of NHS Scotland (later eDRIS), a study gradually took shape. The first Scottish Veterans Health Study was conducted at the University of Glasgow and examined the long-term health of 57,000 veterans in comparison with 173,000 people with no record of service, followed up to the end of 2012. The ground-breaking report was widely welcomed, but by 2017 it was clear that an update was needed. The generosity of Forces in Mind Trust has enabled this second study, Trends in Scottish Veterans' Health, to follow up an expanded cohort of 78,000 veterans and 253,000 non-veterans to the end of 2017. The opportunity has been taken to present the results as a wide-ranging study of veterans' health, including aspects of the historical background which are vital to a full understanding of the issues.

This report is written for the widest possible audience, with the aim of improving the understanding of veterans' health. As far as possible, technical terminology has been avoided or, where it is essential, it has been explained in readily-understandable language. Technical appendices giving more detail are provided for the interested reader.

Executive Summary

The Trends in Scottish Veterans' Health study illustrates the complexity of the factors influencing veterans' health. Background societal and personal factors interact with both in-service experiences and factors operating in post-service life, and the net impact is modulated by individual lifestyle choices. Length of service is important, with longer-serving veterans generally enjoying better long-term health than those who leave early, especially those who fail to complete the minimum engagement. Thus there is both a 'healthy worker effect' and a 'less healthy leaver' effect.

Tobacco smoking has a major impact on veterans' health. Research in the 1950s and 1960s showed that people who were then young soldiers were smoking around 20% more than civilians; 50 years later, up to 10% of veterans have experienced at least one major smoking-related health outcome, reflecting the consequences of this earlier smoking pattern. Changes to military smoking policy were made in 2006 with a ban on indoor smoking, but it will be many years before the health benefits become measurable.

Excess alcohol intake in military personnel has been a longstanding concern, however there is no evidence of long-term harm in veterans, in excess of that seen in the wider community, and there is a small reduction after background socio-economic circumstances are taken into consideration. Even in Early Service Leavers, any apparent increase is explained by their community background. There is no evidence that intravenous drug abuse is a major problem, although veterans with PTSD are at increased risk of misusing drugs.

Interpretation of trends in the mental health of veterans is complicated by a rapidly-changing mental health landscape across the wider community. Some findings such as an increase in risk in the 1970s birth cohorts are difficult to explain, and further research is needed. There is clear evidence that mental health is a particular challenge for middle-aged veterans. Much recent emphasis has been on supporting people in transition from serving to veteran status, especially focussed on young leavers. Their needs are different – they need support into sustainable employment, housing and financial stability in order to forestall the development of future problems, but it is older veterans who have not had such measures in place at the time of their own transition, and whose social structures may now have broken down, who now require mental health services tailored to their needs.

It is clear that much has been achieved in recent years, beginning with the implementation of what was to become the Defence Health Strategy in the late 1970s and, over time, encompassing mandatory fitness training and health promotion, and important policy changes such as the ban on indoor smoking. The impact on the long-term health of veterans is clear to see. For many conditions, the worst outcomes in comparison with people of the same age in the wider community are seen in veterans born in the 1940s and 1950s. Veterans born since 1960, who joined the Armed Forces from the late 1970s when these changes were coming into force, have much better outcomes; in many cases no worse than the wider community, and sometimes better, especially for people who have served for longer and therefore have had longer to be exposed to these beneficial initiatives.

Nonetheless, it is important to remain focussed on the need to protect the long-term health of people who serve, and there remains more to do, especially in respect of tobacco smoking which is the single most easily modified threat to veterans' health. Mental health is also a concern, but it is likely that this reflects, at least in part, trends in the wider community and should be understood in that context. With mental health resources under considerable pressure across the community, care is needed to ensure that resources are targeted most appropriately, and there is compelling evidence of need among middle-aged veterans. Services aimed at non-veterans may not best meet their needs.

The recently published UK Government Veterans' Strategy Action Plan highlights the importance of underpinning policy with robust data, as articulated in the 2018 document The Strategy for Our Veterans which included a cross-cutting commitment to enhance the collection, use and analysis of data to build an evidence base. Monitoring of the effectiveness of policies is crucial, although the natural history of many of the diseases of importance means that this can only be done over a long timescale. It would be best achieved through routine ongoing monitoring of the health outcomes of veterans by national statistical organisations.

A summary of the principal findings in each health outcome area is provided on pages 18 to 21.

Summary of Recommendations

- Smoking cessation is the single most effective measure which can be taken to improve veterans' health, and every effort should be made to reduce the burden of preventable smoking-related disease.
- Smoking during recruit training should be prohibited in order to break the link between 'bonding' and tobacco.
- Recognising the unique nature of the military environment in which many veterans commenced smoking, cessation services specifically aimed at veterans should be made available, and healthcare providers should be encouraged to refer veterans of any age into these services.
- Some veterans may misuse alcohol because of Service-related mental health disorders. Their needs may not be best met by routine addiction services in the community. Services aimed at veterans are likely to be a better fit for their needs.
- Research is needed to explore the substantial increase in risk of mental ill-health in veterans born between 1970 and 1979.
- There is an urgent need for research, including qualitative studies, into the mental health of middle-aged veterans to establish the reasons for the worsening increase in their risk of PTSD.
- There must be a holistic approach to the provision of care to veterans with mental health disorders, encompassing physical health as well as exploring all possible contributory factors to poor mental health including those occurring pre- and post-service. Screening for diabetes is essential, as is the provision of general lifestyle advice and access to smoking cessation and weight management services as appropriate. Any perception that smoking and dietary excess are 'comforting' and should be overlooked is misplaced, and lifestyle advice should be regarded as an important adjunct to mental health care.
- Middle age has been identified as a high-risk period for mental ill-health and suicide in veterans. There is a need to reach out to this age-group and provide services tailored to their needs and experiences. Women veterans may benefit from separate dedicated support.
- Statistics on the health of the veteran community should be routinely monitored and published by national statistical organisations. This should be greatly facilitated by the recent inclusion of the "Are you a veteran?" question in the decennial census.

Summary of Chapters

Chapter 1 Introduction

Chapter 1 introduces the historical background to concerns about veterans' health, from the early 20th century wars, through the Second World War and the Cold War, to the most recent conflicts, set in the

context of the birth of the National Health Service and the growth of computerised health records in Scotland.

Chapter 2 Research Questions

Chapter 2 sets out the research questions from the first Scottish Veterans Health Study, which reported outcomes to the end of 2012, and the questions which would be addressed in this second, follow-up, study, Trends in Scottish Veterans' Health. The research questions focus on assessing veterans' long-term health in comparison with the wider community, changes over time, and the specific areas of mental health, musculo-skeletal disorders and limb amputation.

Chapter 3 How Many Veterans?

Chapter 3 examines changes in the size of the veteran community over the course of the 20th century, the number of veterans currently living in Scotland, and an estimate of likely future veteran numbers.

Chapter 4 Understanding Veterans' Health

Chapter 4 describes the determinants of veterans' health, from the perspective of pre-service, in-service and post-service. Childhood adversity, lifestyle choices and socio-economic status may impact on the entire population; factors such as military deployments are specific to the veteran community, as are issues around transition from serving military to veteran status. A map of the areas in Scotland where veteran populations are highest is presented, together with an analysis of social deprivation in relation to length of service. The chapter concludes with an explanation for the non-statistically trained reader, in familiar terms, of the statistical methods used in the study.

Chapter 5 Cardiovascular Diseases

Diseases of the heart and blood vessels are common in the community, but the first Scottish Veterans study demonstrated an increased risk of around 20% in veterans in comparison with people who had never served, which was tentatively attributed to higher levels of military smoking. This follow-up study examines the risk of heart attack, stroke and peripheral arterial disease, and shows that over time, the trend is towards a reduction in the excess risk in veterans. The risk is highest in those with the shortest service (Early Service Leavers), and those with the longest service are at reduced risk in comparison with the wider community. The risk is also highest in the older veterans, even when compared with non-veterans of the same age. Reassuringly, veterans born from 1960 have no overall increase in risk of cardiovascular disease, suggesting that military health promotion initiatives which have been in place since the late 1970s, when these people joined the Armed Forces, are proving effective in the long term.

Chapter 6 Cancer

Chapter 6 examines the risk of a wide range of cancers which may be relevant to military populations, and shows that there is an increased risk of lung cancer, but that the risk of prostate cancer, testicular cancer and bowel cancer is not significantly different from the wider community. The risk of breast cancer in women veterans varied with length of service; overall there is no difference from non-veteran women, but that is made up of a reduced risk in Early Service Leaver women and an increased risk in those with the longest service. An important explanatory factor is likely to be childbearing, since early childbirth tends to be protective whilst the risk is increased in women who have not given birth or who delay childbearing.

Mesothelioma, a rare but highly dangerous cancer affecting the membranes around the lung, is associated with asbestos exposure; the Scottish Veterans study showed a complex pattern, although there was no increase in overall risk in veterans. Surprisingly in view of the level of service in tropical regions in the past, there is a slightly reduced risk of malignant melanoma (for which unprotected sun exposure is believed to be an important risk factor) in the oldest veterans, with no difference from the wider community in younger veterans. The blood and lymphatic cancers (including leukaemia) are explored in detail, with again no overall difference for veterans. In summary, military service was not shown to involve an increased risk of cancer overall, other than for lung cancer for which smoking is the most important risk factor.

Chapter 7 Other Physical Conditions

Chronic obstructive pulmonary disease is another smoking-related condition with an increased risk in veterans but, as with lung cancer and cardiovascular disease, the increased risk is confined to the oldest veterans (born before 1960) and people with the shortest service, who have had the least opportunity to benefit from in-service health promotion. Type 2 diabetes is slightly more common in veterans, with no clear evidence of a changing trend over time, but an important finding is that veterans with PTSD are at increased risk of also having diabetes, emphasising the importance of a holistic approach to the care of veterans with mental health conditions and ensuring that their physical health is not ignored.

A serious potential risk of diabetes is the loss of a limb due to the development of circulation problems, and overall, more veterans have lost limbs due to disease than as a result of combat. Although the risk of limb loss from disease is no different from the wider community, over 40% of cases were due to diabetes, whilst two-thirds had peripheral arterial disease; the overlap is due to people having both diagnoses. Importantly, both diabetes and peripheral arterial disease are potentially preventable. Around two-thirds of people who are medically discharged from service have a musculo-skeletal disorder, predominantly affecting the lower limb or back. It is therefore reassuring to find that the risk of having to undergo a hip or knee replacement in later life, mainly for arthritis, does not differ between veterans and non-veterans.

Two major neurological conditions were examined in the study; multiple sclerosis (MS) and motor neurone disease (MND). The causes are currently unknown although a number of risk factors have been suggested. The data show that for MS, there is no increase in risk in people who have served, and there may be a small reduction in longer-serving people. With regard to whether military service plays a causal role in individual cases, specialist advice should be sought. The first Scottish Veterans' Health Study showed a 56% increase in risk of MND in veterans in comparison with non-veterans, similar to the findings of an unrelated study among US personnel. The follow-up study shows that the excess risk has reduced to 24%, again similar to a recent US study showing a 23% increase in risk. However, with the very small number of cases of this rare disease, it is not possible to be certain that this represents a true downward trend.

Chapter 8 Mental Health

Mental health is a complex topic, especially with regard to trends. The baseline in wider society is important, and in recent years there has been a marked deterioration in mental health across the community, especially among young people. This is reflected in some of the trends observed in the veteran population. The chapter begins with a brief historical overview, and explores the differences and similarities between military and civilian trauma and mental ill-health. An important finding was a marked deterioration in the mental health of veterans born after 1970 in comparison with the wider population; this cannot be explained by operational service as many of the affected veterans were Early Service Leavers who had already left before the start of operations in the Middle East. Further analysis shows that the majority of the deterioration is due to an increase in the risk of PTSD. Although there is evidence of a slow improvement in more recent birth cohorts, further research is indicated to explore what underlies this trend.

Examining specific conditions, differences in mood disorder (depressive illness) were almost entirely explained by being an Early Service Leaver and by socio-economic deprivation, if people who also had

PTSD were excluded. There was a similar pattern for anxiety on its own. For both depression and anxiety, women veterans showed no difference from women in the non-veteran community. It was PTSD diagnoses where the majority of the differences between veterans and non-veterans were found, with the highest risk in the 1975-1979 birth cohort, an unexplained finding. There is evidence that the excess risk is reducing in the most recent (post-1985) birth cohorts, but as the peak age for mental ill-health is in middle age, this picture may change as the cohort ages.

Chapter 9 Suicide, Self-Harm and Substance Misuse

Despite extensive research, there remains no consensus as to whether the risk of suicide is increased in veterans, although recent studies including the first Scottish Veterans study to 2012 have tended to indicate that there is no overall link with military service. This has been confirmed in the follow-up study to 2017. The peak age for suicide was in middle age, with very few cases in veterans under 25. Any apparent increase in risk in Early Service Leavers is explained by deprivation, however there is an increased risk in older women veterans in comparison with non-veteran women of the same age. Veteran women were also older on average at the date of suicide than non-veteran women. Importantly, the study found a long lag between leaving service and suicide, peaking at 22 years for men and 27 years for women. Analysis of trends over time showed that the risk in veterans had been increased in comparison with the wider community, up to around 2010, but thereafter the risk has been the same as in non-veterans.

In contrast to suicide, self-harm was commoner in younger veterans, and tended to present much closer to leaving service. There are two peaks in age, at 22 and 34 years, in both veterans and non-veterans. There has been an overall increase in risk in recent years, mirroring the trend in the wider community although the increase in veterans is greater. In many cases, self-harm was associated with a diagnosed mental health disorder, most commonly mood disorder or anxiety, although PTSD was also strongly associated with risk of self-harm. Only in a small percentage of cases was self-harm associated with later suicide; 2.6% of veterans who self-harmed under age 30, and 4.3% of veterans who self-harmed at age 30 and older.

Serving military personnel are known from other studies to have a higher risk of harmful drinking. Reassuringly, the two Scottish Veterans studies provide no evidence that this pulls through into an increased risk of alcohol-related harm in later life, as measured using alcoholic liver disease as a marker. Both studies show a small (3%) reduction in overall risk, but after adjusting for deprivation, the reduction was a statistically significant 8%. The only group with an increase in risk are Early Service Leavers who have completed training but leave before completion of their minimum engagement. Again though, this can be explained by factors in their background community as the increase becomes non-significant after adjusting for deprivation. Trend data shows that, as with suicide, the risk was increased in the past, but since around 2010, there has been no difference from the wider community. Allowing for a time-lag of around 20 years for the development of alcoholic liver disease, this corresponds to a change in drinking pattern around 1990. The pattern suggests that although there may be a period of heavy drinking in service after the completion of initial training, for most people this does not persist at a harmful level into post-service life.

Drug misuse is challenging to assess from routine health statistics, but hepatitis C is strongly associated with intravenous drug use and therefore provides a limited proxy measure. Both Scottish Veterans studies have shown a substantially reduced risk of hepatitis C in veterans compared with the wider community, suggesting that the Compulsory Drug Testing programme has had a marked and lasting effect, at least on intravenous drug use. However, there was a strong association with PTSD; despite small numbers, veterans with PTSD were six times more likely to have a hepatitis C diagnosis than veterans with no record of PTSD, suggesting that some are using drugs of abuse to self-medicate.

Chapter 10 Conclusions and Recommendations

This chapter draws together the findings of the study and makes recommendations to further improve the health and welfare of the veterans of military service, as detailed in the first part of the Executive Summary.

1 Introduction – Caring About Veterans' Health

1.1 HISTORICAL BACKGROUND

1.1.1 Early Twentieth Century Conflicts

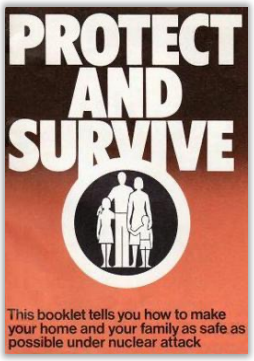
Awareness of the toll that military service can exact on health has been recognised for many centuries.

> *Soldier, rest! thy warfare o'er,*
> *Sleep the sleep that knows not breaking;*
> *Dream of battled fields no more,*
> *Days of danger, nights of waking*[1].

Throughout modern history, warfare has been a constant if unwelcome companion to society. The birth of the twentieth century saw over 400,000 British troops committed to the Second Boer War 1899-1902, of whom 22,000 were killed, 23,000 were wounded and 12,000 died of disease[2]. Many returned bearing lifelong scars, both mental and physical. Only 12 years later, the United Kingdom was at war again, in a conflict which would see nearly 8 million British men in uniform, nearly all of Britain's male workforce. Ten per cent never returned; those who did included 41,000 amputees. The ubiquitous nature of the experiences of that war, whether the horrors of the trenches on the Western Front, the beaches at Gallipoli or the disease-ridden conditions at Salonika which resulted in many dying without ever hearing a shot fired in anger, meant that the entire community understood the veteran experience. It was a shared experience, from which no family or community was spared.

1.1.2 The Second World War, National Service and the Cold War

That shared experience was reinforced between 1939 and 1945 as the next generation was exposed to the Second World War. This time, it was not just those in uniform who were 'veterans of conflict'. Developments in powered flight paved the way for mass bombing of civilian targets, and the entire British community knew the sound of falling bombs, the fear of air-raids, and the consequential destruction and loss of life. The Second World War gave way to a fragile peace, the Cold War, bringing an ever-present threat of nuclear holocaust. A long-running public information campaign throughout the 1950s to 1980s ensured the maintenance of a high level of awareness of the threat within the community[3]. A trained uniformed force was maintained through compulsory conscription (National Service), the majority of men serving for two years from the age of 18. Having ever served in the military, being a veteran, remained ubiquitous in British society. Scarcely a family could not legitimately claim to be part of the veteran community. Veterans' health was everyone's health, at least as far as men were concerned. The few people who had



[1] Sir Walter Scott 1771-1832. The Lady of the Lake.
[2] https://www.bbc.co.uk/news/10390469
[3] Young, Taras. Nuclear War in the UK. Cornerstone Books (2019).

never served were those who were medically or occupationally exempt – perhaps less than 10% of men born before 1943 – and many who were ineligible for the Armed Forces gave valuable service to the Civil Defence organisation.

1.1.3 Veterans and the Birth of the National Health Service

At the birth of the National Health Service (NHS) in 1948, veterans' healthcare was everyone's healthcare, for all the reasons described above. Everyone understood the physical and mental wounds of war. The only groups of veterans for whom special arrangements were made were those whose experiences were less familiar, for example those who had been Far East prisoners of war, many of whom returned with the aftermath of unfamiliar tropical diseases. They retained the right to care in military hospitals for the rest of their lives. For other veterans, their care was to be provided by the NHS.

The second half of the twentieth century was a time of profound change. The discharge of the last National Service conscript in 1962 brought about an all-volunteer force, whilst the size of the Armed Forces was progressively reduced down to its present level (2020) of under 150,000 Regular personnel. Many of the overseas bases closed, or were reduced in size, and the opportunities for two-year tours accompanied by families in Germany, or in attractive localities such as Singapore and Hong Kong, reduced greatly in parallel with an increase in the number of operational deployments to Northern Ireland, Bosnia, Kosovo, the Persian Gulf, Afghanistan and many other localities.

With the passage of time and reducing numbers in uniform, fewer members of the civilian community had experience of a family member serving in the Armed Forces. The position of the veteran was no longer ubiquitous. Increasingly, some veterans began to feel that their experiences could not be understood or properly managed by those who had never served. A need for a range of veteran-specific services was becoming apparent. Some of these would be provided by the NHS, but the bulk of the new service provision would fall to the third sector.

1.1.4 The First Gulf War and the Need for Research

That perceived need was brought into sharp focus when some veterans of Operation GRANBY, the first Gulf War (1990-1991), began to experience symptoms which could not readily be explained by conventional medicine. Research was urgently needed, as were treatment services, but at a broader level, attention began to focus on the care of veterans as a distinct population subgroup. There is nothing unique about that; for many years children have been cared for by paediatric services, older people by elderly medicine specialists and working people by occupational health services. Planning high-quality services should be underpinned by a needs assessment to determine the nature and extent of the requirement. But here there was a knowledge gap. Although extensive research had been conducted in the USA on the health of veterans of the Vietnam war (1955-1975), and in Australia on veterans of the Korean war (1950-1953), and of their involvement (1962-1972) in the Vietnam war, there was very little research on the long-term health of a broader cross-section of veterans, and none in the United Kingdom. Two important reasons stand out. The first was the computing power needed to undertake large-scale population studies, which only developed in the second half of the 20th century. Secondly, until the ending of National Service in 1962, there was no valid comparison group of people who had never served, but were otherwise similar to the veterans in all respects, to act as a benchmark against which the veterans' health outcomes could be compared. Even then, the first comparable non-veterans were very young; comparing conditions affecting older people would not be possible for many years.

1.2 Measuring Health – the Scottish Perspective

Scotland was a pioneer in health data analysis at a population level. Hospital discharge records, cancer registrations and deaths have been held centrally since 1968, and the records have been computerised since 1980-81. The use of data linkage to enable 'read across' of these records was developed throughout the 1980s, and has been further refined over time. A wide range of data sources is available for linkage, resulting in an extremely powerful system which can be used for a wide variety of research applications[4]. Strict confidentiality protocols and procedures are in place to ensure that individuals' right to privacy and confidentiality is safeguarded[5]. These linked data form the basis of the two major studies which have underpinned this report.

Uniquely in the United Kingdom, the Scottish NHS registration database includes a cipher for "Exit to Armed Forces" applied when an individual joins for service, which is informed by a data feed from the recruitment offices. When that individual leaves the Armed Forces and re-registers with a primary care practitioner in Scotland, a "From Armed Forces" cipher is generated on the record. Strict confidentiality is applied to the NHS database records, which are not accessible to healthcare providers[6]. The ciphers are believed to be reasonably complete except for a short period in the mid-1990s when a procedural change resulted in a shortfall, although an NHS campaign to encourage veterans to report their status to their primary care provider resulted in a number of previously unrecorded veterans being identified. The existence of these records has enabled two major studies to be conducted into the long-term health of veterans, in comparison with people who have never served.

[4] Fleming M, Kirby B, Penny KI. Record linkage in Scotland and its applications to health research. J Clin Nurs. 2012 Oct;21(19-20):2711-21. doi: 10.1111/j.1365-2702.2011.04021.x.
[5] https://www.isdscotland.org/Products-and-Services/eDRIS/How-eDRIS-is-Secure/
[6] A test enquiry to NHS Scotland confirmed that this ruling was strictly applied.

2 Research Questions

2.1 The First Study

The first study, the Scottish Veterans Health Study[7] , which used data to the end of 2012, was based on the following research questions:

- Do military veterans have better or worse long-term health outcomes (physical or mental) than people who have never served?
- Are there specific conditions which are associated with military service, and is there evidence of causality?
- Are some sub-groups of veterans at greater risk than others?
- Are there any trends over time?
- What is the overall impact of military service on health?

The outcome of that study[8] provided the first indication of specific areas where inequalities existed, and informed policy development in response to the implementation of the Armed Forces Covenant, as well as planning for additional services for veterans.

2.2 The Follow-up Study

By 2017, it was clear that a follow-up study would be needed, both to assess changes and to answer questions which had been out of scope for the first study. The Trends in Scottish Veterans' Health Study, funded by Forces in Mind Trust, therefore set out to answer the following new research questions:

- How have the health risks faced by veterans changed between 2012 and 2017, and to what might any changes be attributable?
- How does the health (mental and physical) of young recently-transitioned veterans differ from that of young people in the wider community?
- How does the long-term risk of limb amputation in veterans post-service compare with the risk faced by the wider population, and what are the principal antecedent conditions?
- How does the risk of disabling musculo-skeletal disorder in veterans compare with the risk in the wider population?

As the study progressed, it became clear that the comprehensive dataset which NHS Scotland generated for the study was able to provide much more information on veterans' health which would be of potential value to policy makers, planners and service providers, as well as contributing to the wider understanding of veterans' health. We are grateful to Forces in Mind Trust for allowing us the flexibility to exploit this. The result is a much wider-ranging report than was at first envisaged.

[7] The Scottish Veterans Health Study http://theses.gla.ac.uk/7144
[8] Ibid.

3 How Many Veterans?

3.1 The UK Armed Forces

The number of people serving in the Armed Forces changed greatly over the course of the 20th century and with it, as they left military service, the number of veterans varied. As the UK definition of a veteran is met after only a single day's service[9] and, unlike some other nations, requires neither operational service nor honourable discharge, all those who have ever served enter the pool of veterans, and only leave it when they die. The number of veterans in the community is therefore determined by the balance between those leaving the Armed Forces, and those reaching the end of their lives.

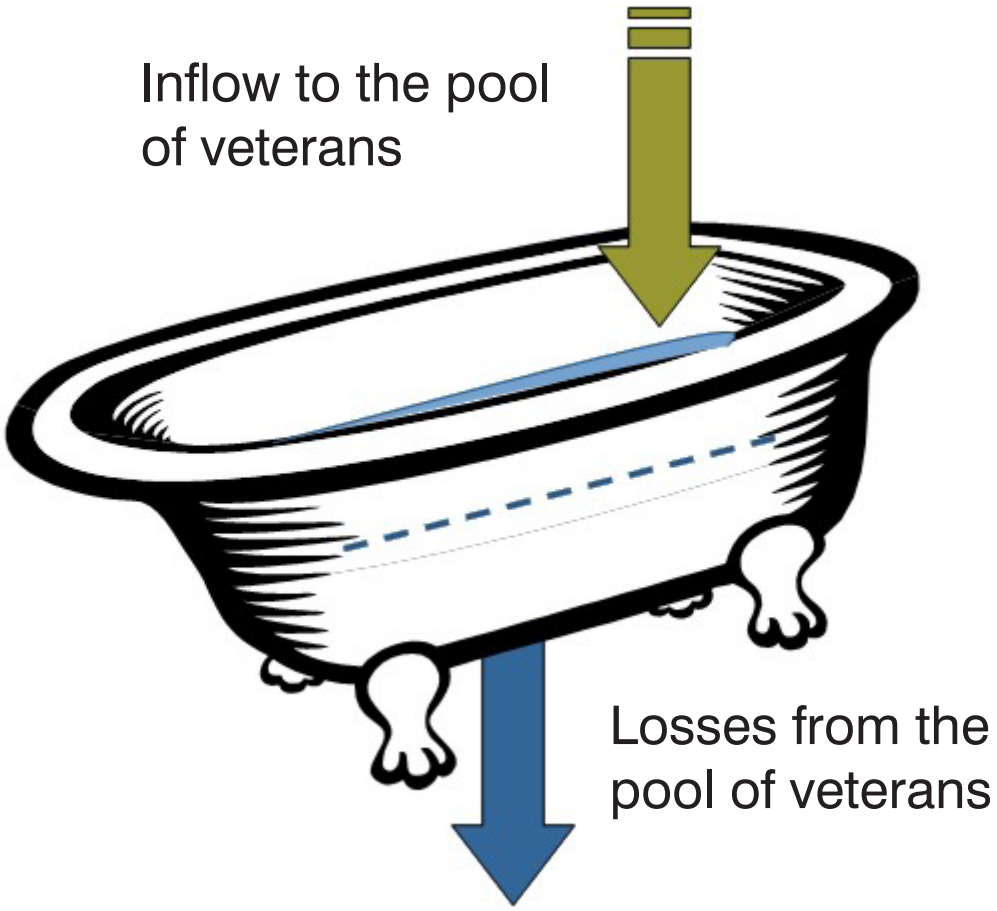


Figure 3-1 - Inflow and Outflow to the Pool of Veterans

At times of downsizing of the Armed Forces, for example in the years following major conflicts, or the implementation of redundancy programmes, there is therefore a great increase in the number of veterans in the community, altering the demographic characteristics of the veteran community itself as well as of the smaller number who continue to serve.

[9] C. Dandeker, S. Wessely, A. Iversen, and J. Ross, "What's in a Name? Defining and Caring for "Veterans": The United Kingdom in International Perspective," Armed Forces and Society 32, 2 (2006): 161-77

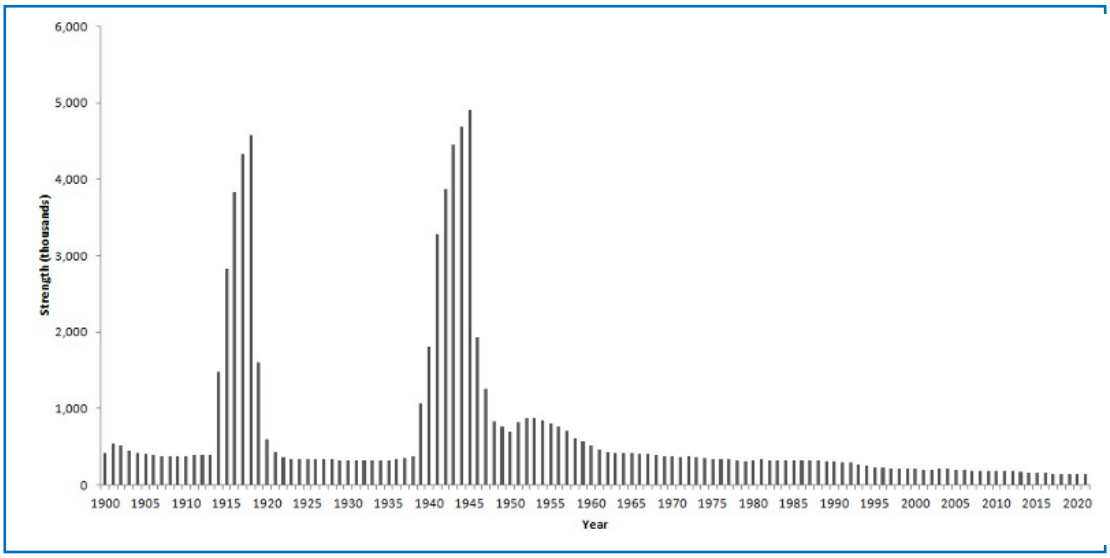


Figure 3-2 - Strength of the UK Armed Forces by year, 1900-2021

Figure 3-2 shows the strength of the UK Armed Forces from 1900 to 2021. By 1920, and again in the period 1950-1960, there would have been a great increase in the number of veterans returning to the civilian community. It is estimated that some 8.4 million people served in the First World War, out of a total UK population of around 40 million in 1920. To this may be added around 350,000 who served in the Second Boer War (1899-1902), a small number of whom took part in both conflicts. Together with the veterans of earlier conflicts who were still alive, it is therefore likely that by 1920, there were some 10 million veterans in the UK, or about 25% of the population. Being a veteran was the norm, at least for adult men. Importantly, transition was something that all experienced, and would have been as familiar as leaving school. It was a normal stage in the life-course.

By the end of the Second World War, a further 5 million had served; some took part in both conflicts. The ending of the war was followed by a period of National Service conscription, which saw all able-bodied men aged 17-20 years required to serve for two years and then complete a period of reserve service, unless they were in a 'reserved occupation' such as coal mining, agricultural work or were in the Merchant Navy. Recruitment to National Service officially ended 15 years after the end of the Second World War, on 31 December 1960, and by this time, the majority of adult men in the UK were veterans, equating to an estimated 15 million people[10]. By now though, the First World War veterans were aging and the number of veterans was already starting to fall.

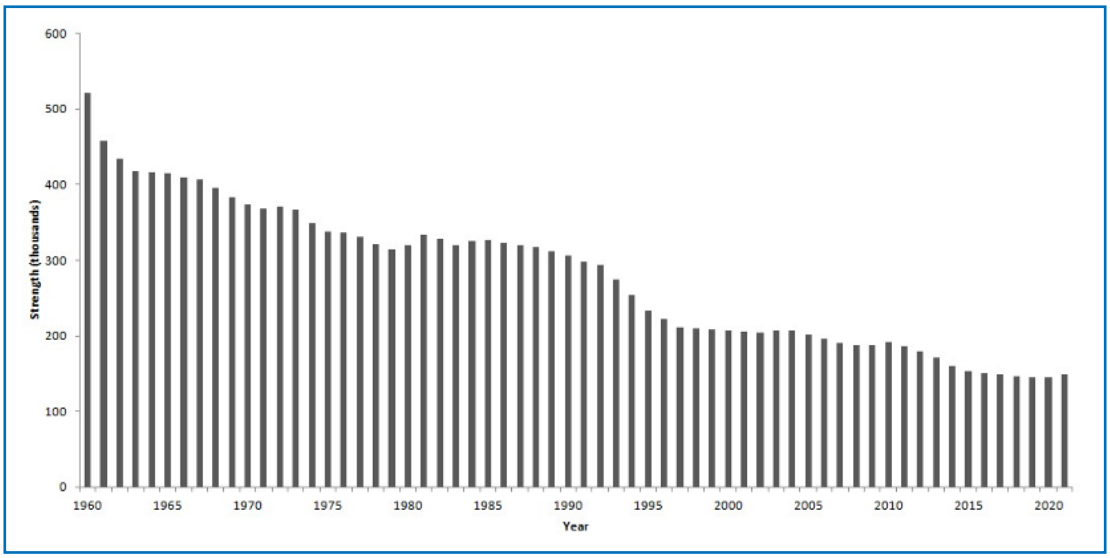


Figure 3-3 - Strength of the UK Armed Forces by year, 1960-2021

[10] Historical UK population estimates derived from the Office for National Statistics https://www.ons.gov.uk/aboutus/transparency-andgovernance/freedomofinformationfoi/populationbyagegenderandethnicity

From the end of National Service, and later the end of the Cold War, the number of people serving has reduced in a series of steps driven by policy changes, as illustrated in Figure 3-3, which shows the strength of the Armed Forces from 1960. Although this led to several points at which the number of veterans increased abruptly, generally these increases were small in comparison with the overall picture. The number leaving each year and joining the pool of veterans is now under 15,000, compared with around 22,000 a few years ago. At the same time, the pool of Second World War veterans has now reached old age, and as at 2020, no-one under the age of 93 will have taken part in that conflict. Even the last man to complete National Service was born 82 years ago. Thus the majority of today's veterans joined as volunteers, a major change from only a few years ago when the majority were conscripts or had intentionally volunteered for war service.

The number of veterans has reduced substantially in consequence of these changes. In 2005 the Royal British Legion estimated that there were 4.8 million veterans in the UK[11]. By 2017, this had fallen to 2.4 million in Great Britain*[12] , and it is estimated to further fall to 1.6 million by 2028[13]. If the size of the Armed Forces, the current rate of discharge and the UK death rate remain steady, the size of the veteran population may be expected to stabilise eventually at around 1.3 million[14]. The percentage of households which include a veteran was estimated to be 5% in 2017, falling to a projected 2-3% by 2028. An estimated 60% of veterans are currently above working age (65 and older); it is anticipated that this will fall to 54% by 2028 but the majority of veterans will still fall into this category. Although new veterans are often thought to be at highest risk, they constitute only a small proportion of all veterans; an estimated 1.25% of the pool are in their first two years as a veteran.

3.2 The Number of Veterans in Scotland

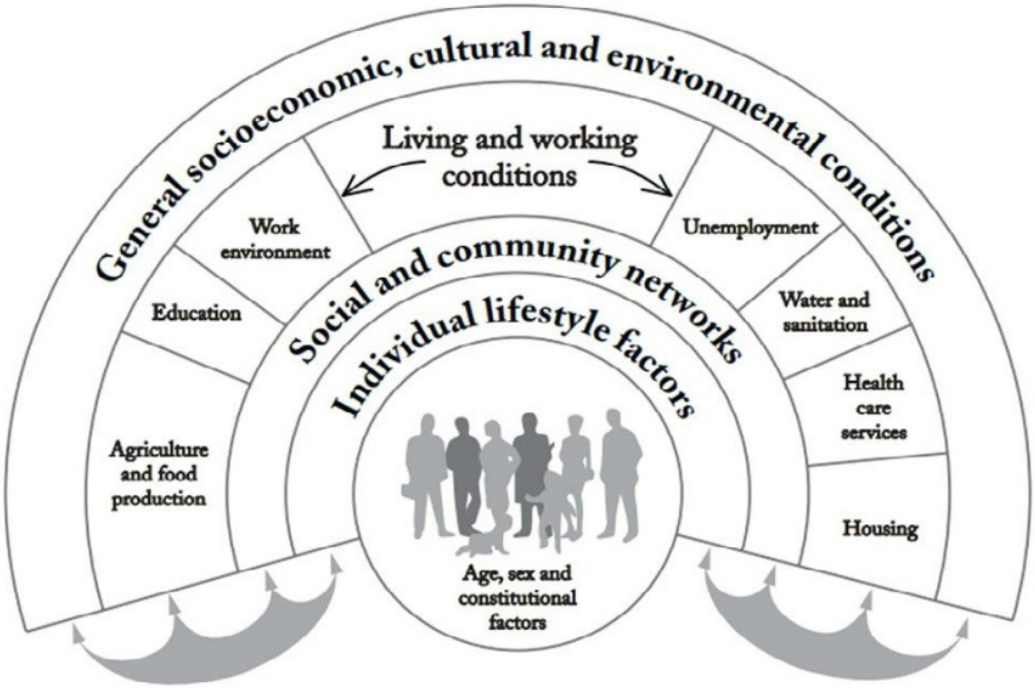
The proportion of the Armed Forces recruited from Scotland has fluctuated from year to year[15], but a figure of 10% is commonly used for planning purposes. The Scottish Government currently uses a figure of 230,000 veterans living in Scotland[16]. The Venture Trust, in its evaluation of its Positive Futures programme[17], estimated that there were 71,200 veterans in the age range 18-65 years in Scotland. The dataset used in the Trends in Scottish Veterans' Health Study, comprising 78,365 veterans aged 22-73 years at the end of data collection[18], which represents a 100% sample of all veterans meeting the study criteria identified by NHS Scotland, is consistent with this figure.

*ie excluding Northern Ireland
[11] The Royal British Legion (2005) Profile of the ex-service community in the UK.
[12] Annual Population Survey: UK Armed Forces Veterans residing in Great Britain, 2017. Ministry of Defence.
[13] Population Projections: UK Armed Forces Veterans residing in Great Britain, 2016-2018.
[14] Calculated from data published by the Office for National Statistics. No account has been taken of geographical variations in recruiting or death rates.
[15] Eg MoD Freedom of Information response FOI13-02-2012-121523-005 dated 23 February 2012.
[16] "Veterans' Health & Wellbeing in Scotland". Scottish Veterans Commissioner, August 2017.
[17] "Evaluation of the Positive Futures Programme 2016-2018". Venture Trust, September 2018.
[18] Encompassing those who became veterans from age 15 and upwards, in the period when military service could start at that age.

4 Understanding Veterans' Health

4.1 Influences on Veterans' Health

The health of veterans, as with all members of the community, is determined by many factors, **individual, social and environmental**, as illustrated in Figure 4-1.



Source: Dahlgren and Whitehead[19]
Figure 4-1 - Determinants of Health

Although this forms a framework for the health of the community, it does not provide sufficient information about the influences on veterans' health. It is helpful to look at when and how the different factors operate on veterans' health.

Figure 4-2 - Factors Influencing Veterans' Health

[19] Dahlgren G and Whitehead M (1993) Tackling inequalities in health: what can we learn from what has been tried? Working paper prepared for the King's Fund International Seminar on Tackling Inequalities in Health, September 1993, Ditchley Park, Oxfordshire. London, King's Fund.

4.1.1 Pre-Service

Pre-service factors are generally those arising in childhood or adolescence and, if likely to impact on fitness to serve, may result in rejection at the recruit selection stage. Examples are asthma and childhood epilepsy. However other factors which are now known to influence long-term health also originate in the pre-service period but cannot usually be taken into consideration during selection. These include constitutional factors such as genetics, as well as neonatal and early childhood factors such as prematurity and parental smoking. Childhood adversity, such as physical or sexual abuse, parental imprisonment or addiction, is also now known to have an important influence on adult mental health, but it would simply be impractical to exclude from service everyone who had experienced adversity in early life – especially as some people who have had a difficult upbringing nonetheless do very well in military service. The pre-service factors are predetermined, and can only be influenced by recruiting policy, for example excluding people who already have a history of certain medical conditions.

4.1.2 Lifestyle

Lifestyle choices are one of the greatest influences on long-term health – whether an individual chooses to smoke, drink alcohol to excess, take exercise or maintain a healthy weight. The first Scottish Veterans Health Study showed that the single biggest influence on long-term health was smoking-related disease, which accounted for twice as many episodes of serious ill-health as mental health. Generally, lifestyle choices impact on both veterans and non-veterans, although veterans are likely to have benefited from in-service health promotion encouraging a healthier lifestyle. 'Occurrences' are also the health-related events of daily life which, outside time spent in military service, are common to both veterans and non-veterans – accidental injuries and diseases.

4.1.3 In-Service

The **in-service period** varies in length from one day to over 40 years, but with an average length of service of around 6 years, the majority of veterans spend more time as members of the wider community than in service. Nonetheless the in-service period is often highly important in its impact on long-term health. For many people, it marks the transition between adolescence and adulthood, including establishing personal habits such as smoking and attitudes to alcohol. On top of this might be specific occupational exposures including deployment or combat, although less than 25% of the Armed Forces are combat troops and overall, an even lower percentage have direct experience of combat. Those with the shortest service may not even have completed training, and so will never have seen operational service. The health impacts of the in-service period are strongly influenced by Defence policy, including health promotion, health and safety and much else.

4.1.4 Where might they have served?

As the Scottish Veterans dataset is derived from NHS records and is not linked to MOD records, there is no information about whether individual people were in the Army, the Naval Service (Royal Navy and Royal Marines) or the Royal Air Force, their trade or occupation, where they served, or the deployments in which they took part. This would have been invaluable but would have required data linkage between civilian and military records, which is not generally possible. However knowledge of the dates of military operations allows a broad correlation with the dates when groups of individuals were in their early years of service and therefore possibly more vulnerable to adverse mental health impacts. The greatest impact is likely to have been seen in Army personnel, who make up the greatest numbers (over 50% of the Armed Forces) and are more likely to have deployed as ground troops. Table 4-1 summarises major operations, deployments and changes which may have impacted on specific birth cohorts.

Table 4-1 - UK Military Operations 1960-2017

Birth cohort	Age 18 in:	Military operations	Significant changes
1945-1949	1963-1967	Aden 1963-1967 Brunei 1962-1966 Dhofar 1962-1975 Malaysia 1962-1966	
1950-1954	1968-1972	N. Ireland 1969-2007	
1955-1959	1973-1977	N. Ireland 1969-2007	
1960-1964	1978-1982	N. Ireland 1969-2007 Falklands 1982	Basic Fitness Test 1978[20] Improved health promotion
1965-1969	1983-1987	N. Ireland 1969-2007	
1970-1974	1988-1992	Gulf War 1990-1991 Yugoslavia 1991-2001 Bosnia 1992-1995 N. Ireland 1969-2007	
1975-1979	1993-1997	Yugoslavia 1991-2001 Bosnia 1992-1995 N. Ireland 1969-2007	Options for Change 1994-5[21]
1980-1984	1998-2002	Kosovo 1998-1999 Yugoslavia 1991-2001 Sierra Leone 2000 Afghanistan 2001-2017 N. Ireland 1969-2007	
1985-1989	2003-2007	Iraq War 2003-2011 Afghanistan 2001-2017 N. Ireland 1969-2007	Defence Health Strategy 2004 Def Mental Health Service 2004
1990-1995	2008-2013	Iraq War 2003-2011 Afghanistan 2001-2017	

[20] The introduction of the Basic Fitness Test represented an important initiative to improve cardiovascular fitness and reduce obesity, and the start of a coordinated programme of health improvement in the Armed Forces.

[21] Options for Change was a major redundancy programme in the early 1990s which reduced the size of the Armed Forces by some 18%, following the end of the Cold War. Whilst many volunteered for redundancy, there were many who were made compulsorily redundant. Many regiments were amalgamated and bases were closed, leading to job uncertainty and a loss of corporate identity for those who remained in service.

4.1.5 Post-Service

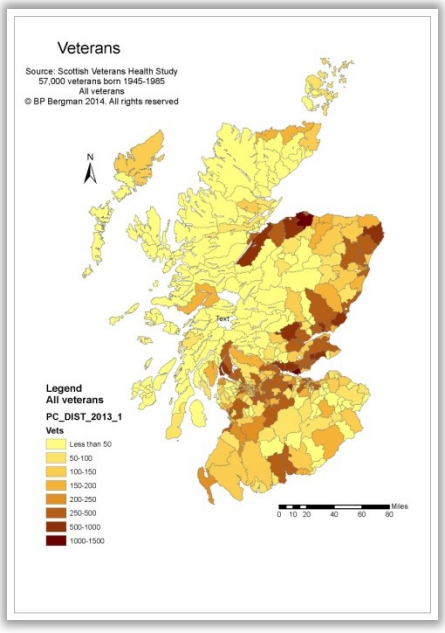
The **post-service** period may represent the greater part of a veteran's life. Influences on long-term health in the post-service phase are heavily dependent on a successful transition. The Army uses a HARDFACTS mnemonic to assist in planning for transition. Interestingly, HARDFACTS does not include Employment, which is widely recognised to be an important determinant of health, both through the Healthy Worker Effect[22] whereby those in employment are found to have lower mortality than workless people, or simply the mental health effects of transitioning from a secure, well-paid job to being unemployed[23]. It may be that future employment is regarded as being part of the career transition process and is not considered at this point, although as it underpins many of the factors such as finance and training, its absence is surprising.

Health
Accommodation
Relocation
Drugs & Alcohol
Finance
Attitude
Children & Family
Training
Support Agencies

Overarching all of these factors are post-service lifestyle choices such as smoking, alcohol, exercise and obesity, and personal circumstances such as occupation, housing, relationships and social networks.

4.1.6 Where Do Veterans Live?

For the 2012 study, a mapping exercise was undertaken to show the main areas where veterans settle. Perhaps surprisingly, this showed that veterans tend to be concentrated in the areas around military bases, as shown on the map[24]. Possibly this reflects post-service employment as a civilian on the base, the family having put down roots during the final posting or, in the case of Royal Navy personnel, already having a settled family home in the 'home port'. Another map giving the locations of veterans who had a War Pension or higher level Armed Forces Compensation Scheme award (not shown here) indicated that they were more likely to have settled in or close to the major cities – possibly driven by a desire to be close to medical facilities or other support services.



[22] Li, C-Y., and F-C. Sung. "A review of the healthy worker effect in occupational epidemiology." Occupational Medicine 49.4 (1999): 225-229.
[23] Thomas C, Benzeval M, Stansfeld SA. "Employment transitions and mental health: an analysis from the British household panel survey." Journal of Epidemiology & Community Health 59.3 (2005): 243-249.
[24] Note that this map omits Shetland as the number of veterans settled there was small.

4.1.7 Socio-Economic Status

The link between socio-economic status and health has been recognised for many years; it underpins the inequalities which are now understood to be a major driver of health[25]. Measuring those inequalities in a way that captures all the influences on health can be problematic. The traditional view was to assess 'social class' based on the main earner's occupation, ranging originally from the 'landed gentry' at one end of the scale to unskilled manual workers at the other. Over time, the system was refined but UK National Statistics still use a classification based on occupation, although this now captures a greater range of categories including students, retired people and the never-employed[26]. For the Armed Forces, classification has proved problematic, with various attempts to develop a meaningful system[27] although none proved entirely satisfactory. The current National Statistics classification has three categories, for officers (higher managerial), NCOs and other ranks with a supervisory role, and 'intermediate' for all other Armed Forces employees. Veterans are classified according to their civilian occupational status, with no specific designation for having previously served.

This occupationally-based classification of individuals does not capture sufficient information to examine the health impact of deprivation overall in the areas where people live, and a number of composite measures have been developed which take account of other relevant factors. In Scotland, the Scottish Index of Multiple Deprivation (SIMD) is generally used[28]. This divides the country into nearly 7000 blocks ('data zones') with an average population in each of 800 people. Each data zone is then allocated a score on based on average income, employment levels, health, education (including skills and training), housing, crime, and access to services. The scores allow the data zones to be divided into either five or ten categories, ranging from the most deprived to the least deprived. The Trends in Scottish Veterans' Health Study used the five-category ('quintile') version. Postcode information in the dataset allowed a SIMD quintile to be allocated to every study participant. This information meant that the effect of different socio-economic circumstances and living conditions could be taken into consideration when looking at possible reasons for differences in veterans' health.

Table 4-2 - Socio-economic status and length of service

SIMD	Basic training	Other ESL	4-6 years	7-9 years	10-12 years	13-16 years	17-22 years	Over 22 years
1 Most deprived	25.0%	25.3%	22.3%	19.4%	17.9%	16.8%	12.5%	9.6%
2	23.3%	24.0%	22.0%	21.8%	20.4%	20.5%	18.6%	15.7%
3	20.1%	20.0%	21.1%	21.0%	22.4%	23.4%	24.4%	23.7%
4	18.5%	17.7%	19.5%	21.2%	22.7%	23.0%	25.1%	28.6%
5 Least deprived	13.1%	13.0%	15.1%	16.7%	16.6%	16.3%	19.4%	22.5%

Table 4-2 shows the percentage of veterans in each SIMD category by length of service. There is a steady gradation of reducing levels of deprivation with increasing length of service. The highest percentage of veterans in the most deprived SIMD categories (SIMD 1 and 2) is in the two categories of Early Service Leavers, whilst the highest percentage of veterans in the most affluent categories (SIMD 4 and 5) is in people who have served for longest. Nonetheless, just under 10% of the longest-serving veterans are living in the most deprived circumstances. This group equates to about 650 people, distributed throughout Scotland, and it is likely that they represent the most vulnerable veterans whose need for support is greatest.

[25] "Fair Society, Healthy Lives". Marmot, M. (2012)
[26] The National Statistics Socio-economic Classification https://www.ons.gov.uk/methodology/classificationsandstandards/standardoccupationalclassificationsoc/soc2020/soc2020volume3thenationalstatisticssocioeconomicclassificationnssecrebasedonthesoc2020#category-descriptions-and-operational-issues
[27] Yoong SY, Miles D, McKinney PA, Smith IJ, Spencer NJ. A method of assigning socio-economic status classification to British Armed Forces personnel. Journal of the Royal Army Medical Corps. 1999 Oct 1;145(3):140-2.
[28] https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/

4.2 Studying Veterans' Health

Trends in Scottish Veterans' Health is a comparison between the health experience of those who have served and that of the wider community who have never experienced military service, examining the long-term health experience of veterans who were up to 73 years of age at the end of the collection of data in 2017. One of the aims of the study is to explore how the health of veterans differs from the wider community, given that so many factors are shared, and how this relates to time in service. In turn, that provides information to policy makers, planners and service providers on which services for veterans can be based. The study follows on from the **Scottish Veterans Health Study**, which looked at veterans' health to the end of 2012[29]. Repeating the study every few years provides information on how veterans' health is changing, enabling an agile and dynamic response to the changing needs of veterans. It also provides feedback to those planning and delivering in-service health promotion on whether that is proving effective, and whether any new issues are emerging.

Above and beyond the factors common to everyone, veterans represent an **occupational cohort** – a group of people whose shared experience was their employment. The past tense is appropriate; in becoming veterans, they have all moved on from that employment – some recently and others over 50 years ago, after periods of service which vary greatly. Their ages at the end of the study varied from the early 20s to the early 70s. That diversity presents challenges in making meaningful comparisons – are we comparing like with like?

The statistical technique known as **survival analysis** enables comparisons to be made which take account of these differences. The results may be unfamiliar at first sight, and this next section provides a simplified guide to interpreting the results.

4.2.1 Hazard ratios

Many of the comparisons show a **hazard ratio**, which is simply a comparison between the risk of developing a particular condition by a specific age in veterans, compared with non-veterans. A hazard ratio of 1 means there is no difference. A hazard ratio of 1.5 means that veterans are half as likely again as non-veterans to develop the condition – also described as a 50% increase in risk. A hazard ratio less than 1 means that veterans are less likely than non-veterans to develop the condition – for example a hazard ratio of 0.8 means a 20% reduction in risk.

4.2.2 Averages – Mean vs. Median

There are two types of 'average' commonly used in population studies. The most familiar is the **mean**, which is the 'average' most commonly meant in everyday speech. It is calculated by adding all the values together and dividing by the number of values. For example, to calculate the average lifespan of a group of people, their ages at death are added together and divided by the number of people. That can be misleading in population studies; a large number of people towards one end or the other of the range can make a large impact on the mean which does not necessarily help in understanding the 'big picture'.

A more useful type of average is the **median**. This is the middle value (for example, age) which has half the people above it and half below it, so there is an equal chance of being above or below the median. If the spread of values is evenly distributed, the mean and median are similar. However if the values are bunched together at one point but with a long 'tail' ('skewed'), there can be a substantial difference. For example, the majority of people only stay in the Armed Forces for up to 6 years, but a few serve for 40 years or more. These few people with very long service make a major contribution to the **mean**, which in 2012 was 8.6 years. The corresponding **median** however was 6.3 years; half the veterans served for less than that, and half for longer, which was a much better reflection of people's length of service. The median is therefore a much more meaningful figure, and is generally used in this report.

[29] Available from http://theses.gla.ac.uk/7144/

4.2.3 Graphs and Confidence Intervals

4.2.3.1 Cumulative Hazard Graphs

Calculating the risk of developing a condition at each age for veterans and non-veterans and plotting the results on a graph gives a clear visual representation of the comparison of risks between veterans and non-veterans, and can also show the age at which the health of veterans and non-veterans starts to diverge. These are known as cumulative hazard graphs, and an example is shown below. All the examples in this section are from a different study, and are for illustrative purposes only.

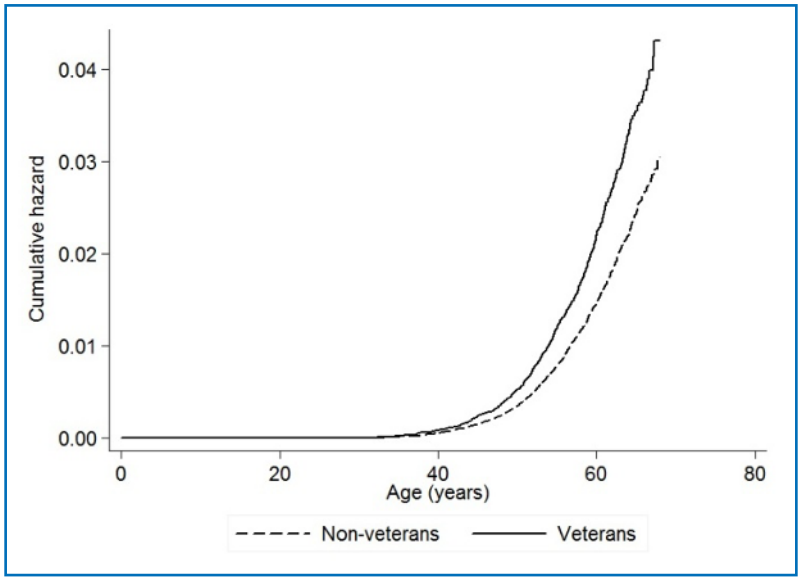


Figure 4-3 - Example of a Cumulative Hazard Graph

A lot of information can be drawn from graphs of this type. The solid line represents veterans, whilst the dashed line shows non-veterans for comparison. The graph shows the risk of developing a condition by a particular age, not the number of people who actually had the condition by that age.

In this example graph we see a condition which does not affect people under the age of about 40, but then almost immediately veterans are at higher risk than non-veterans, and that increased risk continues to the end of follow-up. At age 50, less than 1 in 100 veterans and non-veterans are likely to have the condition, but by age 60, it is likely to affect 3 per 100 veterans and around 2.5 per 100 non-veterans. If a condition is found to affect young people too, and there is a difference in risk in older veterans but not in younger veterans, that might mean that a policy change such as improved health promotion has reduced the risk in more recent veterans.

4.2.3.2 Birth Cohort Graphs

Changes over time can also be explored using birth cohort graphs. A birth cohort is a group of people who were all born in the same year or, more usually, group of years. The graphs enable a visual comparison between veterans and non-veterans born in a specific group of years, which can provide important additional evidence of the impact of policy change. In this study, 5-year birth cohorts have generally been used, although for some rare conditions, it has been necessary to use longer groups of years in order to have sufficient numbers of cases. In other cases the later birth cohorts have been aggregated, for conditions which are rare in young people but more common in older people, for example using 5-yearly birth cohorts up to 1974 but then considering all cases occurring in people born since 1975 together.

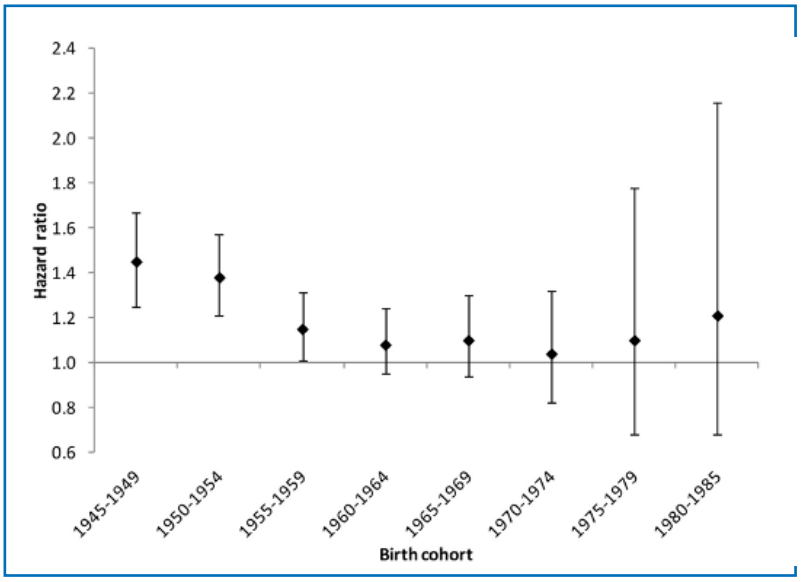


Figure 4-4 - Example of a Birth Cohort Graph

In the example above, the increase in risk is highest in the oldest veterans. Veterans born between 1945 and 1954 have about a 40% increase in risk. The excess risk then reduces, although there is some evidence that it is increasing again in the later birth cohorts.

4.2.3.3 Confidence Intervals

The vertical lines in the graph above represent confidence intervals. These show the range of results that might be expected if the study was repeated on a different group of veterans. The bigger the number of veterans studied, the narrower the range is going to be, and the greater the degree of confidence that the result is meaningful. In the graph above, fairly large numbers of older veterans are affected so the confidence intervals are quite small, in other words the results are likely to be similar even if the study was repeated. However for veterans born in the years 1975-1979 and 1980-1985, there were not many cases of the condition so the upward trend might have just been a chance finding. If the confidence intervals cross the midline and therefore span a hazard ratio of 1, there might in fact be no difference at all. When this happens, the result is said to be **not statistically significant**. There may be a difference, but equally there may not be. Such non-significant results may provide an indication, but need to be interpreted with caution.

4.2.4 'Big Data', Population Health and Individual Health

The Trends in Scottish Veterans' Health Study is based on 'big data'; an analysis of the long-term health outcomes of over 78,000 veterans born between 1945 and 1995 who were registered with NHS Scotland and compared with the health outcomes of over a quarter of a million people drawn from the non-veteran community. Such large numbers encompass a wide range of characteristics and experiences. The veterans may have served for a only few days, or for over 40 years. They may have never progressed beyond recruit training, or may have been in highly skilled roles such as fast jet pilots. Similarly, the comparison non-veteran population comprised people from all backgrounds, experiences and walks of life. The health outcomes presented in this report therefore represent averages for the veteran and non-veteran populations, in the same way that nationally-published health statistics represent the whole population studied. These data are important in providing information to policy-makers and the planners of health and welfare services, and the long-term trends provide evidence whether health is 'moving in the right direction', or whether areas of risk have been highlighted and new initiatives, interventions or services are needed. For veterans' health, knowing whether veterans are at greater or less risk of particular conditions

than non-veterans can help to highlight the effects of military service on health, or indicate whether specialist services for veterans are needed. What this 'big data' cannot do however is provide information on any individual's personal risk; that would require assessment and advice at an individual level from an appropriate professional. Any analysis of the study data that would provide information at an individual level is specifically forbidden for privacy reasons, as described in the next section. And even if the risk of a particular condition is lower in veterans that in the wider community, 'less risk' does not mean 'no risk', and some people may still develop the condition.

4.2.5 Privacy and confidentiality

The majority of the data used in preparing this report was sourced from the National Health Service (NHS) Scotland and the National Records of Scotland (NRS), and has been subject to strict controls. Its use for the purpose of this study was approved by the Public Benefit and Privacy Panel of NHS Scotland[30]. Everyone who has worked on the data has undergone training in research data security. All the data is anonymous, and it can only be accessed on NHS Scotland secure computer systems. As a further safeguard, small numbers are not permitted to be shown, in case it becomes possible to identify a specific individual, and all results have to be cleared for release by an authorised Information Guardian. Because of these safeguards, the study was compliant with NHS Scotland Ethics standards for anonymised secondary data studies and individual patient consent was not required.

[30] PBPP approval number 1718-0133

5 Cardiovascular Diseases

5.1 Introduction

Cardiovascular diseases are diseases of the heart and blood vessels, often caused by a build-up of fatty deposits in the arteries (atherosclerosis). This can give rise to coronary heart disease (heart attack), stroke or peripheral arterial disease. These conditions are characterised by partial or complete blockage of the artery or arteries supplying part of the body, which can result in the death of the tissues that depend on that artery for their blood supply. A reduction in the blood supply, not amounting to a complete blockage, can cause conditions such as angina, transient ischaemic attacks (TIAs or mini-strokes) or cramp-like leg pain on walking (claudication). If untreated, these can go on to more serious outcomes. If an artery becomes completely blocked, it can lead to conditions such as:

Heart attack (blocked coronary artery in the heart)
Stroke (blocked artery to brain)
Limb loss (caused by a blocked artery in leg)

One of the biggest risk factors for cardiovascular disease is smoking. Other risk factors include obesity, lack of exercise, high blood pressure, diabetes, raised cholesterol and an unhealthy diet. A healthy lifestyle, especially avoiding exposure to tobacco smoke, and maintaining a healthy weight are the best protection against cardiovascular disease.

5.2 How Common is Cardiovascular Disease?

Around 685,000 people in Scotland live with cardiovascular disease[31] - about 13% of the population, although the Scottish Health Survey report puts this figure higher at 16%. It is predominantly a condition of older people, affecting only about 7% of people aged 25-44 but rising to 46% of people over age 75. In 2018, coronary heart disease was responsible for 6,615 deaths in Scotland, although the mortality for coronary heart disease has decreased by 37% since 2008[32]. Stroke is also a major cause of disability, as is peripheral arterial disease which, if untreated, can result in gangrene and loss of a limb (usually the leg).

5.3 Are Veterans at Risk?

During their service, veterans will generally have maintained a healthy lifestyle with the requirement to maintain operational effectiveness and, since 1978, pass regular fitness tests. Unfortunately we have no data on the lifestyle[33] of veterans in Scotland (or anywhere in the UK) as no large-scale surveys have been carried out, but it is likely that not all veterans manage to maintain a healthy lifestyle after leaving the Armed Forces. Important research in the 1960s and 1970s on smoking habits of young soldiers[34,35], showed that they were smoking about 20% more than civilians of the same age, and putting together figures for military and civilian smoking from different sources shows that this pattern has changed little over many years.

[31] British Heart Foundation data 2017/18
[32] Scottish Health Survey 2018 (rev. 2020)
[33] eg Smoking, diet, exercise, weight
[34] Richards HJ, Crowdy JP. Smoking habits of young soldiers. British Journal of Preventive & Social Medicine. 1961 Apr;15(2):84.
[35] Lewthwaite CJ, Graham JT. The smoking habits of young soldiers. Journal of the Royal Army Medical Corps. 1992 Jun 1;138(2):67-71.

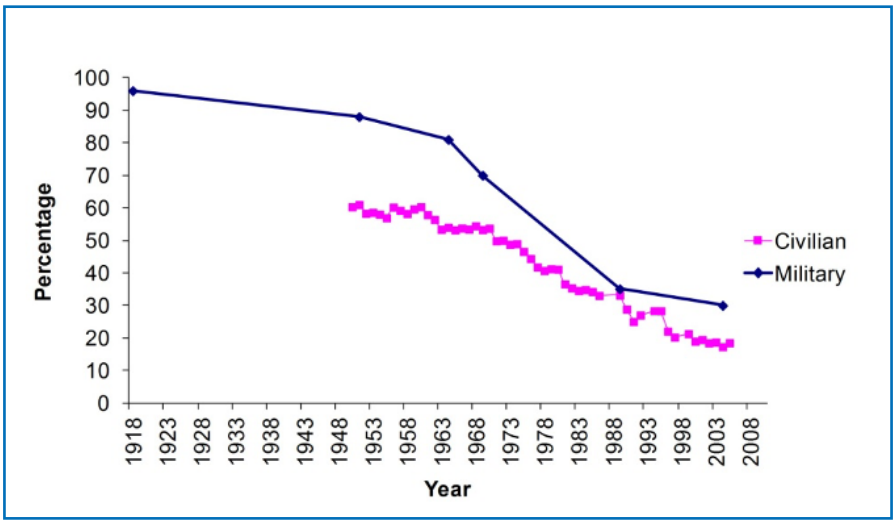


Figure 5-1 - Trends in military and civilian smoking, 1918-2008
(data collated from multiple sources)

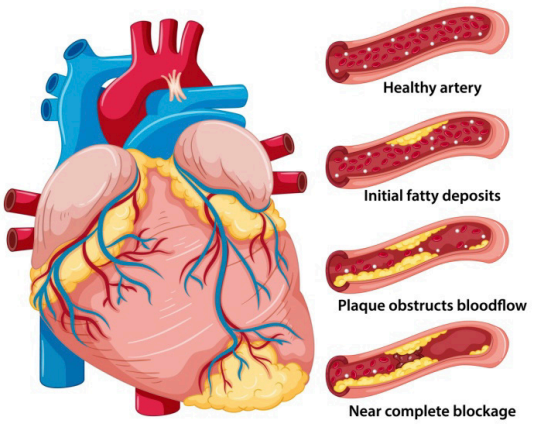
Even those who did not smoke were likely to have been affected by passive smoking in barrack rooms until recently. It was not until 2006 that indoor smoking on military premises was banned.

Was a healthy lifestyle in-service sufficient to counteract the harmful effects of smoking, and possibly putting on weight in later life? We examined the risk of the three commonest cardiovascular diseases (coronary heart disease, stroke and peripheral arterial disease) in veterans compared with people who had never served to try and find out.

5.4 Coronary Heart Disease

5.4.1 What is Coronary Heart Disease?

The coronary arteries are small but essential arteries that surround the heart, supplying the heart muscle itself with blood carrying oxygen and essential nutrients[36]. The fatty plaques of atherosclerosis that can develop in these arteries not only cause them to become narrowed, but also make them stiffer and less able to supply extra blood during exertion. This gives rise to angina, a cramp-like pain in the chest during exercise, which generally eases with rest. Angina can be treated with drugs or with a surgical procedure. There is a risk of angina progressing to a complete blockage of the artery. If that happens, the part of the heart muscle supplied by that artery will die as it has lost its circulation. This is a heart attack – the medical term is myocardial infarction. It is a serious and life-threatening condition requiring urgent treatment.



[36] Image source: https://www.freepik.com/vectors/infographic Open source infographic vector created by brgfx - www.freepik.com

5.4.2 Are Veterans at Risk?

In the first Scottish Veterans Health Study, which ran to 2012, we looked at the risk of a heart attack in veterans compared with people of the same age and sex who had never served, and we found that on average they were 22% more likely than non-veterans to have experienced a heart attack. By the end of 2012 3.8% of the veterans and 3.1% of the non-veterans had suffered a heart attack. Most of the heart attacks were in men; less than 1% of women, both veterans and non-veterans, had been affected as heart attacks are generally less common in women. In the follow-up study which ran to the end of 2017, we found that 4.0% of veterans and 3.3% of non-veterans had been hospitalised with a heart attack, but the increased likelihood in veterans had reduced from 22% to 15%. The overall higher percentage of cases reflects the ageing of the study population by a further 5 years.

5.4.3 Long-term Trend in Heart Attack

We looked at what we would have found if the study had been conducted at earlier points in time. This graph shows how the hazard ratios for the risk of heart attack in veterans compared with non-veterans have changed over time.

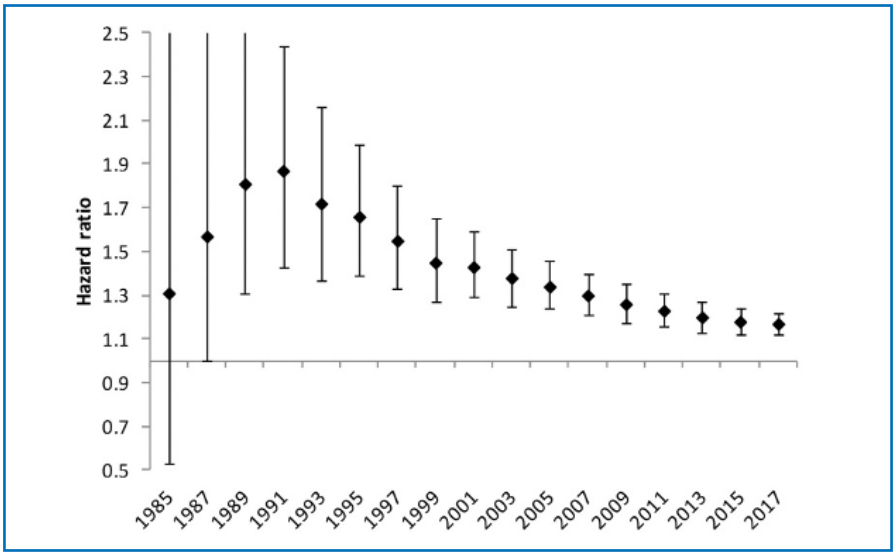


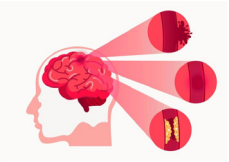
Figure 5-2 - Long-term Trend in Risk of Heart Attack

The increased risk in veterans was low at first, but the oldest veterans and non-veterans were only 40 years of age at the start of the graph. The difference between veterans and non-veterans then increased rapidly to a peak in the early 1990s before starting to fall. Possible reasons for this are examined in Section 5.8.1.

5.5 Stroke

5.5.1 What is a Stroke?

The brain is supplied by a network of blood vessels, and if one becomes blocked, it causes the area of brain supplied by that blood vessel to die[37]. This can result in loss of movement in a part of the body (paralysis), or loss of speech. The result is severe disability, which may be permanent, although urgent specialist treatment can improve the outlook after a stroke. Fatality after a stroke is high. Some types of stroke are also the result of bleeding on the brain, which can be caused by high blood pressure or damage to one of the blood vessels, although this is less common.



[37] Image source: https://www.freepik.com/premium-vector/human-brain-stroke-illustration_5506882.htm#page=1&query=stroke%20brain&position=28

5.5.2 How Common is Stroke?

Stroke is less common than heart attack, with around 0.2% of the population aged 45-64 experiencing a stroke every year in Scotland, rising to 0.5% of those aged 65-74 years and 1.5% of those aged 75 years and over. The average age for people to experience a stroke in Scotland is 71 years for men and 76 years for women, with men being at higher risk than women. The rate has fallen by 10% over the last 10 years.[38]

5.5.3 Are Veterans at Risk of Stroke?

We examined the risk of stroke in veterans aged over 40, since stroke is very rare in young people and if it occurs, it may have different causes from stroke in older people. In 2012 we found that 0.83% of veterans and 0.67% of non-veterans had been hospitalised with a stroke, meaning that the veterans had a 21% increase in risk, similar to the increase in risk of a heart attack. By 2017, 0.94% of veterans and 0.86% of non-veterans had experienced a stroke, and the increased risk in the veterans had fallen to 16%, again mirroring the improvement in risk of a heart attack.

5.5.4 Long-term Trend in Stroke

The excess risk of stroke in veterans is reducing, but more slowly than for heart attack. It is difficult to measure the excess risk accurately before the mid-1990s when the oldest veterans in the study reached 50 years of age, as the number of cases was small in earlier years. In 1997 veterans were 48% more likely to have had a stroke than non-veterans; ten years later this had fallen to a 26% excess, and by 2017 they were only at 17% increased risk.

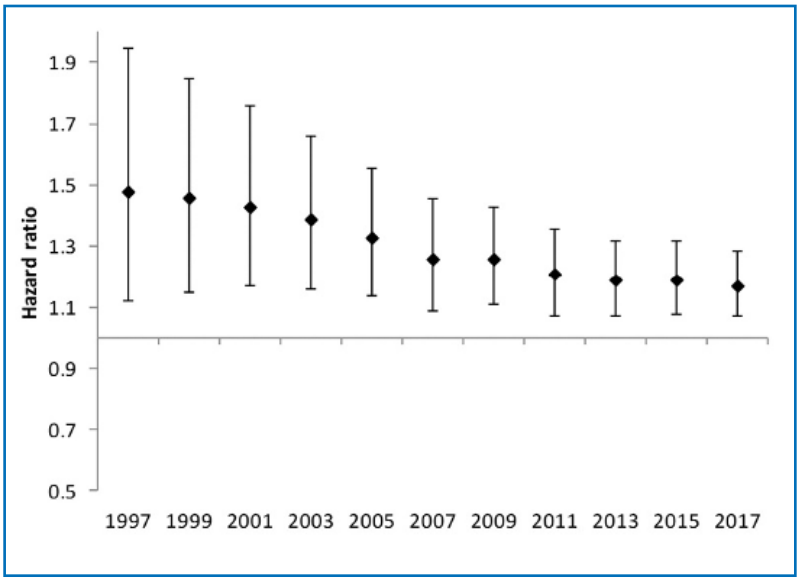


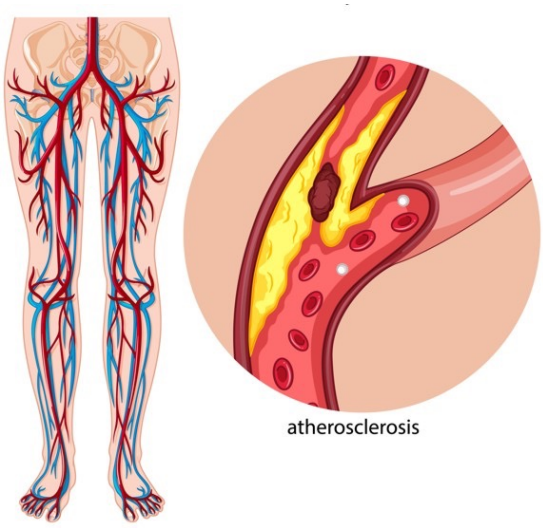
Figure 5-3 - Trend in Long-term Risk of Stroke

The graph shows the gradual reduction in the excess risk of stroke in veterans over the years.

[38] Data from Public Health Scotland 'Scottish Stroke Statistics' https://beta.isdscotland.org/find-publications-and-data/conditions-and-diseases/stroke-statistics/scottish-stroke-statistics/

5.6 Peripheral Arterial Disease

Peripheral arterial disease (PAD) is surprisingly common, with about 7,000 new cases per year in Scotland[39], but it is less well-known than the other main cardiovascular diseases. Fatty deposits[40] build up in the arteries of the legs, restricting the blood supply to the legs, especially during exercise. In mild cases there may be no symptoms. Once the condition becomes more severe, it can give rise to a painful aching sensation in the legs even just with walking, which goes away after a few minutes' rest. This causes a characteristic 'stop-start' gait which has the medical term of intermittent claudication, from a Latin word meaning 'to stop'. If left untreated, it can progress to muscle wasting or ulcers on the skin, and even complete blockage of the arteries. This is a medical emergency as it risks gangrene and can result in amputation. The main risk factors are smoking, high blood pressure and diabetes.



5.6.1 Are Veterans at Risk?

PAD is much more common in veterans than non-veterans. By the end of 2017, 1.3% of veterans had been diagnosed with PAD, compared with 0.9% of non-veterans, a 32% increase in risk. However this was an improvement from the position at the end of 2012, when the increase in risk in veterans was 46%.[41] The reduction in excess risk can be attributed to more new cases having occurred in the non-veterans than the veterans between the two dates. A possible cause for this might be that the veterans developed the disease earlier in life due to heavier smoking, with the non-veterans partially catching up later. Also, the number of cases occurring in younger veterans was reducing, as levels of military smoking fell.

5.6.2 Long-term Trend in Peripheral Arterial Disease

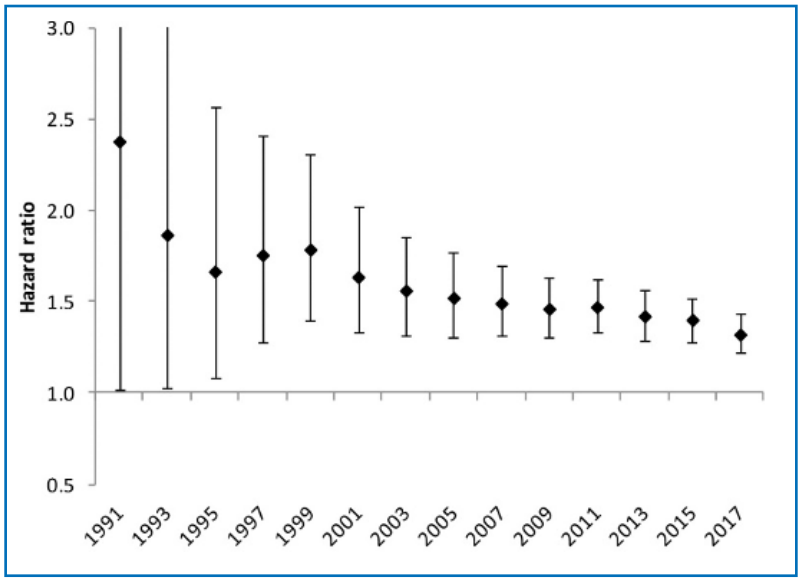


Figure 5-4 - Trend in Long-term Risk of PAD

[39] Scottish Needs Assessment Programme (SNAP) Briefing – Peripheral Arterial Disease. Jan 2000.
[40] Image source: https://www.freepik.com/vectors/cartoon. Created by brgfx - www.freepik.com
[41] Bergman BP, Mackay DF, Pell JP. Peripheral arterial disease in Scottish military veterans: a retrospective cohort study of 57 000 veterans and 173 000 matched non-veterans. Journal of Public Health. 2019 Mar 1;41(1):e9-15

Figure 5-4 illustrates changes in the excess risk of PAD over time. At first there are few cases, and this is reflected in the wide confidence intervals (see Section 4.2.3.3 for an explanation of confidence intervals). As the number of cases increases, so the confidence intervals become narrower and the certainty of the findings improves. As with stroke, the excess risk is reducing slowly but remains significantly higher in veterans than non-veterans.

5.6.3 Amputation

PAD was the commonest cause of lower limb amputation in veterans occurring after the end of service, accounting for two-thirds of all cases and, in the long term, far outweighing the number of amputations due to combat in veterans.[42] However, amputation for this condition was no more common in veterans than non-veterans, despite more cases of PAD, suggesting that veterans with PAD may be more concerned about the restriction on their ability to walk and could be coming forward earlier for limb-saving treatment.

5.7 Length of Service

If a health condition is made worse by military service, we would expect the difference between veterans and non-veterans to increase, the longer people had served. Those whose service was short would have a similar risk to the wider community, whilst those who had been 'exposed' for longest would show the greatest difference. For all three cardiovascular diseases, we found the opposite. The greatest difference in risk was among the Early Service leavers, who did not complete their minimum term of engagement, whilst those with the longest service showed a reduction in risk.

Table 5-1 - Comparative risk of cardiovascular disease by length of service

	All veterans	Early Service Leavers	Non-Early Service Leavers	Long service (over 12 or 16 years)
Heart attack	15% higher	34% higher	7% higher	4% lower
Stroke	16% higher	47% higher	4% higher	23% lower
PAD	29% higher	54% higher	19% higher	4% lower

The table indicates that longer military service protects against cardiovascular disease. Those with the shortest service (Early Service Leavers) do not have sufficient time in service to benefit from military health promotion; furthermore their long-term health may be influenced by their socio-economic circumstances both before and after service, as they are more likely to live in areas of high deprivation. The finding that long-term health is better in those with longer service is an example of the 'healthy worker effect' or, as it has been termed in relation to veterans, the 'healthy warrior effect', whereby people who remain in employment for longer generally enjoy better health outcomes. By contrast, those who leave early exhibit a 'less healthy leaver' effect.[43]

Longer service protects against cardiovascular disease

[42] Bergman BP, Mackay DF, Pell JP. Postservice lower limb amputation in Scottish military veterans. BMJ Mil Health. 2022 Feb 1;168(1):25-28.
[43] Bergman BP, Macdonald EB, Mackay DF, Pell JP. Healthy workers or less healthy leavers? Mortality in military veterans. Occupational Medicine. 2019 Dec 31;69(8-9):570-6

5.8 Putting it all Together

5.8.1 Long-term Trend in All Three Cardiovascular Diseases

We looked at what we would have found if the study had been conducted at earlier points in time. Here we see the hazard ratios showing how the risk in veterans compares with non-veterans over time.

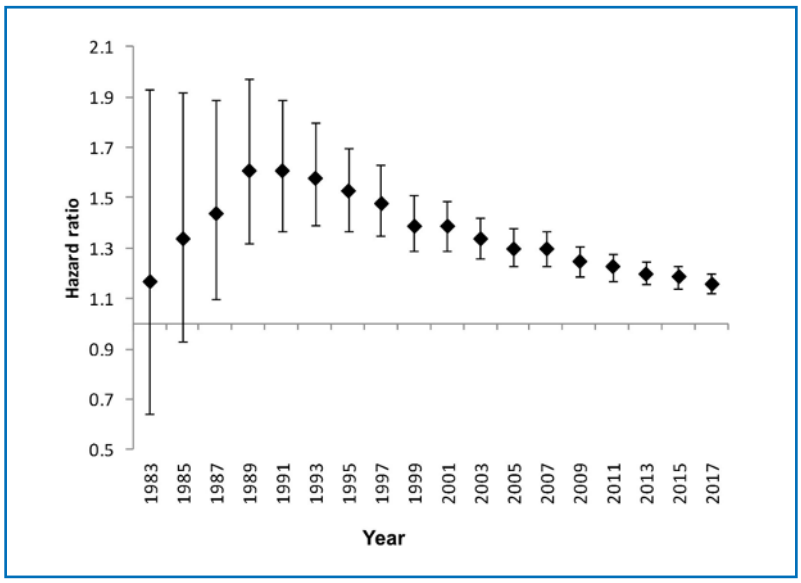


Figure 5-5 - Long-term Trend in Cardiovascular Disease

The graph shows that at first there was very little difference between veterans and non-veterans, but in 1983 the oldest were only 38 years of age so cardiovascular disease was rare. This is reflected in the long confidence interval bars[44] which show a lot of uncertainty. Over the next few years, up to the early 1990s, the risk in veterans compared with people who had never served increased rapidly up to a peak of 80% increased risk. This coincided with a worrying increase in the number of serving personnel who were developing heart attacks, many at early ages[45]. This has never been fully explained although smoking was thought to be a key factor. Gradually, from about 10 years after the introduction of enhanced health promotion, the excess risk in veterans began to fall steadily, although it still remains higher than in non-veterans. Over time, the confidence interval bars have become shorter with the increase in the number of cases on which the analysis is based, showing that the results are likely to be reliable and reflect a genuine trend. If the present trend continues, the excess risk is likely to continue to fall slowly (the trend appears to be levelling off), but the rate is likely to remain higher unless in-service smoking falls to mirror the rate of smoking in the wider community.

The excess risk is reducing over time

[44] See Section 4.2.3.3 for an explanation of confidence intervals.
[45] Lynch P. Coronary risk profile of young soldiers with coronary heart disease. Journal of the Royal Army Medical Corps. 1985 Feb 1;131(1):38-41.

5.8.2 Change Over Generations

We looked at whether the pattern of cardiovascular disease was changing over the generations and we found that the oldest veterans had the greatest increase in risk, even when compared against non-veterans of the same age. However for people born from 1960 onwards, there was no difference in risk between veterans and non-veterans.

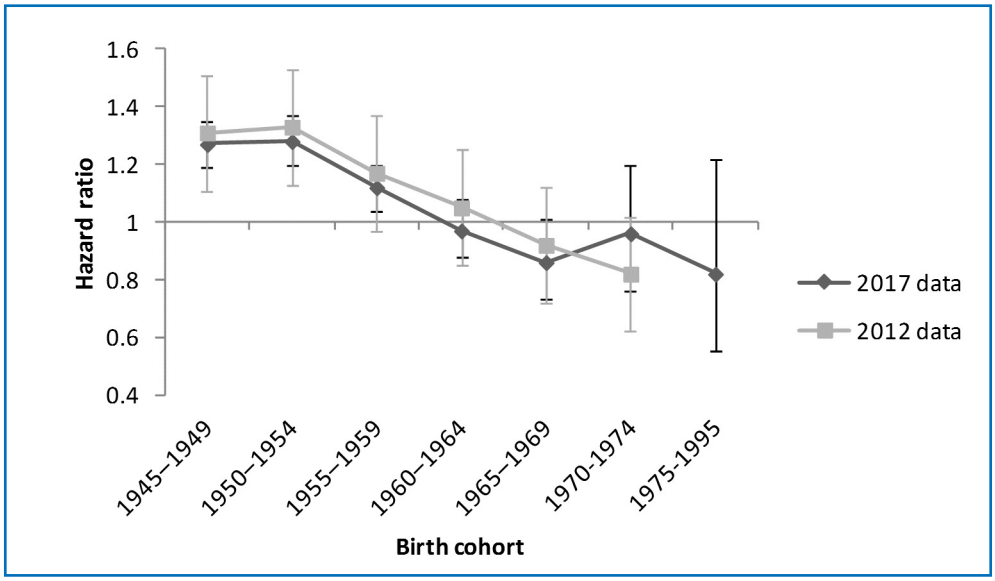


Figure 5-6 - Birth Cohort Graphs, Cardiovascular Disease 2012 and 2017

By 2017, this had not changed – it was still the people born before 1960 who had the highest risk compared with the non-veterans. If it was simply due to their age, it should have been the people born before 1965 who were at higher risk in 2017, 5 years after the first study. Because the 'neutral point' of 1960 did not change, we can be confident that there was a real change at this point. What happened that made a difference?

5.8.3 Military Health Promotion

People born from 1960 would have generally joined the Armed Forces from 1978 onwards. From 1976, the UK Government began to publish reports on improving the health of the population[46], and the Armed Forces quickly followed with a series of measures to improve military health and fitness, including the 'Fit to Fight' programme which introduced the Basic Fitness Test (BFT) for the Army. Other tests of fitness followed, and health promotion and smoking cessation were introduced into mandatory military training.

Although military smoking has remained at a higher level than in the wider population, the reduction that took place in the 1980s is demonstrated in Figure 5-1, and the beneficial impact on the long-term cardiovascular health of veterans, over 40 years after the introduction of the Fit to Fight initiative and related health promotion, can now be clearly seen.

In-service health promotion has been beneficial

[46] 'Prevention and Health: Everybody's Business' (Department of Health and Social Security 1976)

5.9 Key Messages

5.9.1 For Veterans

- Veterans are more likely than non-veterans to develop cardiovascular disease, and possibly at an earlier age
- The biggest risk factor is smoking. Obesity, lack of exercise and poor diet are also important
- The excess risk is reducing over time
- More recent generations of veterans have benefited from enhanced military health promotion and fitness training
- The risk is highest in people whose service was shortest, who had the least time to benefit from in-service health promotion
- It is never too late to stop smoking; even older people can reduce their risk of cardiovascular disease[47]

5.9.2 For Policy and Service Provision

- Provide targeted health promotion to all service users identified as veterans, at every appropriate opportunity
- Provide smoking cessation services targeted to veterans
- Recognise the positive social milieu associated with in-service smoking such as 'smoke breaks' and bonding which encouraged veterans to be smokers
- Do not assume that all military smoking is due to 'stress'[48]
- Address the higher rates of smoking in people with mental ill-health which worsens their cardiovascular risk[49]

[47] Mons U, Müezzinler A, Gellert C, Schöttker B, Abnet CC, Bobak M, de Groot L, Freedman ND, Jansen E, Kee F, Kromhout D. Impact of smoking and smoking cessation on cardiovascular events and mortality among older adults: meta-analysis of individual participant data from prospective cohort studies of the CHANCES consortium. BMJ 2015 Apr 20;350.
[48] Gerald E. Larson, Stephanie Booth-Kewley & Margaret A. K. Ryan (2007) Tobacco Smoking as an Index of Military Personnel Quality, Military Psychology, 19:4, 273-287, DOI: 10.1080/08995600701548205
[49] Campion J, Checinski K, Nurse J, McNeill A. Smoking by people with mental illness and benefits of smoke-free mental health services. Advances in Psychiatric Treatment. 2008 May;14(3):217-28.

6 Cancer

Although often referred to under one heading, cancer is not a single disease. There are many different types, with widely differing causes. Where the cause is known, prevention may be possible, whilst for other types, the cause remains unknown in the present state of scientific knowledge. Some cancers can be detected early with simple screening tests, at a stage when treatment is more likely to be successful, whilst others may be relatively 'silent' and only cause symptoms once the disease is far advanced.

6.1 Why Study Cancer?

Studying the number of cases of specific cancers in the community, and how these change over time, can provide valuable information on causes, effectiveness of treatment and opportunities for prevention. For example, in a groundbreaking research paper published in 1950, it was reported that the number of deaths from lung cancer had increased fifteen-fold between 1922 and 1947, with the increase in men four times that for women.[50] A similar increase had been recorded throughout the Western world. Various theories were put forward as to why this should be, including atmospheric pollution, but tobacco smoking seemed the most likely when it was realised that there were many more smokers among the lung cancer patients than in a comparison group of people without lung cancer. Furthermore, the higher the number of cigarettes smoked, the greater the risk of lung cancer. The increase in number of cases from the 1920s onwards closely matched the rise in cigarette smoking during and after the First World War, and the gender balance; at that time, men were more likely than women to be smokers. Although at first the tobacco industry was reluctant to accept this compelling research, a number of controls and other initiatives to help people stop smoking were introduced by the Government from the 1960s onwards. Later studies showed that stopping smoking, even well into middle age, avoids most of the risk of dying of lung cancer[51], as well as helping to protect against many other smoking-related diseases.

Some cancers are also associated with specific occupations, and this has particular importance for veterans as military service can sometimes involve exposure to cancer-causing substances. This was especially so in the past, before the introduction of modern health and safety legislation, so older veterans may face disproportionate risks of these cancers. One example is mesothelioma, a tumour affecting the membrane that surrounds the lungs, which is associated with exposure to asbestos and was a particular risk for shipyard workers and others who came into contact with this substance. Identifying the cancers that have an occupational origin is important in order to protect the long-term health of workers.

Studying the number of cases of cancer in a community is also important in planning the healthcare services that will be needed to treat them, and also support services such as those provided by local authorities and specialist charities.

6.2 Measuring Cancer Cases

The Scottish Cancer Registry was established in 1958 and collects details of each case diagnosed. Reports are published every year,[52] currently by Public Health Scotland, and have the status of National Statistics.[53] The confidential patient data are processed in accordance with EU General Data Protection Regulations and Data Protection Act 2018 legislation, and form the basis of the NHS Scotland Scottish Morbidity Record (SMR) 06 dataset, which was linked to the dataset used for the present study on veterans' health.

[50] Doll R, Hill AB. Smoking and carcinoma of the lung. British Medical Journal. 1950 Sep 30;2(4682):739.
[51] Peto R, Darby S, Deo H, Silcocks P, Whitley E, Doll R. Smoking, smoking cessation, and lung cancer in the UK since 1950: combination of national statistics with two case-control studies. BMJ. 2000 Aug 5;321(7257):323-9.
[52] eg Cancer Incidence and Prevention in Scotland (to December 2019). Published 11 May 2021
[53] National Statistics. https://osr.statisticsauthority.gov.uk/national-statistics/

6.2.1 Which are the Commonest Cancers?

This table shows the commonest cancers in Scotland, with the number per 1,000 people diagnosed in 2019 in brackets. Note that, for example, 0.33 per 1,000 would equate to one in every 3,000 people in a year. Also for the Overall column (men and women), prostate cancer only affects biological men, but breast cancer affects both women and men, although more rarely in the latter. The number of people living with specific cancers may be different, as there may be more people living with a less common cancer having a high survival rate, than a common cancer which is more often lethal.

Table 6-1 - Commonest Cancers in Scotland, Overall and by Sex

	Men	Women	Overall
1	Prostate (1.63)	Breast (1.67)	Lung (1.03)
2	Lung (1.10)	Lung (0.96)	Breast (0.84)
3	Bowel (0.91)	Bowel (0.66)	Bowel (0.78)
4	Head & neck (0.34)	Uterus (0.29)	Prostate (1.63)
5	Melanoma (0.31)	Melanoma (0.26)	Melanoma (0.29)
6	Kidney (0.27)	Ovary (0.20)	Head & neck (0.24)

6.2.2 Are Veterans at Risk?

The study was restricted to cancer occurring from the age of 20 years, as some childhood cancers occur and anyone affected is likely to have been medically rejected for military service. Although the numbers affected are small, this would have increased the number of cancers in the non-veterans group, and would have introduced an inaccuracy.

The first Scottish veterans study looked at data to the end of 2012, and showed that 6.4% of veterans and 6.7% of non-veterans had been diagnosed with any cancer during the follow-up period. Statistical analysis, which took into account the shorter follow-up of most of the veterans due to their time in service, showed that there was no difference in the risk between veterans and non-veterans.

By the end of 2017, the percentage of veterans with a cancer diagnosis had risen to 7.9%, whilst 8.1% of non-veterans were affected. An overall increase since 2012 is to be expected owing to ageing of the study cohort, as cancer is generally more common in older people. There was now a small overall reduction in risk in the veterans, as can be seen in the following graph; the hazard ratio comparing risk between the veterans and non-veterans showed a decrease of about 5% in both men and women. This is welcome news, and possible reasons are explored in the following sections on individual cancers.

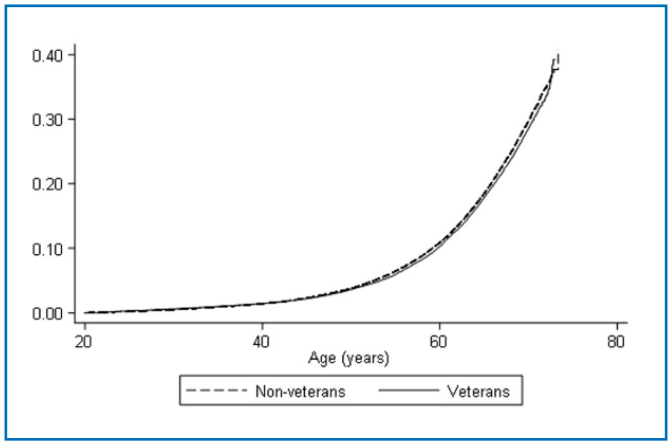


Figure 6-1 - Cumulative Hazard Graph for All Cancer

6.3 Lung Cancer

Lung cancer is the most common form of cancer across the community, being diagnosed in over 5,000 people per year in Scotland. Most cases are related to tobacco smoking, although about 1 in 10 cases occur in non-smokers. Rarer causes include exposure to the radioactive gas radon, which can seep into houses from underlying granite rocks in some areas,[54] and occupational exposures such as asbestos, cadmium or silica.[55] Some cases in non-smokers are in people who have been exposed to second-hand smoke, perhaps living in a household with smokers, or working in a smoky environment such as a pub prior to the 2006 ban on indoor smoking in Scotland. Lung cancer is three times more common in more deprived areas than in areas with less deprivation, reflecting the higher prevalence of smoking in deprived communities and the greater likelihood of working in hazardous manual occupations. The general trend in incidence is downwards, with a 10% fall over the last 10 years. The reduction in incidence in men has been greater than in women, perhaps due to higher rates of smoking in men than women in the past, and increasing rates of smoking in women in more recent times[56].

6.3.1 Lung Cancer in Veterans

For lung cancer, only cases occurring from the age of 40 years have been included, as the occasional cases that are reported in younger age groups are usually part of a different disease. In the first study, 0.8% of veterans and 0.6% of non-veterans had developed lung cancer by the end of 2012. The veterans were at 22% greater risk than non-veterans, although lung cancer was more common in deprived communities, and if this was taken into account, the difference reduced to 16%. The majority of cases were in men; the rates were lower in women with only 0.5% of women veterans and 0.6% of women non-veterans affected.

By the end of 2017, the percentage of people affected had increased, as expected, as a further five years had elapsed and there were now more older people. There were now 1.0% of veterans with a lung cancer diagnosis, compared with 0.8% of non-veterans. However the increase was slightly smaller in the veterans,[57] so that the increased risk in veterans was now only 18%, compared with 22% five years earlier. Unexpectedly, there was now an increased risk in women veterans compared with non-veterans which was statistically significant[58] and which had not been apparent five years earlier.

The risk of lung cancer varied with length of service, and was highest in those with the shortest service. When Early Service Leavers (ESL)[59] were compared against all non-veterans, their increase in risk of lung cancer was 46%, but when non-ESL (people who had served at least 4 years) were compared against the same group, their increase was only 5%, which was not significant. ESL were at 36% greater risk than their longer-serving veteran colleagues, although this reduced to 26% when socio-economic deprivation was taken into account.

[54] The Scottish Government has undertaken extensive work to identify affected houses, and remediation measures are available http://www.radonscotland.co.uk/

[55] Modern health and safety legislation aims to protect workers from these hazards, but many older workers such as those in the mining and ship-building industries were exposed in the past, before the risks were recognised. It can take 30 or more years for some of these occupational cancers to develop.

[56] Data from Cancer Incidence and Prevalence in Scotland (to December 2019). Public Health Scotland 2021.

[57] This is not obvious from the percentages, due to rounding of the figures to one decimal place

[58] Meaning that it was likely to be a true reflection, and had not simply occurred by chance

[59] Taken to be people with less than 3 years' service, to avoid incorrect classification of people who served for the earlier minimum of 3 years rather than the current 4 year engagement

6.3.2 Long-term Trend in Lung Cancer

Lung cancer is mainly a disease of older people. For smokers, number of years smoked, number of cigarettes per day and age at starting to smoke all influence risk.[60] In smokers it often requires around 30 years from initiation of smoking until the risk of lung cancer starts to become apparent. Therefore with the oldest veterans in the study aged only 36 years at the start of data collection in 1981, the number of cases did not start to rise until the mid-1990s when they reached the age of 50. The next graph shows that the hazard ratios for the risk of lung cancer in veterans compared with non-veterans have changed over time. At first there is little difference between veterans and non-veterans. The disease is still rare in both groups as they are still young, and the confidence intervals are wide.[61] By the year 2000 though, with the oldest veterans now aged 55, the hazard ratio for veterans is beginning to increase steadily, and this continues to a peak of 1.24 (a 24% increase in risk) in 2005. Thereafter, there is a slow reduction over the next five years, but after that the graph has levelled off and there has been little change in more recent years.

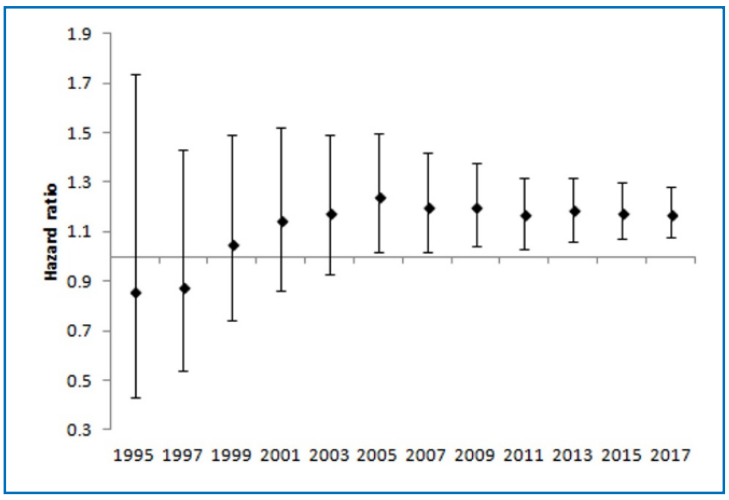
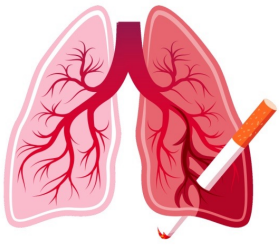


Figure 6-2. Long-term trend in lung cancer

6.3.3 Interpretation

Military smoking rates were known to be high in the 1960s and 1970s[62], and this is reflected in the increasing risk of lung cancer seen in the graph as the oldest veterans move into the higher-risk age bracket. A reduction starts to become apparent from the 2007 data point. Moving back 30 years from then takes us to 1977, and as the Basic Fitness Test was introduced in 1978, with its mandatory health education and requirement to maintain physical fitness which encouraged personnel to stop smoking, it is likely that this was the reason for the start of a reduction. The long delay between starting to smoke and the development of lung cancer, together with the continuing higher prevalence of smoking in the Armed Forces, are likely to underpin the lack of a continued fall in risk. The increase in risk in women veterans compared with non-veterans (Section 6.3.1) suggests that more Servicewomen had taken up smoking. National data from 2011[63] show 25% of women aged 18-24 (equating to the age of military service for most) in Scotland were current smokers, only slightly lower than men of the same age at 28%. Although traditionally women had been less likely to smoke than men in the past, the fall in male smoking prevalence in the second half of the 20th century was not matched in women, and indeed there had been an increase in UK female smoking rates around 1970.[64] This increase in smoking, especially in young women, may in part have been driven by a misguided belief that smoking would help to control body weight and thereby aid dieting.[65]



[60] Ruano-Ravina A, Figueiras A, Montes-Martinez A, Barros-Dios JM. Dose–response relationship between tobacco and lung cancer: new findings. European Journal of Cancer Prevention. 2003 Aug 1;12(4):257-63.
[61] See Section 4.2.3.3 for an explanation of confidence intervals.
[62] Lewthwaite CJ, Graham JT. The smoking habits of young soldiers. Journal of the Royal Army Medical Corps. 1992 Jun 1;138(2):67-71.
[63] Smoking habits in the UK and its constituent countries. Office for National Statistics 2019.
64 Graham H. Smoking prevalence among women in the European community 1950–1990. Social Science & Medicine. 1996 Jul 1;43(2):243-54.
65 Potter BK, Pederson LL, Chan SS, Aubut JA, Koval JJ. Does a relationship exist between body weight, concerns about weight, and smoking among adolescents? An integration of the literature with an emphasis on gender. Nicotine & Tobacco Research. 2004 Jun 1;6(3):397-425.

6.3.4 Recent Trends in Military Smoking

Recent data shows that tri-Service smoking rates are continuing to fall, and are now down to 19% of men and 12% of women, although the rate for Army personnel is higher at 23% of men and 15% of women.[66] These figures remain higher than the UK national rate of 15.9% of men and 12.5% of women[67], hence in view of the long lag period for the development of lung cancer, it is likely that the rate in veterans will remain higher than in the wider community for many years to come. It is essential that efforts to reduce the burden of this life-shortening disease continue and that both serving personnel and veterans are given every encouragement to stop smoking. As there is evidence that some people take up smoking after joining the Armed Forces, perhaps as part of 'bonding' with their new peer group,[68] policies to discourage smoking among recruits would also help to protect future health.

Military smoking remains higher than the national rate

6.4 Prostate Cancer

Cancer of the prostate gland, which sits at the base of the bladder, is the commonest cancer to affect men. It affects sufferers in different ways, which is not yet fully understood. Some people experience a very serious and aggressive form of the disease, whereas in others (especially older men), it can be relatively harmless and does not ultimately affect lifespan. Often there are no symptoms in the early stages; when symptoms do develop, they are often identical to the features of a benign (non-cancerous) enlarged prostate, meaning that it is essential for men experiencing urinary problems to consult a health professional, as prompt treatment produces the best outcomes. Prostate cancer is commoner in people who have a first-degree male relative (eg father or brother) with the disease, and in Afro-Caribbean men. Other risk factors are uncertain; obesity may be a factor, as may tobacco smoking, but a healthy lifestyle with regard to diet and exercise may be protective. A blood test (the PSA or prostate-specific antigen test) has been developed but the results can be difficult to interpret, and its use for routine screening at a population level is not recommended in the UK. As a clinical test though, it forms an important part of the investigation of people with symptoms, and monitoring people at high risk.

6.4.1 Prostate Cancer in Veterans

In other studies there is no clear agreement as to whether military service is associated with change in the risk of prostate cancer. In the first study, by the end of 2012, 0.48% of veterans and 0.51% of non-veterans had a diagnosis of prostate cancer, which equated to an 8% reduction in risk in veterans. By the end of 2017, with the cohort now five years older, the percentage affected has gone up to over 0.9%, but the reduction in risk in veterans is now clearer at 10%. The graph illustrates that this is largely driven by a reduction in risk in the oldest veterans, which is consistent with prostate cancer being predominantly a disease of older men. Overall, there was no difference in the likelihood of veterans undergoing prostate surgery, whether for cancer or for benign prostate disease, in comparison with non-veterans.

[66] Ministry of Defence. Freedom of information response, 2 June 2020. FOI2020/05127
[67] Adult smoking habits in the UK: 2109. Office for National Statistics.
[68] During informal discussion, one veteran recounted: "You accepted one, because you wanted to be part of the group. Then you had to buy a packet of cigarettes, so that you had some to share round."

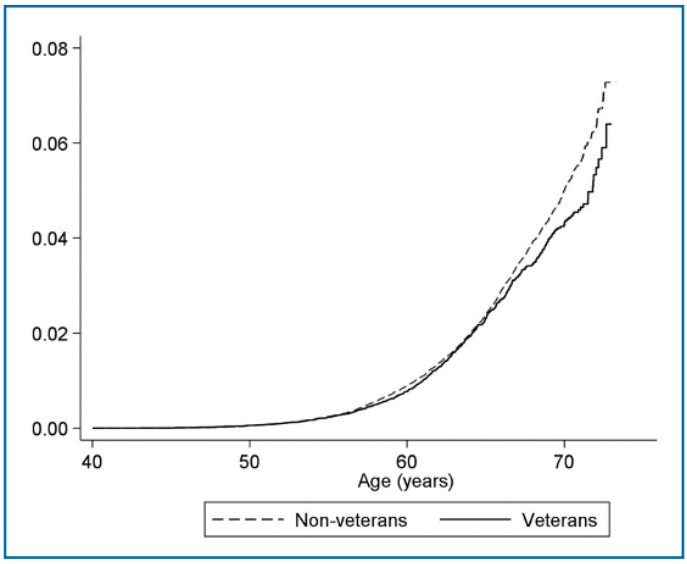


Figure 6-3 - Cumulative hazard graph for prostate cancer

This is confirmed by looking at the risk for different birth cohorts, when the risk of prostate cancer in veterans born between 1945 and 1949 (the oldest veterans studied) is seen to be 15% lower than in non-veteran men of the same age. The reduced risk is also stronger in people with longer service. In Early Service Leavers (ESL), it is only 4%, compared with 15% in people who had served for at least the minimum engagement. This may reflect the effect of lifestyle, since ESL are known from other studies to be more likely to lead a less healthy lifestyle. Overall therefore, the study provides no evidence that military service is a risk factor for prostate cancer; having served may even provide some protection.

6.5 Bowel Cancer

Cancer of the large bowel (colon and rectum) is the third commonest cancer in Scotland, in both men and women. Risk factors for bowel cancer include diet (insufficient fibre or excessive red and processed meat), obesity, lack of exercise, smoking and heavy alcohol intake. The risk is also increased if a family member has had bowel cancer, and in people with chronic inflammatory bowel disease (ulcerative colitis or Crohn's disease), although they will normally be carefully monitored as part of their routine medical care. Irritable bowel syndrome does not increase the risk. Some 3,700 cases of bowel cancer were diagnosed in Scotland in 2017,[69] with the majority in people over the age of 50 although cases do occur in younger people.

Around 60% of people diagnosed with bowel cancer can expect to survive for at least 5 years, and this is one of the conditions where early detection and treatment makes a considerable difference to the outcome. Picked up early, bowel cancer can be curable. As many cases have no obvious symptoms in the early stages, since 2009, all adults aged between 50 and 74 years of age who are registered with NHS Scotland have been invited to take a simple screening test every two years. Around two-thirds of people invited take up the test. The test is also available to serving military personnel in the eligible age bracket. People who test positive are invited to attend for more detailed examination, and about 5% of people who have a positive screening test are diagnosed with cancer, or 0.12% of all those who take the screening test. Importantly, nearly two-thirds of cancers diagnosed by the screening programme were at an early stage, when up to 95% of people would be expected to survive for at least five years.[70] By the end of 2018 it was estimated that the screening programme had detected around 6,000 new cancers, out of 1.6 million people screened. It is estimated that 1 in 16 men and 1 in 20 women in Scotland will develop bowel cancer in their lifetime, underlining the importance of screening to maximise early detection and treatment.

[69] Data from Public Health Scotland https://www.isdscotland.org/Health-Topics/Cancer/Bowel-Screening
[70] Scottish Bowel Screening Programme Statistics. NHS National Services Scotland (2019).

6.5.1 Bowel Cancer in Veterans

The first study showed that to the end of 2012, there was no difference in the risk of bowel cancer between veterans and non-veterans; 0.6% of both groups had received a bowel cancer diagnosis. It was slightly more common in men than women, although the number of cases in women was small so there was uncertainty about the interpretation. There was no significant difference between veterans and non-veterans in any 5-year birth cohort, and being an Early Service Leaver did not affect the risk.

By the end of 2017, the percentage of people who had received a bowel cancer diagnosis had increased as the cohort was now older; 0.71% of veterans and 0.74% of non-veterans were now affected. The overall difference was now statistically significant, with a 10% reduction in risk overall, taking account of the generally shorter length of follow-up of the veterans. There was a clear effect of length of service; Early Service Leavers had the same risk of bowel cancer as non-veterans, whereas people who completed at least the minimum engagement were at 13% reduced risk. The graph demonstrates the reduction in risk in veterans.

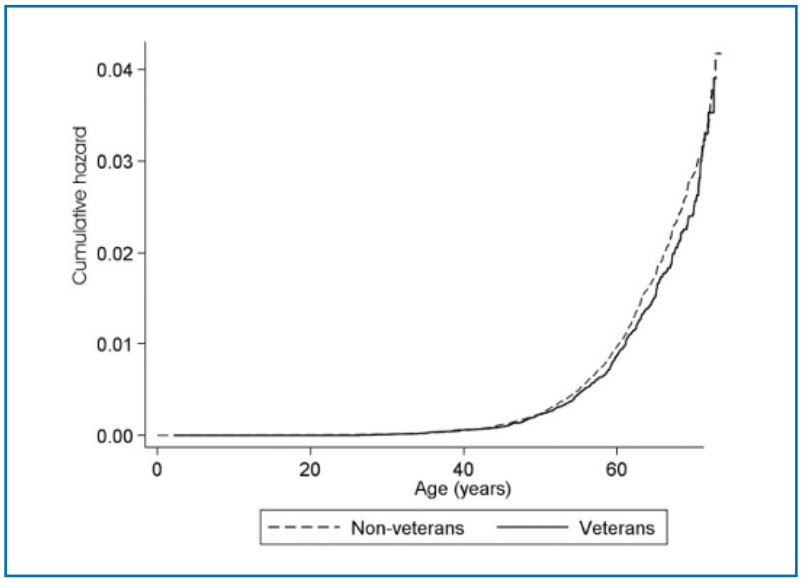
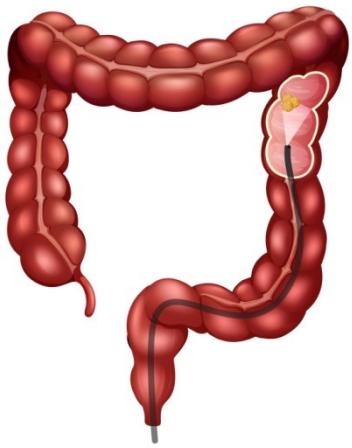


Figure 6-4 - Cumulative hazard graph for bowel cancer

6.5.2 Investigation and Surgery

The follow-up study included data on lower bowel endoscopy (the 'camera test'), and on the number of people who underwent surgery to remove part or all of the lower bowel. Both of these procedures may also be undertaken for reasons other than investigation or treatment of cancer, so they provide a measure of bowel disease overall in veterans, in comparison with the wider population. Overall 6.2% of veterans underwent a lower bowel endoscopy during the follow-up period, compared with 6.4% of non-veterans. Only 4.8% of veterans undergoing endoscopy were found to have bowel cancer, compared with 5.1% of non-veterans. Of those found to have cancer, 35% of veterans and 36% of non-veterans needed major surgery on the bowel, whilst it is likely that the remainder had early-stage disease which could be managed more simply.



As with prostate cancer, the study shows no evidence that military service is a risk factor for bowel cancer, and having served for at least the minimum engagement may provide some protection.

6.6 Testicular Cancer

Cancer of the testicle is relatively uncommon, accounting for only about 1% of cancers in men, but it is militarily important as it is predominantly a disease of young men. It is most common between the ages of 30 and 34, and is rare in elderly men. In Scotland, it was the 16th commonest cancer in 2017, with a total of 197 new cases diagnosed. Importantly, it is highly treatable and almost 99% of people diagnosed with the disease are alive 5 years later . Survival has improved in recent years owing to the development of better chemotherapy. Having an undescended testicle is a risk factor, but no other conclusive risk factors are known . However there have been suggestions that there may be occupational associations, including with military service.

6.6.1 Are Veterans at Risk?

In up to 37 years of follow-up, 0.29% of veterans had experienced testicular cancer, compared with 0.33% of non-veterans. The slight reduction in risk in veterans was not statistically significant. There were no significance differences in risk by length of service.

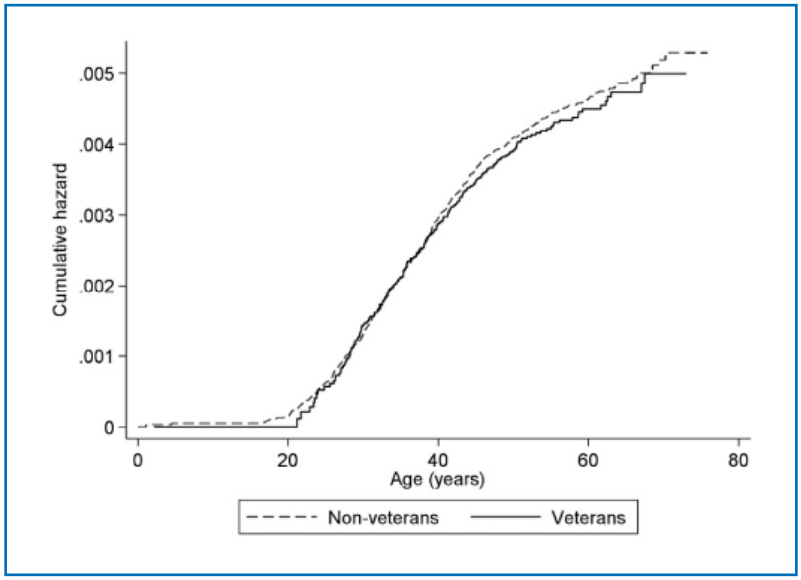


Figure 6-5 - Cumulative hazard graph for testicular cancer

In contrast to many of the other cumulative hazard graphs eg Figure 6-2, where there is a slow rise at first which becomes steeper in older age, the graph above shows a steep rise in the younger age-groups, with the risk flattening off in later life. There is little difference between veterans and non-veterans. It should be noted that some veterans may have been treated for testicular cancer during their service; however as the Scottish Veterans datasets includes cancer registry data, these cases will have been picked up during follow-up by the NHS after they left service. It is therefore possible to be confident that there is no evidence of an increased risk of testicular cancer in veterans resident in Scotland.

6.7 Breast Cancer

Breast cancer is the commonest cancer to affect women, although about 1% of cases affect men. Around 1 in every 8 or 9 women in Scotland will develop breast cancer during their lifetime, accounting for over 4,700 cases in women and 20-30 in men each year.[73] It is rare under the age of 40, and the risk increases with age. There has been a slight increase in incidence in recent years, although mortality has fallen greatly over the last 25 years and up to 9 out of 10 women diagnosed will still be alive five years later. The reasons for this include earlier diagnosis due to the Scottish Breast Screening Programme, and improvements in treatment. There are many risk factors, including obesity, alcohol, physical inactivity, hormone treatment (including risks associated with the oral contraceptive pill and hormone replacement therapy) and exposure to radiation. The risk is increased if a close relative has had breast cancer, and about 2% of cases are due to an inherited faulty gene. People with diabetes are also at slightly increased risk. Unlike most medical conditions which tend to be more common in people living in deprived circumstances, breast cancer is more common in more affluent areas. A greater number of pregnancies reduces the risk, as does being younger at the time of the first pregnancy, and breastfeeding. However a healthy lifestyle provides the best possible protection as around 23% of cases are potentially preventable.[74]

6.7.1 Breast Cancer in Veterans

The 2012 study showed that 2.4% of women veterans had been diagnosed with breast cancer, compared with 2.5% of women non-veterans. Statistical analysis, accounting for the difference in follow-up time, showed that there was no overall difference in risk between the veterans and non-veterans, which was unchanged after taking birth cohort or deprivation into consideration. Only a very small number of male veterans had been affected, with a slightly lower risk than non-veteran men. Length of service was important however. Women who were Early Service Leavers (ESL) had a slightly lower risk than non-veteran women, whereas there was an increase, compared with all non-veteran women, in women who had served for longer, with the highest risk in women who had served for 13-16 years.

By 2017, 2.7% of women veterans and 2.8% of women non-veterans had been diagnosed with breast cancer, the increase reflecting the passage of a further five years and ageing of the cohort. Overall, there was no significant difference in risk between veterans and non-veterans, but the effect of length of service was more obvious. Among ESL, there was a 24% reduction in risk compared with all non-veterans, whilst for women who had completed at least the minimum length of engagement, there was a 19% increase in risk although as the number of cases was fairly small, the figure did not quite reach statistical significance. The graph shows the gradient in risk with length of service.

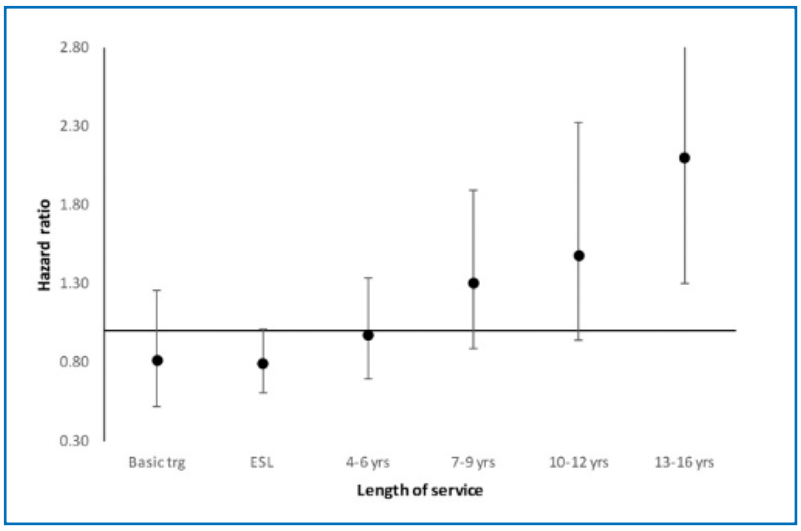


Figure 6-6 - Hazard ratios for breast cancer in women veterans by length of service, compared with all non-veteran women

[73] ScotPHO https://www.scotpho.org.uk/health-wellbeing-and-disease/cancer-breast/data/scottish
[74] Cancer Research UK https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/breast-cancer#heading-Four

6.7.2 Interpretation

For many conditions, the highest risk is found in people who leave service early, the risk decreasing with increasing length of service. The opposite is true of breast cancer in women veterans. It is likely that a number of factors are involved. As noted at Section 6.7, the risk of breast cancer is reduced by early pregnancy, and is increased by delaying the first pregnancy until a later age. Never having been pregnant is also a risk factor. It is likely that many women who left as Early Service Leavers did so because they were pregnant. By contrast, women with longer service are likely to have delayed pregnancy, or to have remained childless, especially prior to 1991 when becoming pregnant automatically resulted in discharge from service. Analysis of the data by a combination of length of service and birth cohort would demonstrate whether the excess risk is now reducing in longer-serving women who, since 1991, have been able to continue to serve on during and after pregnancy, thereby removing the need to delay pregnancy until they were ready to give up their military career. However the number of cases in longer-serving women is too small for this analysis to give meaningful results. Another factor may be socio-economic status; there is a well-recognised association between risk of breast cancer and higher socio-economic status, as described at Section 6.7 and, as shown in Section 4.1.7, longer-serving veterans are more likely to be living in the less deprived areas.

6.8 Mesothelioma

Mesothelioma is a relatively rare cancer but it is important because most cases are linked to occupational factors. The majority of cases are caused by exposure to asbestos, either at work, due to living in close proximity to a source of airborne asbestos, or even by sharing a household with an asbestos worker.[75] In the past it was widely used for its insulating and fire-resistant properties, especially in industries such as ship-building. It was also used in buildings, not only for insulation around pipes and boilers but also in the form of asbestos cement for roofs. Military personnel may therefore have been exposed to asbestos in the course of their duties, especially if they worked in ships, with armoured vehicles where it was used for fireproofing, or in buildings where existing asbestos became damaged. They may also have been exposed in a pre- or post-service occupation, especially in construction, demolition work, or ship-building.

Asbestos is a naturally-occurring fibrous mineral which was formerly mined in many parts of the world. Some veterans will have visited the now disused open-cast asbestos mine at Amiantos in the Troodos Mountains, Cyprus, which surprisingly is a popular tourist site. The risks of asbestos began to be recognised in the 1960s, but it continued to be widely used and worldwide production peaked in 1977 when nearly 5 million tons were mined. Its use was not banned in the UK until 1985, although white asbestos (a mineral called chrysotile), which is less hazardous than blue (amphibolite) asbestos, was permitted in the construction industry until 1999. Breathing asbestos dust can result in a number of lung diseases. The least damaging is pleural plaques, areas of thickening of the membrane surrounding the lungs. It is not a cancerous condition, and many people have no symptoms, but it can be a source of considerable anxiety. More serious is the condition known as asbestosis, where inhalation of asbestos fibres has caused the lung tissue itself to become scarred, causing shortness of breath and a cough. Asbestos exposure also increases the risk of lung cancer, especially in smokers.

The most serious consequence of asbestos exposure is mesothelioma, a cancer affecting the pleural membrane that surrounds the lungs and lines the chest, and occasionally other membranes. It is a very serious condition for which there is no effective treatment; average survival from diagnosis is less than a year, although about 10% of people will live for at least 5 years. As noted above, it is relatively uncommon; in Scotland there are about 200 cases per year, peaking in 2009 when there were 240 cases. The majority of cases are in men, as women were traditionally less likely to work in areas where there was a risk of exposure, although they could still be exposed, for example by handling clothes of a family member who worked with asbestos. In Scotland, the highest rates occur in the west of the country, in consequence of the

[75] Bourdès V, Boffetta P, Pisani P. Environmental exposure to asbestos and risk of pleural mesothelioma: review and meta-analysis. European Journal of Epidemiology. 2000 May;16(5):411-7.

location of the former industries such as ship-building where asbestos was used. On average it takes 20-50 years from exposure before mesothelioma develops; therefore despite the controls that were introduced in the late 20th century, cases continue to occur, and will do so for many years to come. The peak age for mesothelioma is between 60 and 80 years old; with a maximum age of 73 years, the study cohort is still towards the lower end of the age spectrum for this condition, which may have led to fewer cases than might be expected.

6.8.1 Mesothelioma in Veterans

There are no formal records of mesothelioma in UK military personnel.[76] In the 2012 Scottish Veterans Health Study, only 14 cases were identified in veterans, compared with 76 in the larger non-veteran comparison group, representing 0.02% of veterans and 0.04% of the non-veterans. By 2017, as the cohort aged, the percentage in veterans had increased to 0.038% and the non-veterans to 0.044%. Statistically, veterans were at 29% reduced risk in 2017 compared with non-veterans, although the numbers were too small for the result to be statistically significant. Diagnosis of mesothelioma was generally at the same age in veterans and non-veterans, with a median age of 60 in veterans and 59 in non-veterans, with most cases diagnosed between the ages of 53 and 64 years. This represented an increase in age at diagnosis from the 2012 study, reflecting the increasing number of older members of the cohort. Early Service Leavers had the same risk as non-veterans; the lower risk was largely confined to longer-serving veterans.

The increase in risk between the 2012 and 2017 studies is greater in veterans than in non-veterans. However there is a complexity which is revealed by a comparison of the two analyses, as shown in the following graphs.

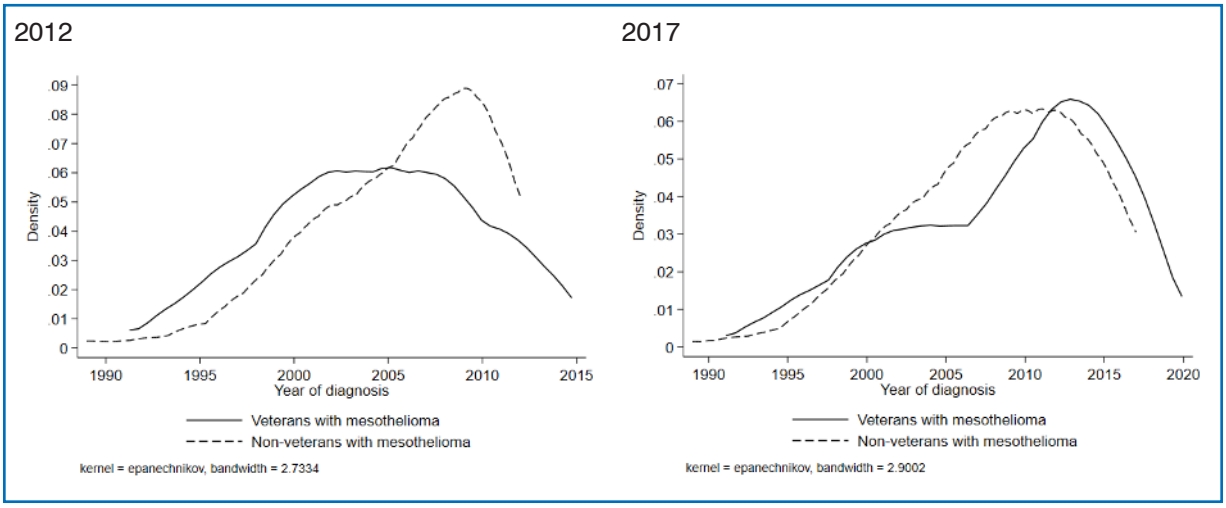


Figure 6-7 - Mesothelioma by year of diagnosis - 2012 and 2017

In the 2012 analysis, there was a peak of diagnoses in non-veterans around 2009, whilst most of the 14 cases in veterans had been diagnosed between about 1997 and 2007. At that time the data showed a 55% reduction in risk of mesothelioma in the veterans, where there had been no such peak. By 2017 however, cases in the veterans had caught up, with a peak of diagnoses around 2014 which clearly would not have been seen five years earlier. Overall, there was now little difference between veterans and non-veterans. The slightly later peak in veterans may have been due to increasing publicity about mesothelioma in veterans, leading to more people with symptoms coming forward or, in view of the small numbers involved overall, it may simply have occurred by chance. Because of the long lag period between exposure and the development of the disease, it is likely that most of the veterans affected in this new peak were exposed in the 1970s and 1980s, when asbestos was still being widely used. The peak in new cases also reflects more members of the study cohort having reached the age at which the majority of cases of mesothelioma occur, from about 65 upwards.

[76] "The Military Experience of Mesothelioma Study (MiMES)", Ejegi-Memeh S, Taylor BH, Tod A, Darlison L. Mesothelioma UK (2020)

6.8.2 Is Military Service a Risk?

Unfortunately the Scottish Veterans cohort contains no information on service (Naval Service (Royal Navy and Royal Marines), Army or Royal Air Force) or trade, so it was not possible to look for any association with military occupational factors. Geographically, the veteran cases were widely distributed around Scotland, with no obvious link to the ship-building areas of the West of Scotland or associations with naval bases. However the similarity of the risk in ESL to the wider population suggests that their exposure may come from pre- or post-service civilian occupational exposure, whilst for longer-serving veterans, it is likely that although some people were exposed through their military occupation, there would have been large numbers of veterans whose service did not bring them into contact with hazardous asbestos, which was sufficient to obscure any risks arising from military service.

The investigation of mesothelioma in Scottish veterans illustrates the problem of using statistical analysis for rare but important conditions. With small numbers of cases, it is often impossible to demonstrate categorically whether the condition is more or less common in veterans. It may be argued though that it is less important to be able to do so in conditions where a clear-cut cause is known, ie exposure to asbestos in this case, and where the individual's occupational history will reveal whether they personally were at risk. What is more important is that people are aware of the risks, that support is available to people who are affected, and that appropriate health services are in place and are resourced to accommodate the current and foreseeable number of cases.

6.9 Malignant Melanoma

Skin cancer comprises a number of different conditions. Some, such as basal cell carcinoma, are easily treatable and usually run a non-aggressive course, whereas others such as malignant melanoma can be more dangerous. It usually presents as a change in a mole, or development of a pigmented lesion on the skin. In Scotland, malignant melanoma accounts for around 4% of all cancers, with equal risk for men and women. The incidence is increasing, from around 500 cases per year 30 years ago to the present level of around 1200-1300 per year. By contrast, around 12,000 people are diagnosed each year with non-melanoma skin cancer. All ages can be affected, although it is rare in childhood, and it is commonest in the 60s and 70s. The predominant risk factor for melanoma is thought to be exposure to ultraviolet light, including sunlight (especially if leading to sunburn) and use of sunbeds. A lack of pigmentation in the skin, characterised by fair skin and fair or red hair, especially when accompanied by widespread freckles, also increases risk. Other factors include family history, exposure to certain chemicals, radiation (including from radiotherapy), and immune suppression either through disease or through treatment such as anti-rejection drugs after transplant surgery.

6.9.1 Is Military Service a Risk?

Military service often involves deployment to sunny climates; in the past, the UK Armed Forces have served in tropical locations such as Singapore, Hong Kong, and Belize, and previously in Middle Eastern countries such as Aden. More recent times have seen deployments to Iraq and Afghanistan. Before the risks of excessive sun exposure were recognised, it was commonplace for male personnel to work in the sun stripped to the waist. More recently, with recognition of the hazards, 'covering up' in the sun has been mandated and sunscreens have been made readily available. It might therefore be expected that the risk of melanoma in older veterans would be higher than in the wider community, reducing with the effect of more recent controls.

6.9.2 Malignant Melanoma in Veterans

The first Scottish Veterans Health Study found that 0.24% of veterans and 0.28% of non-veterans had developed malignant melanoma by the end of follow-up in 2012. By the end of 2017, the corresponding figures were 0.29% of veterans and 0.33% of non-veterans. The cumulative hazard graph shows a complex pattern of risk:

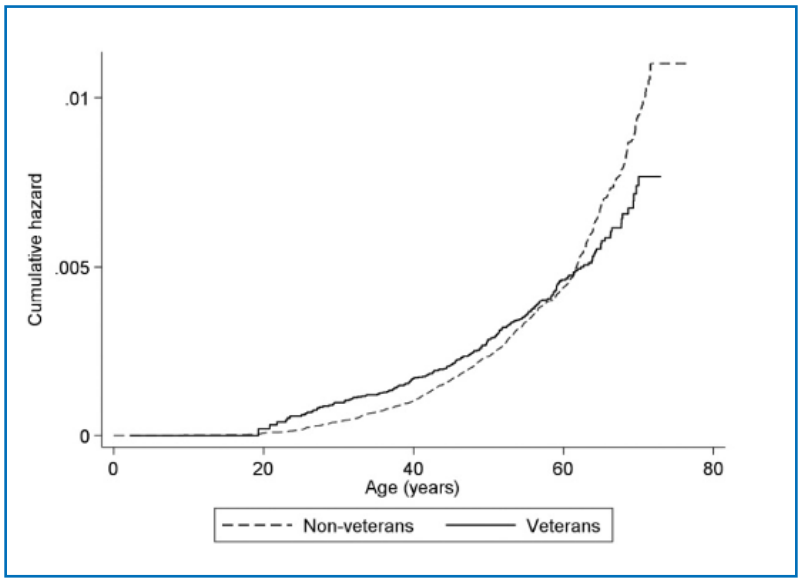


Figure 6-8 - Cumulative hazard graph for malignant melanoma

It can be seen that the lines for veterans and non-veterans cross at around 60 years of age. This is similar to the findings in 2012. Detailed analysis at that time showed that there was no significant difference in risk for younger veterans, whereas the risk of melanoma was reduced for older veterans in comparison with people who had never served.

Examination of the hazard ratios shows that overall, by 2017, veterans were at 15% reduced risk of malignant melanoma. The reduction in risk was only seen in men; women veterans had no difference in risk from non-veteran women. Length of service did not change the pattern of risk, and the reduction was the same for Early Service Leavers as for veterans with over 12 years' service. However the reduction in risk was only significant for veterans born before 1960, and in this group it amounted to 28%. For veterans born from 1960 onwards, there was no significant difference in risk.

6.9.3 Interpretation

This changing pattern of risk for malignant melanoma is difficult to interpret. In view of the known likelihood of sun exposure in many older veterans, the reduced risk of melanoma in this group is unexpected. It is also counter-intuitive that the reduction in risk has disappeared in younger veterans, who have had far better control of their in-service risks. A possible explanation is the apparent negative link between melanoma and smoking.[77] A number of studies have shown a lower risk of melanoma in smokers, and military smoking rates are known to have been much higher in the past,[78] which may be providing some protection to the older veterans. However this should not be interpreted as a reason to smoke; the risk of smoking-related diseases such as lung cancer, coronary heart disease and COPD far outweighs the risk of this relatively uncommon cancer. The loss of the protective effect of smoking, as military smoking rates have reduced, has been compensated by improved protection of military personnel against solar radiation, so their risk is now no different from the wider community.

[77] Dusingize JC, Olsen CM, Pandeya N, Thompson BS, Webb PM, Green AC, Neale RE, Whiteman DC. Smoking and cutaneous melanoma: findings from the QSkin Sun and Health Cohort Study. Cancer Epidemiology and Prevention Biomarkers. 2018 Aug 1;27(8):874-81.
[78] Lewthwaite CJ, Graham JT. The smoking habits of young soldiers. Journal of the Royal Army Medical Corps. 1992 Jun 1;138(2):67-71.

6.10 Blood and Lymphatic Cancers

The blood and lymphatic cancers include the leukaemias, Hodgkin lymphoma and non-Hodgkin lymphoma. Although they are different diseases, with different causes, they will be considered together in this section. In Scotland there are around 600 cases of leukaemia diagnosed per year, representing some 2% of all cancers. There are a number of sub-types of leukaemia, some progressing rapidly whilst others run a more chronic and insidious course. Some predominantly affect children and younger people whilst others are commoner in the older age groups. Treatment for leukaemia has improved in recent years with the introduction of effective chemotherapy and other treatments, and around 55% of patients can expect to be alive five years after diagnosis. The lymphomas can affect all age groups but are commonest in male adolescents and young adults. Hodgkin lymphoma, also known as Hodgkin disease, is much rarer than leukaemia and only affects about 200 people in Scotland per year, or 0.6% of all cancers. Modern treatment is highly effective, with around 84% of patients surviving at least five years. However Non-Hodgkin lymphoma is more common, affecting around 1,000 people per year (3% of all cancers) in Scotland. Five-year survival is around 70%.

6.10.1 Is Military Service a Risk?

The main risk factors for these diseases are age, gender and family history, although smoking may be a risk for Hodgkin lymphoma,[79] which may be relevant to military personnel. Radiation exposure has been linked to leukaemia (other than chronic lymphatic leukaemia), and this is of relevance to veterans of the nuclear test programme in the 1950s and 1960s,[80] to whom War Pensions may be payable if there is evidence of a causal link.[81] An early report from Italy suggested that exposure to depleted uranium might increase the risk of leukaemia, but this has not been confirmed in longer follow-up of other groups,[82] and the consensus is that any extra lifetime risk is too small to be detectable.[83] Non-Hodgkin lymphoma has been linked to exposure to industrial chemicals including solvents and benzene, although a number of studies have failed to confirm a link to military service. As the blood and lymphatic cancers are relatively uncommon in military populations, and uncertainty remains as to whether military service presents a risk, it remains important to monitor the incidence in comparison with the non-veteran population.

6.10.2 All Blood and Lymphatic Cancers

In 2012, the first study showed that 0.52% of veterans and 0.56% of non-veterans had been diagnosed with leukaemia, Hodgkin lymphoma or non-Hodgkin lymphoma; the 4% reduction in risk in veterans was not statistically significant. With ageing of the cohort in the 2017 study, an increase is to be expected and by this later date, 0.59% of veterans and 0.67% of non-veterans had a diagnosis of one of these cancers. All these analyses exclude people under the age of 20 years, in order to avoid the results being affected by childhood leukaemia which would have precluded military service. Overall the veterans were at 8% lower risk, although this was still not statistically significant.

[79] Briggs NC, Hall HI, Brann EA, Moriarty CJ, Levine RS. Cigarette smoking and risk of Hodgkin's disease: a population-based case-control study. American Journal of Epidemiology. 2002 Dec 1;156(11):1011-20.
[80] Very few veterans in the Scottish Veterans study cohorts are believed to have taken part in the nuclear test programme.
[81] Leaflet "Information for British Nuclear Test Veterans". Ministry of Defence. Available from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/912026/NTVleaflet.pdf
[82] Storm HH, Jørgensen HO, Kejs AM, Engholm G. Depleted uranium and cancer in Danish Balkan veterans deployed 1992–2001. European Journal of Cancer. 2006 Sep 1;42(14):2355-8.
[83] Royal Society Working Group on the Health Hazards of Depleted Uranium Munitions. The health effects of depleted uranium munitions: a summary. Journal of Radiological Protection. 2002 May 30;22(2):131.

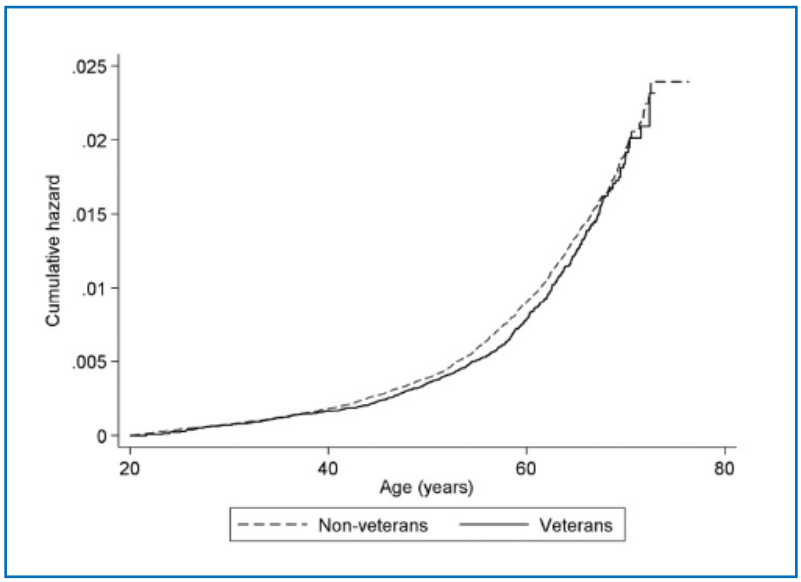


Figure 6-9 - Cumulative hazard graph for any blood cancer

There was no difference for any birth cohort, and the results were similar for both men and women. Length of service did not affect the risk, with Early Service Leavers having a similar risk profile to veterans who had served for over 2 years.

Figure 6-10 - Hazard ratios for blood cancer by birth cohort

6.10.3 Leukaemia

The 2017 data for leukaemia reveal no differences between veterans and non-veterans, mirroring the findings in 2012. Both 0.27% of veterans and non-veterans had a record of leukaemia over the period of follow-up.

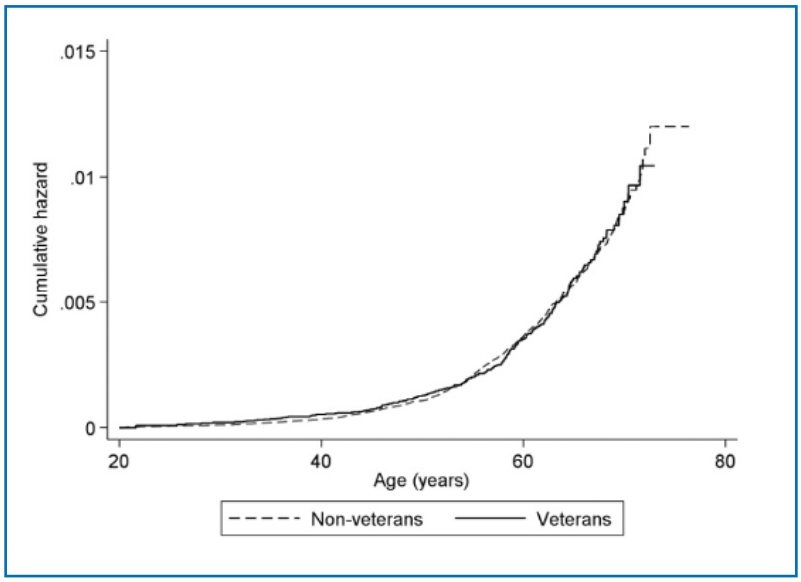


Figure 6-11 - Cumulative hazard graph for leukaemia

6.10.4 Hodgkin lymphoma

Only 70 cases of Hodgkin lymphoma were diagnosed in veterans in up to 37 years of follow-up, representing 0.09% of veterans. It was slightly more common in non-veterans, of whom 0.12% had a record of the diagnosis. The reduction in risk in veterans was 9%, although it was not statistically significant with these small numbers. As before, there were no differences by birth cohort, sex or length of service.

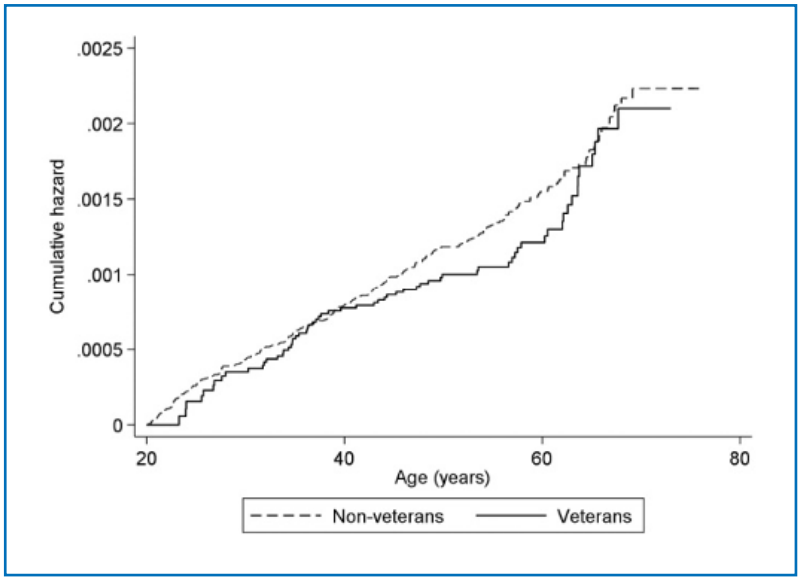


Figure 6-12 - Cumulative hazard graph for Hodgkin lymphoma

6.10.5 Non-Hodgkin Lymphoma

A similar pattern is revealed by the data for non-Hodgkin lymphoma. A total of 0.030% of veterans were affected, compared with 0.035% of non-veterans. The overall non-significant reduction in risk of 11% in veterans, and no differences by birth cohort, sex or length of service, is also consistent with the pattern for the other blood and lymphatic cancers.

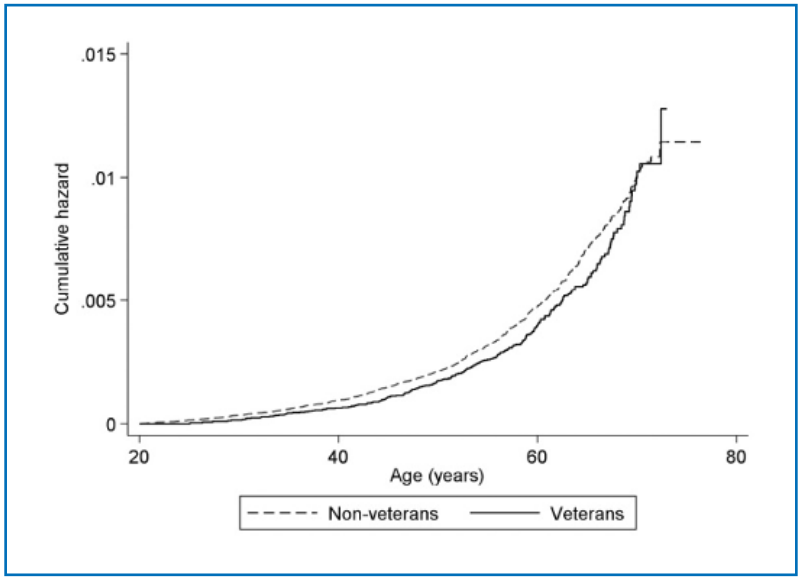


Figure 6-13 - Cumulative hazard graph for non-Hodgkin lymphoma

6.10.6 Blood and Lymphatic Cancer in Veterans

The data from the 2017 study, as with the 2012 data, do not indicate any increased risk of these cancers in veterans compared with the non-veteran population, and there may be a small reduction in risk. As with any epidemiological analysis, it is impossible to provide certainty that specific factors in an individual's service did not contribute to their condition; that is the role of the statutory authorities in, for example, ruling on compensation claims. However it is clear that in long follow-up of this large dataset, there is no evidence of large-scale risk arising from military service, suggesting that relevant controls on hazardous substances are proving effective.

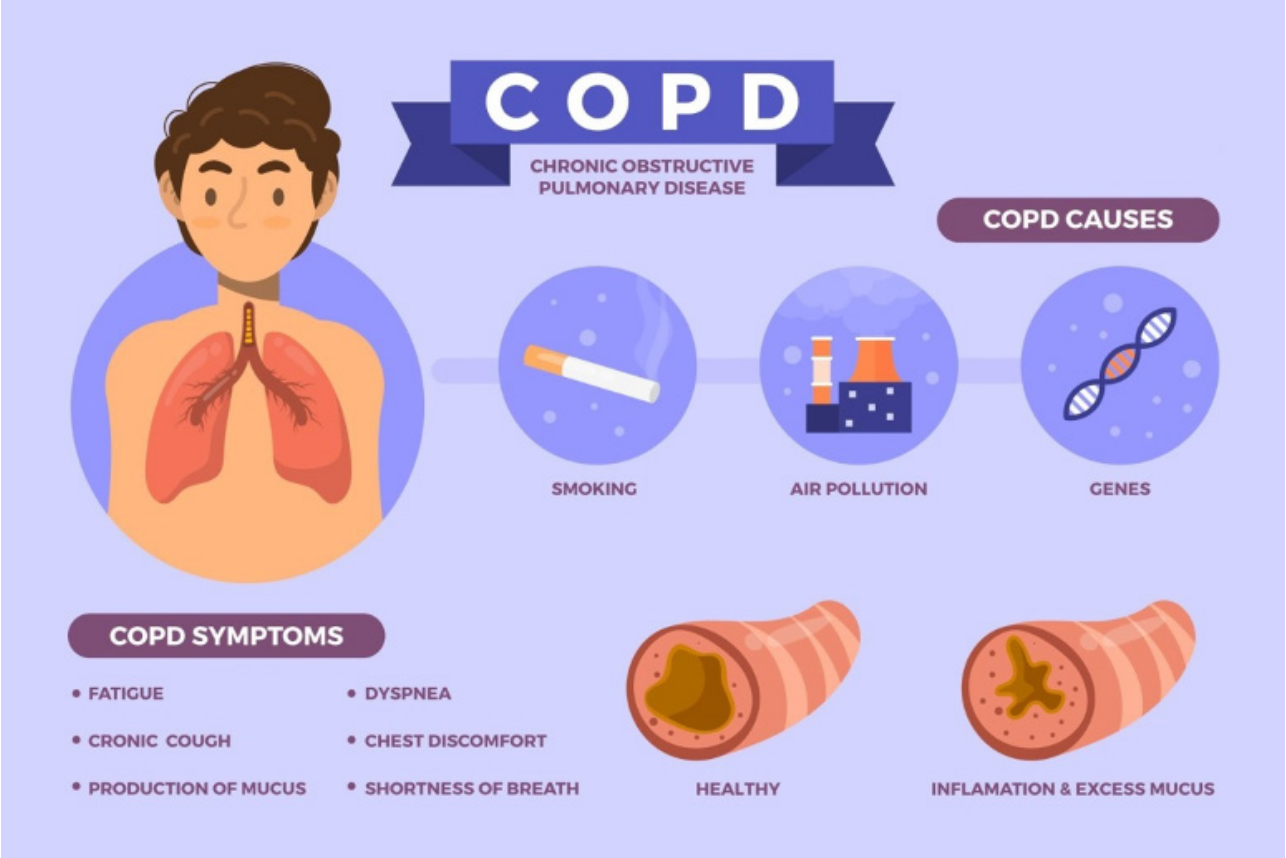
There is no evidence of large-scale risk of blood or lymphatic cancers arising from military service

7 Other Physical Conditions

This chapter will examine a number of other important medical conditions which may affect veterans, looking at whether there is any evidence that military service is a risk factor, and investigating recent trends.

7.1 Chronic Obstructive Pulmonary Disease (COPD)

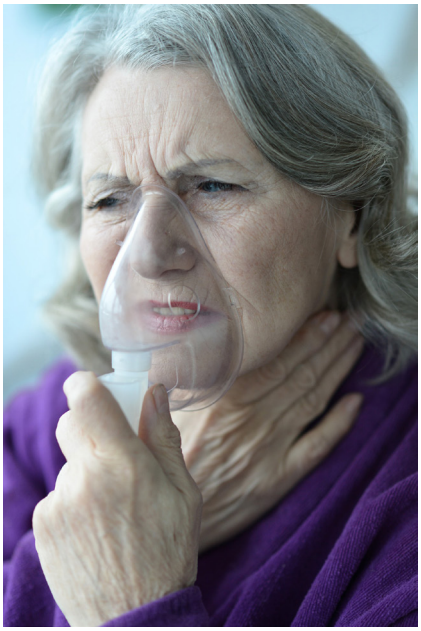
Chronic obstructive pulmonary disease (COPD) is a serious, long-term condition affecting the lungs causing shortness of breath, wheezing and repeated chest infections, due to narrowing and stiffness of the airways. It includes the conditions of chronic bronchitis and emphysema, and some types of asthma. The majority of cases are caused by smoking, and the risk is increased by air pollution and possibly heavy alcohol consumption, as well as deprivation (which itself is associated with increased rates of smoking) and lifestyle factors. Up to 25% of smokers will develop COPD[84], and it is the fourth commonest cause of death in the UK, after coronary heart disease, dementia and lung cancer.[85] Women are at higher risk than men as their lungs are sensitive to lower levels of tobacco smoke.[84]



[84] Scottish Health Survey 2018
[85] Office for National Statistics, 2018 figures

7.1.1 COPD in Scotland

Discovering the true prevalence of COPD in the community is problematic as there is an overlap of symptoms with asthma and other conditions; also, people who are only mildly affected may not seek medical attention. However it has been estimated that there are over 100,000 people in Scotland with COPD, incurring costs to the NHS of £182 million per year. As COPD is a long-term condition predominantly affecting older people, recent falling rates of smoking are not expected to be reflected in reductions in COPD for many years.[84]



In 2018, 4% of adults in Scotland self-reported that they suffered from COPD, ranging from 1% of those under 45 years old to 11% in people aged 65-74, with men and women affected equally. The highest prevalence was in people living in the most deprived areas.[84] The risk rose steadily with number of cigarettes smoked, affecting less than 1% of non-smokers but up to 21% of women who smoked more than 20 cigarettes per day.

7.1.2 Measuring COPD in Veterans

Unlike the Scottish Health Survey, which asked people whether they had ever been diagnosed with COPD by a doctor, the Scottish Veterans studies measured only cases of COPD diagnosed or treated in hospital. The percentages are therefore lower, as the figures represent the more severe end of the spectrum of disease, but are likely to be highly accurate for that level of disease. The studies also only looked at COPD diagnosed over the age of 40, to minimise inadvertently including cases of asthma in younger people. Also, some cases of COPD do occur in young people but they are more often caused by a genetic condition and therefore do not reflect lifestyle-related disease.

7.1.3 Are Veterans at Risk?

The 2012 study found that 3.5% of veterans had a diagnosis of COPD recorded during a hospital admission, compared with 3.2% of non-veterans. The increase in risk in veterans was 9% after allowing for the different length of follow-up. However most of the difference was due to socio-economic circumstances, and after making statistical adjustments for deprivation, the increase was only 5%, which was not significant. Women were about 20% more likely to have COPD than men, for both veterans and non-veterans. The increased risk in veterans was confined to the oldest people, born before 1955, and those with the shortest service, 6 years or less. The highest risk was in the Early Service Leavers. Younger veterans and those with longer service either had no increase in risk or, in the case of those with the longest service, were at reduced risk.

The 2017 data showed that 5.4% of veterans had been admitted to hospital with COPD, compared to 6.1% of non-veterans. After accounting for the different lengths of follow-up, there was a small (4%) increase in risk of COPD in veterans, which disappeared altogether after making adjustments for socio-economic deprivation. However this apparently reassuring picture hides a complexity which is revealed by a more detailed analysis.

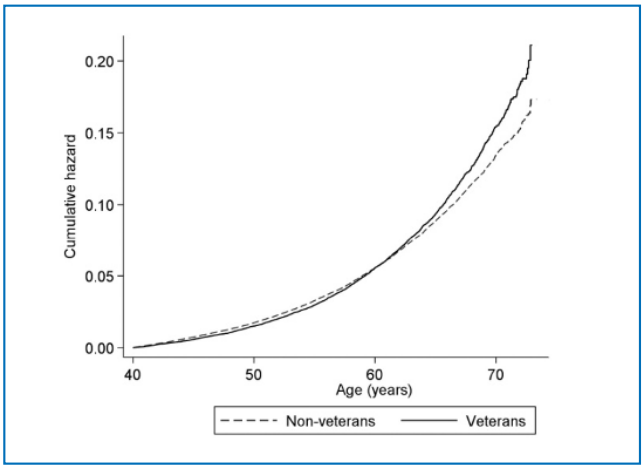


Figure 7-1 - Cumulative hazard graph for COPD

Looking at all veterans together in comparison with all non-veterans, the increased risk in the veterans does not start to appear until after the age of 60. At younger ages the veterans have a slightly reduced risk, which probably reflects the overlap with asthma (which would be a reason for rejection for military service and therefore there will be more young people with asthma in the non-veteran community). This is confirmed by the birth cohort graph, which shows that the risk is only increased for veterans born before 1955 (who would have been 62 and over at the end of 2017) and falls steadily in the younger birth cohorts.

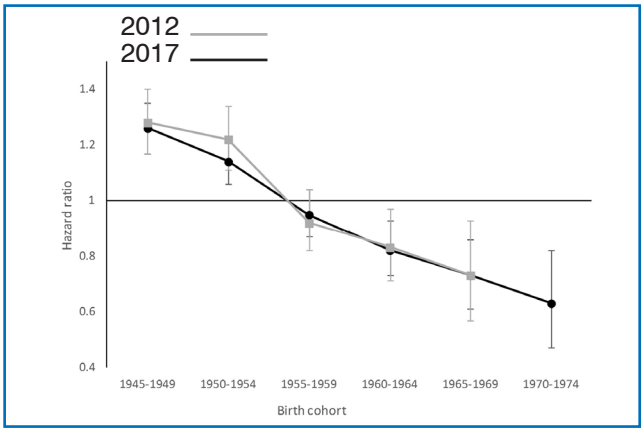


Figure 7-2 - Birth cohort graphs, COPD 2012 and 2017

The 2017 pattern is identical to that seen in 2012, where the increased risk was also seen only in the pre-1955 birth cohorts. If it had been an 'age effect', an increased risk would have been expected to be seen in the 1955-1959 birth cohort in the 2017 graph, but it has not occurred. Therefore it does appear to be a genuine change in risk.

Length of service is an extremely important determinant of the risk of COPD. Although there was little increase in risk when all veterans were compared with all non-veterans, Early Service Leavers were at 48% increased risk compared with all non-veterans, and this was only slightly reduced, to 35%, after taking deprivation into consideration. Excluding the ESL from the veterans showed that they were at 14% reduced risk of COPD compared with non-veterans, and if ESL were compared with all non-ESL veterans, they were at 67% increased risk. This graph very clearly shows the impact of length of service on COPD risk.

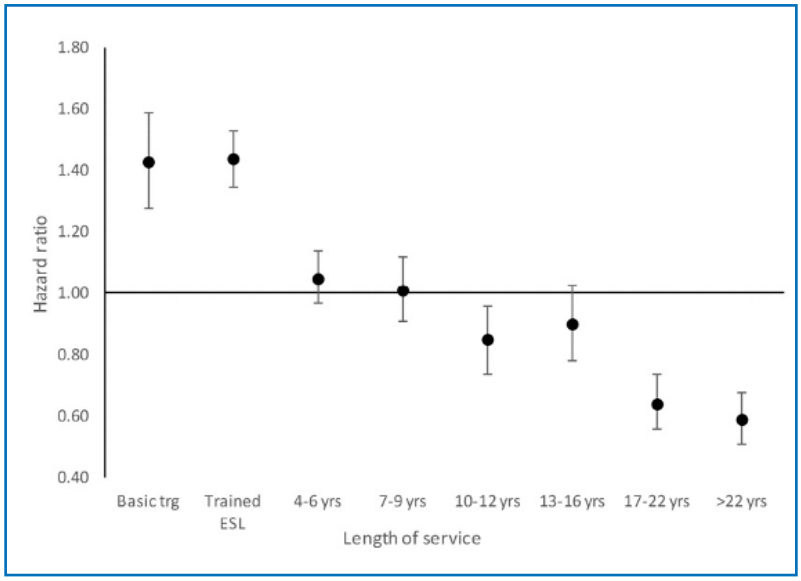


Figure 7-3 - Hazard ratios for COPD by length of service in veterans, compared with all non-veterans

The importance of this finding is that it demonstrates that there is only limited in-service opportunity to influence the risk of this common and disabling condition (for which smoking is the biggest risk factor) in the most vulnerable veterans-to-be, other than by limiting the opportunities for smoking during recruit training when many smoking habits are established. This is discussed more fully in Chapter 6.

7.1.4 Age at Diagnosis of COPD

Although differences in risk of COPD between veterans and non-veterans do not start to emerge until later life, the age at which a first hospital diagnosis of COPD is made is much earlier. For veterans overall, the median age[86] at first record of COPD was 53 years, compared with 45 years for non-veterans. For ESL, it was earlier at 51 years, and for those who completed at least the minimum engagement, it was 55 years.

7.1.5 Long-term Trends in COPD Risk

Examining the long-term increase in risk of COPD is problematic because the differences do not become apparent until the older age-groups, and the oldest members of the study cohort were only 36 years old at the start of data collection. Furthermore, diagnoses were only included over the age of 40, as described at Section 7.1.2.

[86] See Section 4.2.2 for an explanation of median

The following graphs show what would have been found if the study had been done at earlier points in time, to illustrate the long-term trend. Because of the major differences between veterans overall and ESL, they are shown on two separate graphs. Both use the same baseline (the x axis) to indicate the point at which there would be no difference between veterans and non-veterans, although as the hazard ratios for ESL are so much higher, the (empty) area below the x axis is not shown on the lower graph. For the all-veterans graph, there are moderate increases in risk in most years prior to about 2000, although as there were limited numbers of cases, the confidence intervals[87] are wide. After that, the number of cases increases and the confidence intervals become smaller, and there is clear evidence that the small excess risk in veterans overall is reducing, although slowly. This probably reflects the gradual reduction in the percentage of the Armed Forces who smoke.

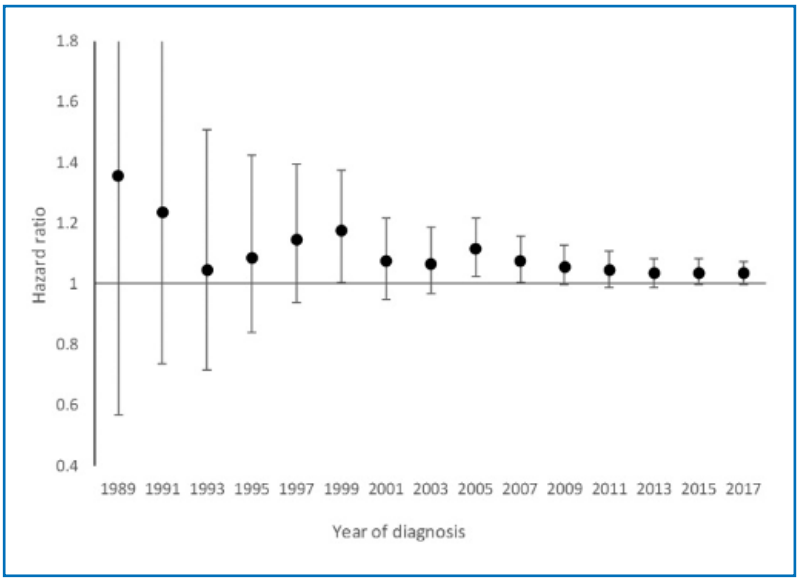


Figure 7-4 - Hazard ratios for COPD in all veterans, by year of first record

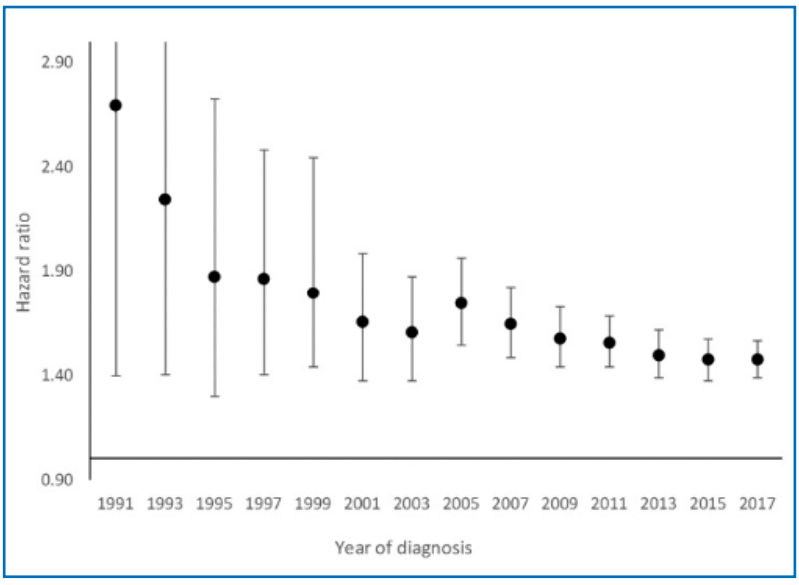


Figure 7-5 - Hazard ratios for COPD by year of first record, ESL only

For ESL, the overall pattern is the same, including the small reduction in excess risk in the new millennium, but all the hazard ratios are much higher. This suggests that ESL veterans are more likely to smoke than non-veterans, and is consistent with the risk of other smoking-related diseases such as lung cancer and heart attacks, which is also higher in ESL.

[87] See Section 4.2.3.3

7.2 Diabetes

Diabetes is a chronic condition in which the body is unable to produce enough of a hormone called insulin, which is made in the pancreas and is required in order to process sugar in the diet. In some people, the body also becomes resistant to the actions of insulin. As a result, too much sugar enters the bloodstream and the blood sugar level becomes too high. If untreated, this causes a wide range of serious complications both in the short- and long-term, and can be life-limiting. Diabetes is treated by drugs to reduce the blood sugar, either insulin by injection, or tablets which in suitable cases can lower the blood sugar, and by diet to reduce weight and limit sugar intake. There are two main types of diabetes, known as type 1 and type 2. About 10% of diabetes in Scotland is type 1 and 88% is type 2; rarer types make up the remainder. Type 1 more commonly begins in childhood or adolescence, causing abrupt onset of serious illness and usually requiring long-term treatment with insulin injections. Type 2 diabetes more often affects people from early middle age onwards. It tends to begin more insidiously and sufferers may not notice anything wrong unless they are tested. People with diabetes are not permitted to join the Armed Forces, since the need for regular monitoring, insulin injections or tablets, and other restrictions, would not be compatible with military activities. If type 1 diabetes develops during service, most people are medically discharged although rarely, it may be possible to be retained in service if employed in a specialised role. This report will focus on the more common type 2 diabetes, as the number of cases of type 1 diabetes associated with service is small. The most important risk factor for developing type 2 diabetes is overweight and obesity, but lack of exercise is also important, as is a diet high in sugar and saturated fats. Lifestyle changes including diet, exercise and maintaining a healthy weight are particularly important in both preventing and controlling diabetes.

7.2.1 Diabetes in Scotland

In 2018, 268,000 people in Scotland were recorded as having type 2 diabetes, representing 2.4% of people aged 40-44 but up to 15.2% of those aged 70-74. It was more common among men, who accounted for 56% of cases. Only 13% of people with a record of type 2 diabetes were of normal or low weight; the majority were either overweight (31.8%) or obese (55.2%).[88]

[88] Scottish Diabetes Survey 2018. NHS Scotland

7.2.2 Are Veterans at Risk?

The first veterans' study in 2012 was only able to detect a diagnosis of diabetes in people who were admitted to hospital (for any reason), when it would have appeared on their computerised in-patient record. Most adults with type 2 diabetes are diagnosed and treated in primary care, except when complications develop, so this is unlikely to be an accurate estimate. Nonetheless, 3.4% of veterans and 3.3% of non-veterans had a record of diabetes, meaning that after accounting for the different length of follow-up, the veterans were at 12% increased risk. If only people over the age of 55 were considered, the increased risk in veterans was 20%, dropping slightly to 17% after adjusting for deprivation. Women veterans were at slightly lower risk. There was a slightly higher risk in Early Service Leavers, but overall, length of service did not have a major impact on the risk of diabetes.

For the 2017 study, it was possible to include data from the Scottish Care Information-Diabetes Collaboration (SCI-DC) database which records all patients with diabetes under the care of NHS Scotland. Cross-checking with hospital data added a small number of newly-diagnosed cases who had not yet been added to SCI-DC. This meant that reasonably accurate and comprehensive data on type 2 diabetes in veterans and non-veterans was available, irrespective of whether people had been admitted to hospital.

Overall, 7.2% of veterans had a record of diabetes in 2017, compared with 6.4% of the matched non-veterans.[89] Veteran men were at 7.6% increased risk of diabetes overall than non-veteran men; for women, where only 3.8% of veterans were diabetic, there was no statistically significant increase in risk. Length of service made little difference, as shown in the graph.

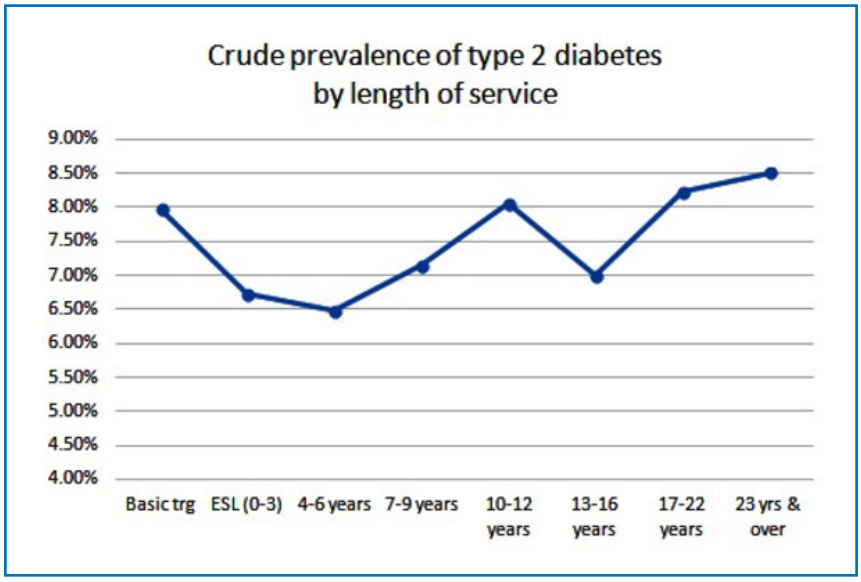


Figure 7-6 - Type 2 diabetes in veterans by length of service

[89] Bergman B, Mackay DF, Pell JP. Type 2 diabetes in Scottish military veterans: a retrospective cohort study. BMJ Open. 2022 Feb 3;12(2).

7.2.3 How is the Risk Changing?

In 2012, the only birth cohorts to show an increased risk in veterans were people born prior to 1960, and there was a fairly steady fall thereafter. By 2017, the increased risk also involved the 1960-1964 birth cohort, demonstrating an 'age effect' which was notably absent from the corresponding graphs for COPD seen in Section 7.1.3. There are more older people in the study cohort, and the prevalence of diabetes has increased accordingly. The confidence intervals (the vertical lines)[90] are now smaller, reflecting the greater number of cases in both veterans and non-veterans.

Although an increasing number of people are now living with diabetes, that is largely due to better treatment and hence survival, and a worldwide study has shown that in the majority of populations, the incidence is not rising. In particular, it is stable in the UK. That is borne out by the analysis of the Scottish Veterans data which looked at what would have been found if the study had been conducted at earlier points in time.

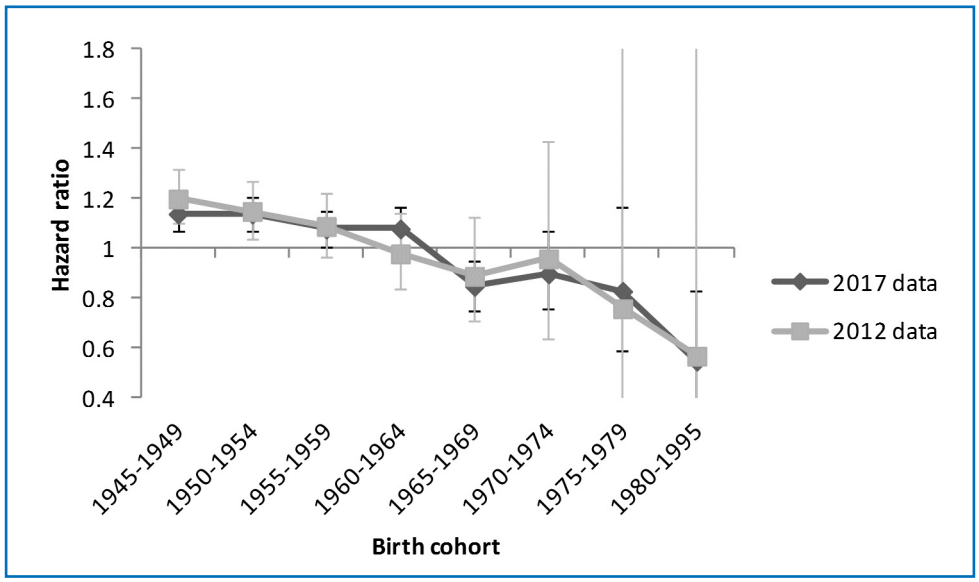


Figure 7-7 - Hazard ratios for type 2 diabetes in veterans by birth cohort, 2012 and 2017

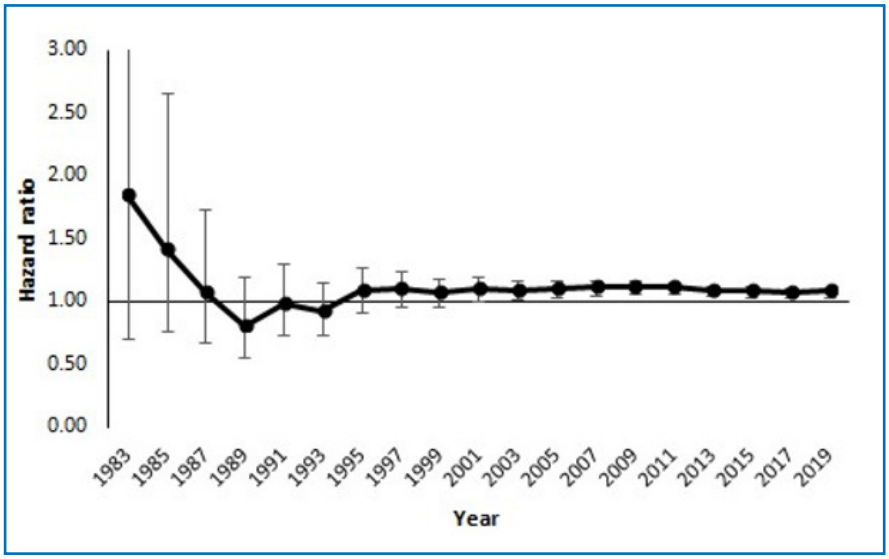


Figure 7-8 - Trend in hazard ratio by year of first record

At first the risk is higher in veterans than non-veterans, but there are few cases and there is little certainty about the findings. However, by about 1995, when the oldest members of the cohort are reaching the age of 50, the pattern is beginning to emerge, and the risk in veterans is slightly higher than in non-veterans. As the number increases, so the certainty of the findings also increases, and as can be seen, the risk then remains stable over many years.[89]

[90] See section 4.2.3.3

7.2.4 Veterans, Diabetes and PTSD

Earlier studies elsewhere have shown that having PTSD increases the risk of developing diabetes.[93] This study has also demonstrated that the impact is stronger in veterans than in people who have not served; type 2 diabetes affected 12.1% of veterans with PTSD, compared with 9.4% of non-veterans with PTSD (and 7.2% of veterans/6.4% of non-veterans overall). Similar findings emerged from a large US military study, adding weight to our findings.[94] Various studies have examined possible reasons, including adverse lifestyle factors and chronic stress, but no conclusions have been drawn. This is an important finding and underlines the importance of approaching veterans' health in a holistic way; a mental health diagnosis should always be accompanied by a careful assessment of general health, and the importance of promoting the healthiest lifestyle possible to each individual's circumstances cannot be over-emphasised.

Veterans with PTSD are at increased risk of type 2 diabetes

7.3 Lower Limb Amputation

Loss of a lower limb in serving military personnel is frequently associated with combat trauma, although cases may also result from road traffic accidents and disease. The First World War saw 41,000 amputees return to civilian life; in more recent conflicts, improved body armour and developments in limb-saving surgery have greatly reduced this burden, but nonetheless, in the first 20 years of the 21st century, nearly 500 Service personnel underwent an amputation,[95] including over 110 who sustained multiple limb amputations. However, nothing was known of the number of people who underwent an amputation after leaving service, whether for trauma or disease.

Artificial limb workshop at Erskine Hospital, World War 1. UGC225/8/5

[93] Vaccarino V, Goldberg J, Magruder KM, Forsberg CW, Friedman MJ, Litz BT, et al. Posttraumatic stress disorder and incidence of type-2 diabetes: a prospective twin study. J Psychiatr Res. 2014;56:158-64.
[94] Boyko EJ, Jacobson IG, Smith B, Ryan MA, Hooper TI, Amoroso PJ, et al. Risk of diabetes in US military service members in relation to combat deployment and mental health. Diabetes Care. 2010;33(8):1771-7
[95] These figures, drawn from published MOD health statistics, are for all amputations including single digits.

The Trends in Scottish Veterans' Health Study[96] examined the risk of post-service amputation in comparison with non-veterans, and found that overall, veterans were no more likely to undergo an amputation after discharge than members of the wider community. However the number of veterans who had lost limbs due to disease far exceeded the estimated number who had lost limbs in conflict.[97] Using a combination of MOD data on amputees, and data provided by Blesma, it was estimated that there were around 30-40 veterans in Scotland who had sustained a lower limb amputation in recent conflicts. However the Trends in Scottish Veterans' Health data showed that 145 veterans had undergone a lower limb amputation after leaving service, over the period of follow-up. This represented 0.19% of all veterans, in comparison with 0.18% of non-veterans. After accounting for the generally shorter period of follow-up of the veterans, there was no overall difference in risk.

More veterans lost limbs from disease than from conflict

Two-thirds of both veterans and non-veterans who had undergone an amputation had a diagnosis of peripheral arterial disease, whilst 42% of veterans and 33% of non-veterans had a diagnosis of diabetes. A third of the veteran amputees, and a quarter of the non-veteran amputees, had both conditions. Very few (under 5%) were due to injury or trauma. A number of people who had undergone amputation also had a mental health diagnosis; for PTSD, this was 4.1% of veterans and 2.8% of non-veterans, whilst mood disorder or depression affected 13.1% of veterans and 9.5% of non-veterans. It was not possible to determine the nature of the relationship between the mental health diagnosis and the amputation, but it is plausible that people suffering from PTSD or depression were more likely to have lifestyle factors such as smoking, unhealthy diet and lack of exercise that predispose to the conditions associated with lower limb loss such as diabetes and peripheral arterial disease. Importantly, the conditions which predispose to post-service limb loss are largely preventable through measures to improve lifestyle, which would reduce the burden of this life-changing outcome.

7.4 Arthritis

Osteoarthritis, often simply referred to as arthritis, is common in the community. It is a major cause of disability and chronic pain, especially in older people, and is associated with an increased need for care and welfare support. Risk factors include traumatic injury, obesity, nutrition, bone density and genetic predisposition.

7.4.1 Are Veterans at Risk?

Some studies in the USA have suggested that veterans have an increased risk of arthritis,[98] but no previous studies among UK veterans have been identified. However injuries and musculoskeletal disorders are the commonest cause of medical discharge from the Armed Forces, accounting for up to two-thirds of cases, so it might be assumed that there would be an increased risk of arthritis in later years.

[96] In contrast to the first Scottish Veterans Health Study, which did not have any data on amputations
[97] Bergman BP, Mackay DF, Pell JP. Postservice lower limb amputation in Scottish military veterans. BMJ Mil Health. 2022 Feb 1;168(1):25-28.
[98] Dominick KL, Golightly YM, Jackson GL. Arthritis prevalence and symptoms among US non-veterans, veterans, and veterans receiving Department of Veterans Affairs Healthcare. The Journal of Rheumatology. 2006 Feb 1;33(2):348-54.

7.4.2 Measuring Arthritis

Measuring the burden of arthritis in the population is problematic. The condition varies greatly in severity, and not all cases come to medical attention since effective medication can be purchased over the counter. Even where drugs are medically prescribed, they may have been given for conditions other than arthritis. The Trends in Scottish Veterans' Health Study therefore looked at the more severe end of the spectrum of the condition, arthritis leading to surgical replacement of the hip or knee joint, as a proxy measure for arthritis in veterans and non-veterans.[99] Only the first hip or knee replacement operation was counted, to avoid double counting where a patient underwent more than one operation.

7.4.3 Joint Replacement in Veterans

Over the period of follow-up, 1.12% of veterans and 1.22% of non-veterans underwent a first hip replacement; veterans were 13% less likely to have a hip replacement than non-veterans. For both veterans and non-veterans, women were more likely than men to undergo a hip replacement. By contrast, there was no significant difference between veterans and non-veterans in the likelihood of undergoing a knee replacement. The operation was slightly less common than hip replacement, being undertaken in 0.97% of veterans and 0.87% of non-veterans. There were no significant difference by birth cohort, length of service or the age at which people underwent joint replacement.

In view of the number of veterans who have been medically discharged for a musculo-skeletal disorder, data from the Trends in Scottish Veterans' Health study provide reassurance that there is no overall increase in the risk of osteoarthritis in later life as a result, at least as far as the maximum age of the study cohort to date (73 years). Nor is there any indication of a worsening of the risk in people who served from 1978 onwards, the year that the Basic Fitness Test was introduced with a consequent increase in road running. Some studies have found that the majority of the risk of osteoarthritis arises from genetic predisposition,[100] which would be consistent with our findings. It should be noted however that a traumatic injury is known to increase the risk of osteoarthritis in the injured joint, and the absence of an overall difference in risk in this large cohort does not mean that military service may not be the cause of the condition in specific individuals.

There is no overall increase in risk of hip or knee arthritis in veterans

7.5 Multiple Sclerosis

Multiple sclerosis (MS) is a chronic, progressive disease affecting the nervous system which is highly variable in its severity. In many people, the symptoms vary over time – known as 'relapsing and remitting'. Some people have infrequent attacks interspersed with periods of relative freedom from symptoms, whereas for other people it results in progressive disability. Early symptoms are often non-specific and it may take some time (possibly years) before the diagnosis is made. Women are more often affected than men, and there is a clear geographical gradient with more cases occurring in the more northerly latitudes. Despite extensive research, the cause remains unknown although genetics, and environmental factors such as exposure to certain viruses or low levels of vitamin D due to inadequate sun exposure have all been suggested. Treatment can help to alleviate relapses but the condition cannot be cured.

[99] Bergman BP, Mackay DF, Pell JP. Hip and knee replacement as a proxy measure for lower limb osteoarthritis in Scottish military veterans. BMJ Mil Health. 2021 Aug 8.
[100] Spector TD, MacGregor AJ. Risk factors for osteoarthritis: genetics. Osteoarthritis and Cartilage. 2004 Jan 1;12:39-44.

7.5.1 Multiple Sclerosis in Scotland

Since 2010, all new cases of multiple sclerosis in Scotland have been recorded on the Scottish MS Register, in order to monitor the number of cases and improve the quality of care.[101] Around 500 new cases are diagnosed in Scotland each year, equating to about 9 people per 100,000 per year, with the incidence being higher in the north than the south. Because of the nature of the condition, accurate data on the total number of people living with MS in Scotland are not known but a figure of around 190 per 100,000, or about 10,000 people, has been estimated.[102]

7.5.2 Multiple Sclerosis in Veterans

In the 2012 study, which looked only at cases of MS recorded in people who were admitted to hospital, 0.25% of veterans and 0.28% of non-veterans had a record of MS, equating to a non-significant 8% reduction in risk in the veterans. Women veterans were 2.9 times as likely to have an MS diagnosis as men; for non-veterans, the figure was 2.3 times greater in women than men.

The 2017 study used data from the Scottish MS Register as well as hospital admission data, giving a greater degree of capture of cases, especially for more recent diagnoses. However the results were similar; MS was recorded as affecting 0.26% of veterans and 0.31% of non-veterans, giving an 11% reduction in risk in the veterans although the number of cases was too small for this to reach statistical significance. The difference was only seen in men, where 0.22% of male veterans and 0.27% of male non-veterans had an MS diagnosis, but for women, the corresponding figures were 0.61% for veterans and 0.60% for non-veterans. The ratio between men and women, for both veterans and non-veterans, was the same as was found in the 2012 study. There was a slightly higher risk in Early Service Leavers, and a reduction in people who had served for at least the minimum engagement which became stronger with longer service. People with more than 12 years' service had a statistically significant 39% reduction in risk of MS compared with all non-veterans, and it is possible that this reflects more time spent away from Scotland in more southerly latitudes. However there were insufficient veteran numbers, when broken down into the fourteen Health Board regions, for any geographical effect within Scotland to be apparent. The graph below shows the small overall reduction in risk of MS in veterans compared with non-veterans.

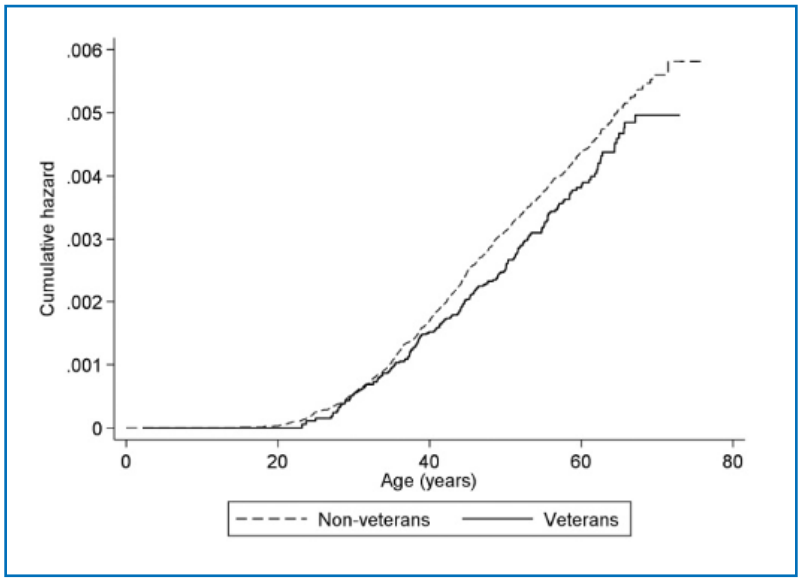


Figure 7-9 - Cumulative hazard graph for MS

[101] The Scottish MS Register https://www.msr.scot.nhs.uk/index.html
[102] Forbes RB, Swingler RJ. Estimating the prevalence of multiple sclerosis in the United Kingdom by using capture-recapture methodology. American Journal of Epidemiology. 1999 Jun 1;149(11):1016-24.

On average, veterans were older than non-veterans when MS was first recorded (which may not be the age of onset, due to delayed diagnosis as the early symptoms are often non-specific); median age 44 years for veterans and 42 years for non-veterans. The following graph shows slightly more diagnoses in the older age-groups, although generally the pattern is similar for veterans and non-veterans. The age of onset suggests that most veterans had left service by the time of diagnosis with MS.

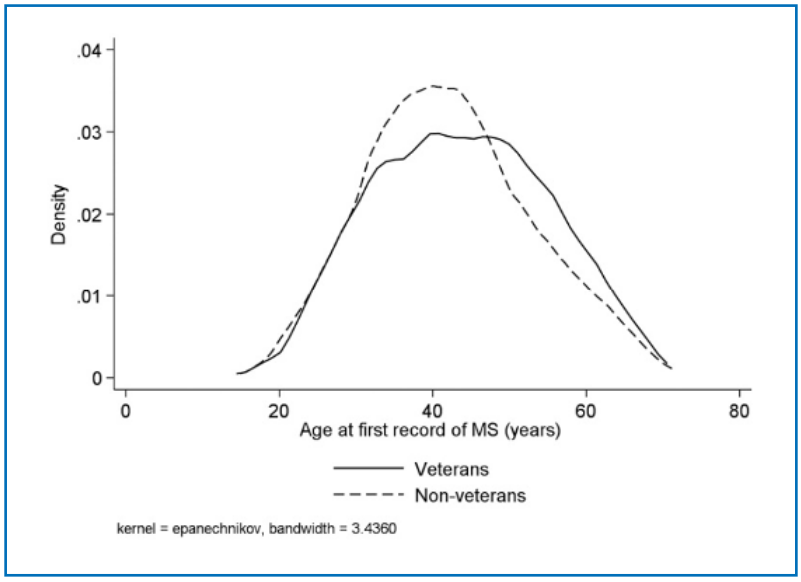


Figure 7-10 - Age at first record of MS, veterans and non-veterans

Published medical discharge data[103] are insufficiently detailed to determine the number of people medically discharged due to MS, but a study at the Defence Medical Rehabilitation Centre at Headley Court reported only 24 cases treated over an 11-year period, suggesting that MS in service occurs infrequently. Of these, around half were medically discharged, the remainder continuing in service on restricted duties. The paper also reported that 57 people were medically discharged from service overall with this condition over the 10-year period 2006-2016.[104] A Freedom of Information request showed 161 people who were medically discharged with MS between 1995 and 2017.[105] As approximately 10% of people who leave service settle in Scotland, these figures indicate that less than one person per year is medically discharged with MS and joins the pool of Scottish veterans.

7.5.3 MS and Compensation

In the past, it was considered although the cause of MS was unknown, the possibility that military service could have caused or aggravated the condition could not be excluded. Therefore, people who developed MS in service or soon after leaving could be awarded a war disability pension or compensation under the Armed Forces Compensation Scheme. In 2013 the Independent Medical Expert Group (IMEG) reviewed the evidence and concluded that "There is no evidence that MS is uniquely occupational and in military personnel, it is clinically indistinguishable from the disorder as it occurs in the wider population."[106] This has impacted on the eligibility of Service personnel for military-specific benefits, although it is a complex area and specialist advice[107] should be sought in each individual case as some people remain eligible. However the results of the present study, from an epidemiological perspective, provide no evidence overall of substantial differences between MS in veterans and MS in the wider population.

[103] https://www.gov.uk/government/collections/medical-discharges-among-uk-service-personnel-statistics-index
[104] O'Sullivan O, Allsopp L, Mitchell J, Price L, Tourle K, Ellis H. Review of neurological rehabilitation for Multiple Sclerosis in the British Military.
[105] DBS/SEC/FOI201808416 dated July 2018
[106] The IMEG report and recommendations on medical and scientific aspects of the Armed Forces Compensation Scheme. Ministry of Defence (2013).
[107] eg https://www.mssociety.org.uk/care-and-support/emotional-support/national-ms-support-groups/mutual-support-armed-forces

7.6 Motor Neurone Disease

Motor neurone disease (MND), known as amyotrophic lateral sclerosis (ALS) in the US, is a rare but extremely serious progressive and life-limiting disorder of the nervous system. It became of military interest and concern in 2003 when a doubling of risk was reported in US personnel who had deployed to the 1991 Gulf War.[108] However, soon afterwards, others cast doubt on the significance of the findings,[109] and a very much larger US study in 2005,[110] covering all conflicts and intervening periods from the First World War onwards, showed that it was military service overall which was associated with an increase in risk, and not just deployment. The increase in risk, compared with people who had never served, was 58%. The findings were confirmed in a later prospective (forward-looking) study, although the increased risk was smaller at only 23%.[111] The risk was higher in World War 2 veterans. As the number of cases was small, it would be unwise to consider the reduction in risk to represent a trend although the higher risk in the earlier veterans is suggestive.

7.6.1 Risk Factors for MND

Many risk factors for MND have been suggested, including genetics, smoking, alcohol, infection, and environmental contaminants such as atmospheric lead, pesticides and other toxins.[112] A risk factor which has recently become recognised as important is intense physical activity, especially in genetically susceptible people[113] or when associated with physical trauma to the head and neck. Professional sports players, especially footballers who head the ball, are also now recognised to be at increased risk.[114] However some cases occur in people who have no obvious external risk factors, and in these cases genetics probably plays an important part.

7.6.2 MND in Scotland

There are around 400 people currently living with MND in Scotland, and about 200 new diagnoses (3-4 per 100,000 people) are made each year.[115] The incidence (rate of new cases) has increased by about 36% over the last 25 years, although this may be partly attributable to better diagnosis.[116]

[108] Haley RW. Excess incidence of ALS in young Gulf War veterans. Neurology. 2003 Sep 23;61(6):750-6.
[109] Rose, Michael R. "Gulf War service is an uncertain trigger for ALS." Neurology 61(6)(2003): 730-731.
[110] Weisskopf MG, O'Reilly EJ, McCullough ML, Calle EE, Thun MJ, Cudkowicz M, Ascherio A. Prospective study of military service and mortality from ALS. Neurology. 2005 Jan 11;64(1):32-7.
[111] Weisskopf MG, Cudkowicz ME, Johnson N. Military service and amyotrophic lateral sclerosis in a population-based cohort. Epidemiology (Cambridge, Mass.). 2015 Nov;26(6):831.
[112] Johnson, R. T., Bradley, W. G., Ritz, B. R., Rocca, W. A., Shefner, J. M. and Wolfson, C. (2006) Amyotrophic Lateral Sclerosis in Veterans: Review of the Scientific Literature, Washington DC: National Academies Press.
[113] Julian TH, Glascow N, Barry AD, Moll T, Harvey C, Klimentidis YC, Newell M, Zhang S, Snyder MP, Cooper-Knock J, Shaw PJ. Physical exercise is a risk factor for amyotrophic lateral sclerosis: Convergent evidence from Mendelian randomisation, transcriptomics and risk genotypes. EBioMedicine. 2021 Jun 1;68:103397.
[114] Chio A, Calvo A, Dossena M, Ghiglione P, Mutani R, Mora G. ALS in Italian professional soccer players: the risk is still present and could be soccer-specific. Amyotrophic lateral sclerosis. 2009 Jan 1;10(4):205-9.
[115] MND Scotland https://www.mndscotland.org.uk/about-us/media-information/
[116] Leighton DJ, Newton J, Stephenson LJ, Colville S, Davenport R, Gorrie G, Morrison I, Swingler R, Chandran S, Pal S. Changing epidemiology of motor neurone disease in Scotland. Journal of Neurology. 2019 Apr;266(4):817-25.

7.6.3 MND in Veterans

In the 2012 study, MND had been diagnosed in 0.07% of veterans and 0.04% of non-veterans, which equated to a 56% increase in risk in the veterans, very close to the 58% increase in risk reported in the 2005 US study.[117] By the 2017 study, there were still 0.07% of veterans affected although the absolute number of cases had increased as there were more veterans in the study. However there had been a greater increase in the number of cases in non-veterans, now equating to 0.06%, and in consequence the increase in risk in veterans was now only 24%, again very similar to the 23% increase found in the follow-up US study.[111]

The following graphs will explore how this change should be interpreted. Because of the small number of cases, the usual birth cohort graphs cannot be used as the number of cases in each 5-year bracket would be too small. Instead, a 'kernel density' graph[118] is presented which gives a much more useful picture.

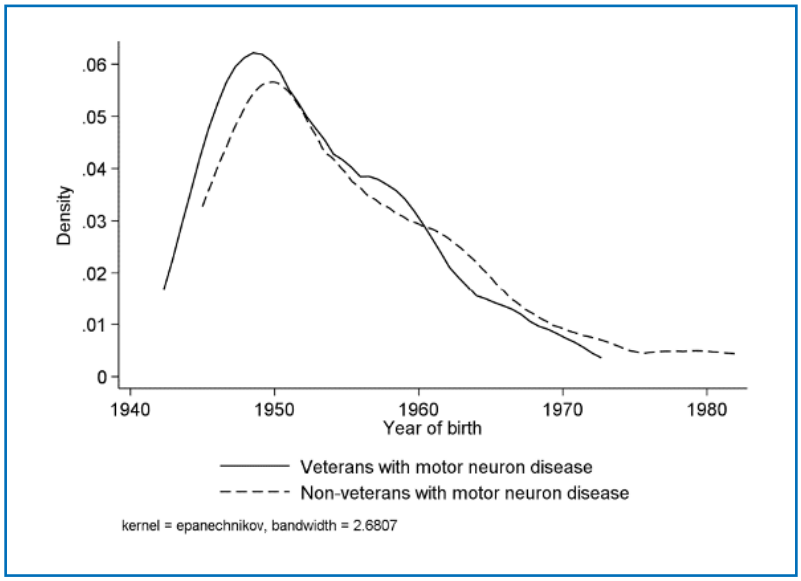


Figure 7-11 - Kernel density graph of MND diagnoses by year of birth

The graph above shows the year of birth of the veterans and non-veterans with MND. It indicates that it is the older veterans (born before about 1950) whose increase in risk is greatest. After that, the solid and dashed lines run closer together and there may even be a reduction in risk in veterans born after about 1960. Looking at the data the other way round, by age at diagnosis, provides even more information.

[118] Similar to the familiar histogram or bar chart, but with a smoothed outline for greater clarity.

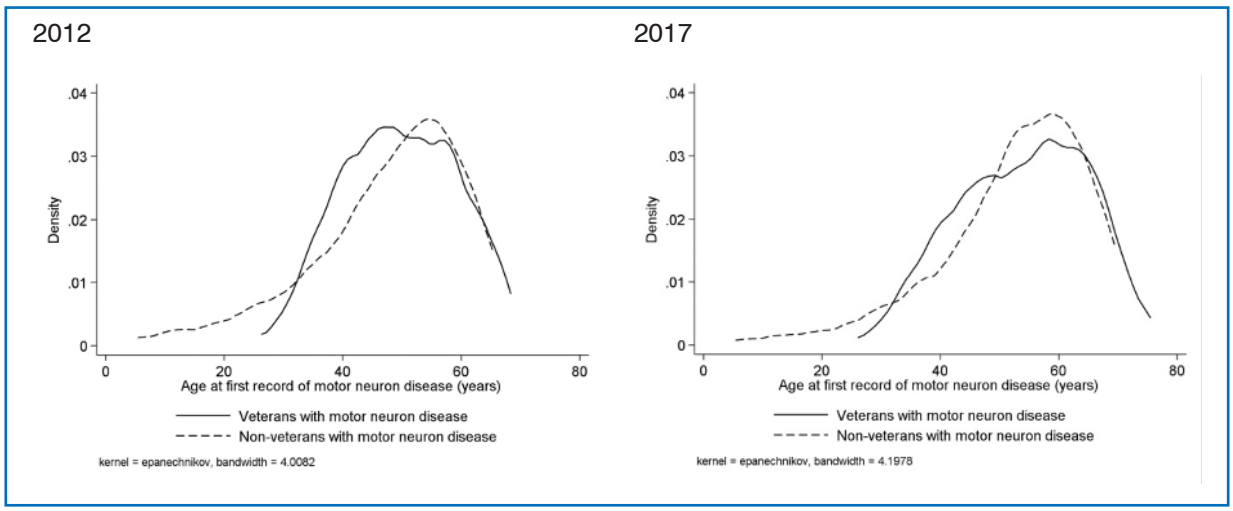


Figure 7-12 - Kernel density graphs of age at MND diagnosis, 2012 and 2017

The left-hand graph shows the position as at 2012. There is a substantial excess of veterans who were diagnosed around age 40, whereas the peak in non-veterans is in the mid to late 50s. By 2017, the pattern has changed. The 'bulge' in veteran diagnoses at around age 40 can still be seen, but with ageing of the cohort, it is now dwarfed by the peak at the same age as non-veterans, ie mid to late 50s. However the non-veteran peak at this age is now higher than for veterans.

People who were in their late 50s in 2017 were born around 1960, and as we have seen with many other conditions, there has been a change in the pattern of veterans' health at around this point. Generally, the health of earlier-born veterans was worse than that of non-veterans, whereas for veterans born after about 1960, their health was the same as, or better than, that of non-veterans. In some cases such as the smoking-related diseases, the change has been tentatively attributed to the introduction of better health promotion activities, such as the Basic Fitness Test and more active smoking cessation initiatives, which impacted on those who joined from around 1978.[119]

[119] ie born in 1960 if aged 18 at recruitment
[120] Armon C. Smoking may be considered an established risk factor for sporadic ALS. Neurology. 2009 Nov 17;73(20):1693-8.

With small numbers, there is necessarily much uncertainty about the interpretation. However it would appear that there was a genuine excess of cases of MND in veterans born in the late 1940s and early 1950s, and that they may have developed the disease earlier than non-veterans, at around age 40. As the cohort was younger at the time of the first study, they had an important impact on the figures. For veterans born after about 1960, they appear to show a pattern similar to non-veterans, with onset at a similar age, and as the cohort is now older, with more people having reached that age, the impact on the overall figures of that earlier excess in older veterans is reducing.

This points to a risk factor which disproportionately affected veterans during service in the 1960s and 1970s but is now reducing. An obvious candidate is smoking, which is widely recognised as a risk factor for MND,[120] although there are others which have been suggested such as exposure to leaded fuels. However the pattern may change again as the cohort ages further, and continued monitoring will be required. For now though, the 2017 study shows that veterans remain at increased risk of MND although the increase is lower than as at 2012.

8 Mental Health

8.1 Introduction

Mental health is one of the most important areas of veterans' health, but it is also the most complicated to understand. Unlike many of the physical diseases, which may be caused by exposure to an infection or a toxic substance such as tobacco smoke, by genetic susceptibility or by factors which are yet to be discovered, mental health is shaped throughout life and is influenced by a wide range of personal and societal factors.[121] Exposure to a traumatic incident at a particular time of stress and vulnerability may result in a person developing a mental health problem; at another time, the same person might have proved more resilient and escaped mentally unscathed.

8.1.1 A Brief History of Mental Trauma

Mental health problems occur widely in the community, affecting around one in four adults in Scotland in any year,[122] but have been of particular concern in veterans, largely because of the exposure to trauma in service which many have experienced. It has been recognised for many centuries that both civilian disasters and military service can result in mental ill-health. The great 17th century diarist Samuel Pepys developed what would today be called post-traumatic stress disorder (PTSD) after witnessing the Great Fire of London in 1666, the edge of which reached just a few yards from his own house; afterwards he described "being terrified in the nights . . .with dreams of fire and falling down of houses", whilst in 1810 Sir Walter Scott wrote of a knight returned from battle and experiencing troubling nightmares in "The Lady of the Lake" (reproduced at the beginning of Section 1.1.1).

PTSD first became a recognised diagnostic term in 1980, and may be regarded as the modern interpretation of conditions such as neurasthenia and shell-shock. Neurasthenia was well known in civilian medical circles from at least as early as 1829, long before the First World War. Shell-shock on the other hand was first described in 1915[123] and specifically affected people who had been close to an explosion, without sustaining an obvious physical injury. Its modern equivalent may be mild traumatic brain injury (mTBI). There is still much debate among academics and medical historians as to whether these conditions were physical or psychiatric in origin. To a large extent, the distinction is immaterial – what matters is that those who suffer are human beings, affected by their experiences. What is more important is how best the conditions can be prevented and, if circumstances mean that is impossible, that they are treated to restore people to as normal a life as possible.

[121] Ross D, Mackay DF, Bergman BP. Risk factors for mental ill health in UK Army personnel: an overview. BMJ Mil Health. 2022 Apr 1;168(2):166-172.
[122] Scottish Health Survey 2019. Scottish Government.
[123] Myers C. A contribution to the study of shell shock.: Being an account of three cases of loss of memory, vision, smell, and taste, admitted into the Duchess of Westminster's War Hospital, Le Touquet. The Lancet. 1915 Feb 13;185(4772):316-20.

8.1.2 Military vs. Civilian Trauma

Although the term PTSD was first described in connection with veterans of the Vietnam War, it soon became clear that many traumatic situations could give rise to PTSD, including in the civilian world. Being mugged, being sexually assaulted, being in an abusive relationship, being abused as a child or a victim of a man-made or natural disaster were all equally likely to produce similar symptoms, as was witnessing a harrowing event or working in a traumatic setting. The term has gradually been refined[124] and most recently, a distinction has been drawn between PTSD and the more disabling condition of Complex PTSD. Delayed-onset PTSD is also recognised, and may develop long after an individual has apparently coped with an occurrence.

These experiences occur across the community, and affect both veterans and non-veterans. In addition, veterans may have experienced traumatising events in the course of their military service, in a similar way to members of the emergency services and others whose work necessarily involves exposure to potentially traumatising situations. Not all veterans will have experienced combat though, or even been exposed to undue danger. Many will have worked in the support services – logistic, medical, or administrative. Less than 25% of the Armed Forces serve as combat troops, whilst even among combat troops, many may never have deployed operationally, depending on when and where they served. This especially applies to those with the shortest service; those who leave whilst still in training will not have deployed, and will only ever have worked within the highly regulated environment of a training unit. With the relatively infrequent exception of those who were involved in an accident in training or who were victims of bullying, PTSD in the earliest leavers is almost certain to have originated outside the military environment.

Some healthcare providers, and particularly those with no military connection, make the assumption that PTSD arising in a veteran is necessarily related to their military experience, and are consequently reluctant to enquire too closely into the causal event, especially if the veteran themself is reticent.[125] This is not necessarily helpful, since some veterans may in fact have PTSD relating to an experience outside their service, and making an accurate diagnosis is as important in PTSD as in any other medical condition if treatment is to succeed.[126] Equally, some veterans may feel that unless their condition can be shown to have arisen from their military experience, they will not be able to access particular services. In general this is not the case for mental health conditions, as veterans are eligible to receive treatment from the majority of specialist providers of veterans' mental health services irrespective of the cause of the problem. If the underlying cause is a traumatic event in childhood or adolescence, treating the purported effects of an event during military service can at best only be of limited benefit.

[124] North CS, Surís AM, Smith RP, King RV. The evolution of PTSD criteria across editions of DSM. Annals of Clinical Psychiatry 2016;28(3):197-208.
[125] Jeffreys MD, Leibowitz RQ, Finley E, Arar N. Trauma disclosure to health care professionals by veterans: clinical implications. Military Medicine. 2010 Oct 1;175(10):719-24.
[126] Recognising post-traumatic stress disorder in military veterans https://www.myamericannurse.com/recognizing-posttraumatic-stress-disorder-in-military-veterans (2010)

8.2 The Spectrum of Mental Health

Mental health encompasses a wide range of conditions. For the purposes of this study, the conditions were restricted to anxiety, mood disorder (depressive illness), severe stress or PTSD,[127] and psychosis. In this report, these will be referred to as 'all mental disorders'. As with other conditions reported here, the data are restricted to the more severe end of the spectrum, covering people who were either admitted to hospital (a general hospital or a psychiatric in-patient facility) or who were admitted for mental health day care. Therefore the percentages are smaller than would be reported if milder cases managed solely by general practitioners were included. Nonetheless, the data make it clear that the majority of veterans do not suffer from mental health problems. The media stereotype which has emerged in recent years of all veterans as 'mad, bad or sad' is both inaccurate and damaging. The majority of veterans have enjoyed their military service and benefited from it,[128] emerging with maturity and new life skills and settling well into post-service life. For the minority who do not, they deserve an understanding approach which recognises the complexity of their underlying risk factors and experiences, and not a 'one size fits all' assumption that their problem can be directly and solely attributed to their time in the Armed Forces, simply because they are veterans.

The majority of veterans have enjoyed their military service and benefited from it

8.3 Researching Mental Health in Military Personnel

At the end of the First World War, there was great concern at the number of Service personnel who had suffered from what were then called 'war neuroses', and a Committee of Enquiry was set up by the War Office in 1920, chaired by Lord Southborough. Evidence was taken from a wide range of military and mental health experts, and a comprehensive report was produced.[129] A recent article provides a useful summary and comparison with modern methods of treatment.[130] Following the Second World War, public interest in military mental health waned, although the Army and the Royal Navy continued to maintain a dedicated joint psychiatric hospital at Netley on the south coast of England until its closure in 1977, and there were military psychiatrists based in the majority of military hospitals, both at home and overseas. At that time there was still little recognition of the association between physical wounds and mental health outcomes; a paper published in 1981 reported only 21 mental health cases among the first 2,000 soldiers wounded on operations in Northern Ireland.[131] There was a considerable resurgence of interest in the aftermath of the first Gulf War when, in the early 1990s, cases started to emerge of a medically unexplained pattern of symptoms which became widely known as Gulf War Syndrome. Although the symptoms went beyond mental health in a proportion of those affected, this acted as the stimulus for an unprecedented amount of research into the health of both serving personnel and veterans. In the UK, the Gulf War Illnesses Research Unit was established in 1996, becoming known as the world-leading King's Centre for Military Health Research (KCMHR) from 2004,[132] with a multi-disciplinary team of researchers although with a strong mental health focus. To date, KCMHR has published several hundred peer-reviewed academic papers, on such wide-ranging topics as common mental disorders, alcohol, risky driving and trends in military smoking.[133] At the start, KCMHR established a large research cohort of deployed and non-deployed military personnel which has been followed up over many years and continues to provide a unique insight into changing patterns of both health and risk factors. The Scottish Veterans studies, described in Chapters 2-4, complement this work by providing a longer view, going back to people whose service began in 1960 and enabling long-term trends to be examined, from the earliest post-National Service veterans to the most recent, in comparison with people in the wider community who have never served.

[127] Severe stress and PTSD are considered together to overcome diagnostic uncertainty, especially in the early years after the introduction of the term 'PTSD', when it was still unfamiliar to clinicians
[128] Iversen A, Nikolaou V, Greenberg N, Unwin C, Hull L, Hotopf M, et al. What happens to British veterans when they leave the armed forces? Eur J Public Health 2005;15:175-84.
[129] Report of the War Office Committee of Enquiry into 'Shell-Shock', Cmd. 1734.
London: HMSO, 1922.
[130] Ashton E. Shell shock. Journal of the Royal Army Medical Corps. 2014 Jun;160:i11-i12.
[131] Owen-Smith, M. S. (1981) 'A computerised data retrieval system for the wounds of war: the
Northern Ireland casualties', Journal of the Royal Army Medical Corps, 127, 31-54.
[132] King's Centre for Military Health Research: A fifteen year report. King's College, London (2010) https://www.kcl.ac.uk/kcmhr/publications/reports/files/15yearreportfinal.pdf
[133] https://kcmhr.org/pubdb/

8.4 Mental Health in Veterans - Overall

Analysis of the data on mental health in veterans, in both the earlier Scottish Veterans Health Study and the present Trends in Scottish Veterans' Health, reveals a remarkable degree of complexity, and it is misleading to look at the overall figures on their own. It is only by examining the detailed picture that it is possible to appreciate the trends and, most importantly, the areas of risk where intervention may have the potential for benefit. At the end of 2012, there was an overall 27% higher risk of a major mental health diagnosis in veterans in comparison with the wider population, but this was heavily weighted towards the older veterans, where the increase in risk was 33% in people born before 1960, compared with 18% in people born from 1960 onwards. Length of service was also important, with a somewhat surprising and, to many people, counter-intuitive negative gradient; the risk was highest in Early Service Leavers and was only increased in people with less than 10 years' service. People with the longest service had a reduced risk of mental health disorder compared with non-veterans; as much as 40% reduction in people with over 22 years' service. Living in deprived circumstances was also important and the increase in risk was slightly less if this was taken into consideration.

By the end of 2017, the pattern had changed. Although the overall increase in risk was slightly lower at 24%, the difference between older and younger veterans had almost disappeared due to a worsening of the difference in people born from 1970 onwards, particularly affecting veterans born 1975-1979 who had a 74% increase in risk. The reasons for this are not clear. Most of those affected were Early Service Leavers who had completed training but did not finish their initial engagement. They are too young to have served in the Falklands or the first Gulf War, but may have served in Op GRAPPLE (Bosnia). It is also possible that some of this group were affected by the Options for Change restructuring programme which saw the careers of many members of the Armed Forces unexpectedly cut short by redundancy. Whatever the reason, they are at heightened risk of adverse mental health outcomes and should be regarded as vulnerable. The two lines on the birth cohort graph show the change in mental health outcomes that has developed over only five years. The increase in the 1975-1979 birth cohort can be seen in the 2012 graph but it was non-significant at that time and could have been a chance finding; five years later there is a very clear pattern of increase in risk. However the data also provide reassurance that there has been some improvement in the more recent birth cohorts. Further research is needed to explore issues potentially affecting this birth cohort, and future trends will need to be monitored.

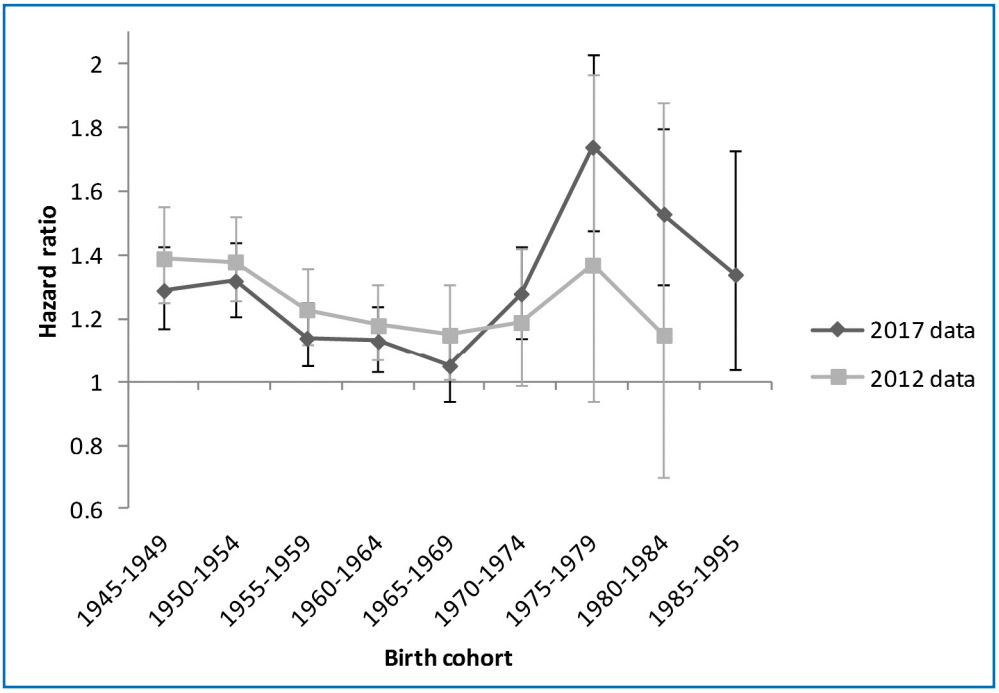


Figure 8-1 - Hazard Ratios for any Mental Health Disorder by Birth Cohort, 2012 and 2017

It can be seen from Figure 8-1 above that the excess risk in veterans is much lower in those born in the 1960s, resulting in a U-shaped curve. It is likely that this is due to some major societal changes which affected this generation, especially in the area of youth unemployment which reached a peak at the time when people born in the 1960s were leaving[134]. By definition, those who later became veterans were protected from the effects of unemployment, thereby conferring a protective effect of military service in comparison with people who had never served.

8.5 Mood Disorder (Depression)

In 2018/2019,[135] 12% of adults in Scotland had two or more symptoms of depression, an increase from 9% in 2012/13. The increase affected both men and women. This represents a baseline in the community against which any changes in veterans should be assessed. At the end of 2012, 2.8% of veterans and 2.6% of non-veterans had experienced an in-patient or psychiatric day-case admission for mood disorder, meaning that the veterans were at 22% higher risk, or 16% if deprivation was taken into consideration.[136] Some people had both mood disorder and PTSD; if the latter was excluded, the increase in risk in the veterans was only 13%, or 9% after accounting for deprivation. This demonstrates the important contribution to the excess level of mental ill-health in veterans that is made by both PTSD and living in deprived circumstances. Women were more likely than men to have experienced depression; 32% more likely for veterans and as much as 61% more likely for non-veterans. Veteran women were no more likely than non-veteran women to have had a depressive illness, although male veterans were 26% more likely than male non-veterans.

[134] Bivand P. Generation Lost: Youth unemployment and the labour market. Touchstone (TUC).
[135] ie Before any impact of COVID-19
[136] As noted at Section 1.2, these percentages for hospital admissions should not be directly compared with the Scottish Health Survey figures, which report responses to a questionnaire.

By the end of 2017, the difference in risk of severe depression between veteran and non-veterans had reduced from 22% to 18% overall, or 14% after adjusting for deprivation. This was accounted for by a reduction in risk in the oldest veterans (born before 1960) from a 32% increase to 23%, but at the same time the increased risk in the younger and middle-aged veterans had gone up from 9% overall to 16%. The difference between men and women was the same – women veterans and non-veterans had the same risk of depressive illness, whilst male veterans were 23% more likely than men in the wider community to have experienced depression. Importantly, the difference was entirely within the Early Service Leavers; if they were excluded from the analysis, there was no difference in risk of depression for men, whilst women non-ESL veterans were at reduced risk. The following graph shows the difference in risk of depression between male ESL veterans and non-ESL veterans, compared with men in the wider population.

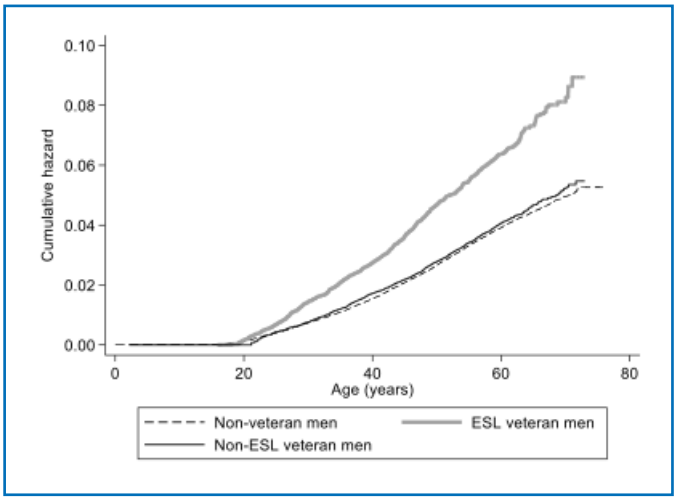


Figure 8-2 - Hazard ratios for mood disorder, non-ESL men and ESL men

8.6 Anxiety

The 2018/2019 figures for Scotland show that 14% of adults had two or more anxiety symptoms, an increase from 9% in 2012/13.[137] The increase was greater in men than in women, indicating a disproportionate worsening of men's mental health over time although women were more likely overall to have symptoms of anxiety.

When looking at anxiety in the Scottish Veterans study, it was important to exclude people who also had PTSD, as until recently PTSD was classified as part of the spectrum of anxiety. Therefore it would have been difficult to avoid double counting when making comparisons with rates of PTSD. The 2012 data show veterans having an 18% increased risk of anxiety (excluding PTSD) compared with non-veterans, which reduced to 14% after taking differences in socio-economic deprivation into account. As with depression, the increased risk was seen in men veterans but not women.

By the end of 2017, there was a similar pattern to that seen with depression; the overall difference in risk between veterans and no-veterans was smaller at 10%, and this was confined to men, with women veterans at no increased risk compared with women non-veterans. This time though, the decrease was across all birth cohorts, and for the youngest (1960 births and later), there was no overall difference in risk. The only exception was the post-1960 Early Service Leavers, who had an increased risk of 43%-52%, similar to 2012.

What was happening? Had there been a real improvement, or had there been a change in the way veterans' mental health problems were diagnosed and classified?

[137] Scottish Health Survey 2019. Scottish Government.

8.7 Post-Traumatic Stress Disorder

In 2012, veterans were almost twice as likely as non-veterans to have been hospitalised with severe stress or PTSD, affecting 1.12% of veterans and 0.69% of non-veterans, an 86% increase in risk in veterans once different lengths of follow-up were accounted for. All birth cohorts were affected, although the increase in risk was highest in the 1975-1979 cohort and lowest in people born 1960-1964. By the end of 2017, the gap between veterans and non-veterans had widened to 110% overall. It had reduced slightly in the oldest veterans, born before 1960, from 95% to 88%, but had increased among veterans born from 1960, from 80% to 129%, with the greatest increase in veterans born between 1975 and 1984.

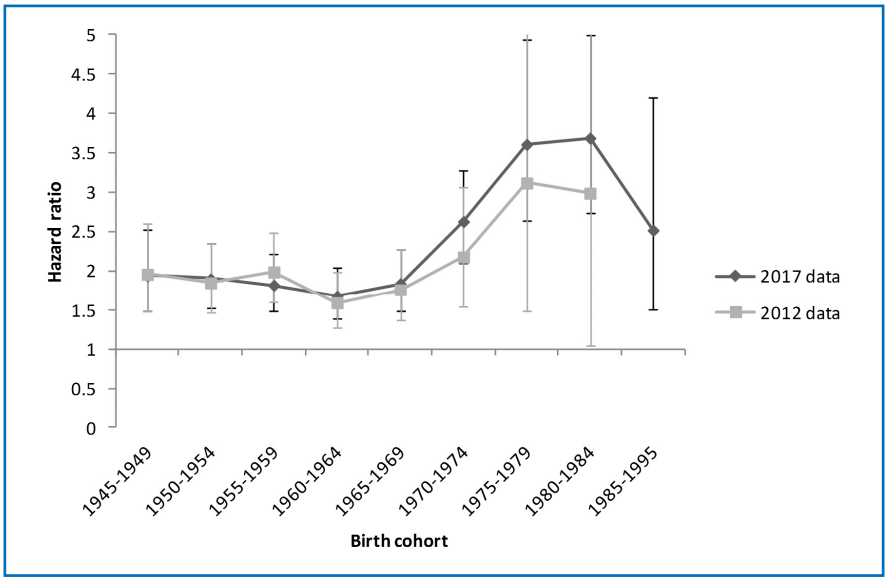


Figure 8-3 - Hazard Ratios for PTSD by Birth Cohort, 2012 and 2017

Comparing the two lines on the graph, although the absolute hazard ratios are higher in 2017, the overall pattern is similar, and the same birth years remain at highest risk despite ageing of the entire cohort by five years. The excess risk seen in these groups has fallen substantially in the 1985-1995 birth cohort (which was not included in the 2012 study). As this is the generation which has borne the brunt of operations in Iraq and Afghanistan, there may be some guarded reassurance to be taken from this, but the risk will need to be monitored in future years as the oldest of this cohort were only 32 years of age at the end of the study, so they may not have reached peak age for mental health problems, which was shown in the first study to be in the late 30s and early 40s.

Examining the data for ESL and people who completed at least the minimum engagement reveals a very different picture from depressive illness and anxiety, at least for men. These graphs show that although there is still an increased risk in ESL compared with all non-veterans, there is also an increased risk of PTSD in longer-serving men, although it is slightly lower than in the ESL men.

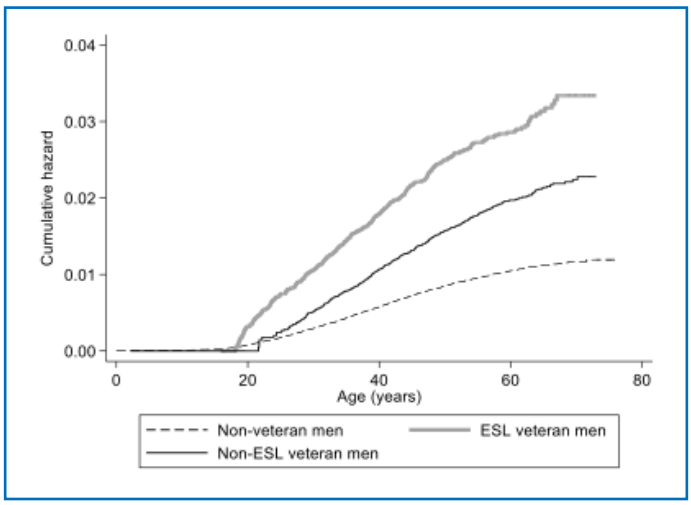


Figure 8-4 - Cumulative hazard graphs for PTSD - non-ESL and ESL men

The data for women show a different picture, with the excess risk in women veterans confined to ESL, whilst those with longer service are slightly less likely to have received in-patient treatment for PTSD than women non-veterans. The 'jagged' line for veteran women is a reflection of the small numbers, which are insufficient to generate a smooth line on the graph.

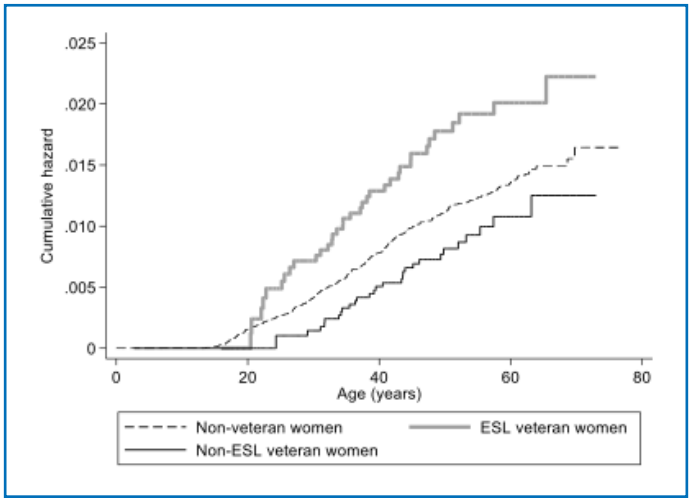


Figure 8-5 - Cumulative hazard graphs for PTSD - Non-ESL women and ESL women

What might have influenced the figures for PTSD to account for the increased risk? It is important to remember that the data presented here represents the more severe end of the PTSD spectrum, in other words people who have needed in-patient treatment. As the excess risk of anxiety (excluding PTSD) has fallen between 2012 and 2017, it is possible that there has been a shift in diagnosis, so that veterans presenting with anxiety symptoms are now more likely to be assessed as having PTSD rather than anxiety, whereas a similar change may not have occurred amongst non-veteran patients.

In terms of operational risk, the high-risk 1975-1984 birth cohort would generally have joined the Armed Forces between 1993 and 2002. Thus for the oldest, and those who served for longer, there may have been an impact of the early days of Op TELIC (Iraq) and Op HERRICK (Afghanistan), which reduced over time as measures were put in place to mitigate adverse mental health impacts, including pre-deployment mental health briefings and post-deployment 'decompression'.[138] However this probably **does not provide sufficient explanation** as those who were ESL would have left prior to the start of those operations, although they may have served in Bosnia. There is a pressing need for **further studies** to examine factors which may be having a disproportionate impact on this group of veterans. It is also important that **healthcare providers** reach out to this vulnerable group of middle-aged veterans.

Further studies are needed to explore the high risk in middle-aged veterans

[138] A short period of rest and relaxation in a non-threatening environment such as Cyprus, prior to completing the move back home

9 Suicide, Self-Harm And Substance Misuse

9.1 Suicide

Although the number of veterans who die as a result of suicide is relatively low, each one is a tragedy, not least because of the sense that it should have been preventable. The impact on family and friends is immeasurable, and it is not unknown for the distress caused to be so great that further suicides result.[139] Although there is a legitimate interest in the media reporting of suicide, and journalists are exhorted to be mindful of the impact of such reports on vulnerable people,[140] nonetheless it has been shown that media reports of celebrity suicides increase suicide rates by 13-30% over the next month or so.[141] No studies have been found which look at the impact of reporting veteran suicides, but headlines such as "Over 2000 British soldiers and veterans killed themselves since 2001 Afghan invasion"[142] are potentially unhelpful when, further down the article, this is explained as an average of 90 per year. With a veteran population now of 2.3 million, and more than that in 2001, 90 per year equates to about 4 per 100,000 veterans, which is well below the UK population average of 12-15 suicides per 100,000 people per year. The recent Government commitment to record all veteran suicides[143] is therefore to be welcomed, although it will be essential for comprehensive information on underlying causes to be collected if effective preventive strategies are to be developed.

9.1.1 Suicide in Scotland

There is no Coroner's Inquest in Scotland; unexplained deaths are investigated by a Fatal Accident Inquiry (FAI) which is conducted by the Procurator Fiscal. Nationally-reported suicide figures for Scotland are based on 'probable suicides' which includes not only confirmed suicides (for example where the intent was clear), but also cases where the intent of the person was unknown although the FAI has determined that the death was likely to have been suicide. In 2020, 805 probable suicides were registered in Scotland, involving three times as many men as women.[144] The graph below shows the rates per 100,000 of the population.

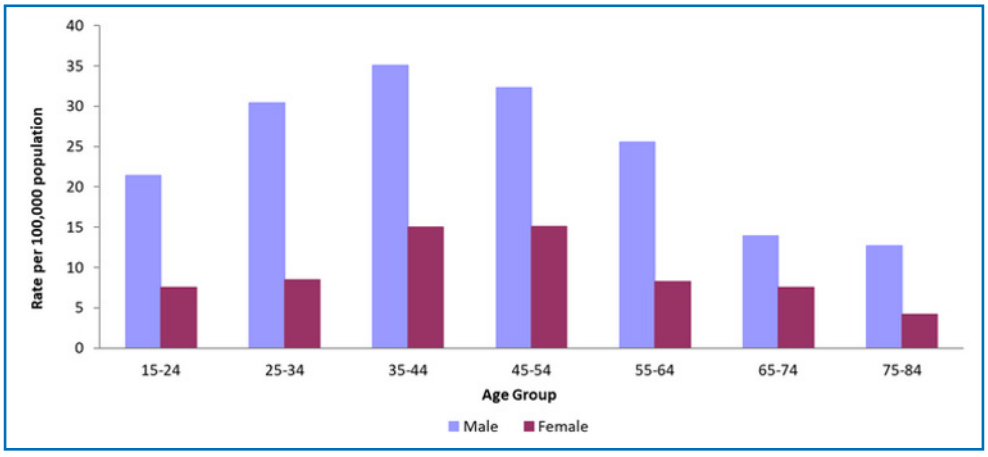


Figure 9-1 - Suicide Rates in Scotland by Age Group, 2020
Source: Public Health Scotland 2021[145]

[139] Velting, D. M., & Gould, M. S. (1997). Suicide contagion. In R. W. Maris, M. M. Silverman, & S. S. Canetto (Eds.), Review of suicidology, 1997 (pp. 96–137). Guilford Press.
[140] https://www.ipso.co.uk/member-publishers/guidance-for-journalists-and-editors/guidance-on-reporting-suicide/
[141] Niederkrotenthaler T, Braun M, Pirkis J, Till B, Stack S, Sinyor M et al. Association between suicide reporting in the media and suicide: systematic review and meta-analysis BMJ 2020; 368 :m575 doi:10.1136/bmj.m575
[142] https://www.ipso.co.uk/member-publishers/guidance-for-journalists-and-editors/guidance-on-reporting-suicide/
[143] https://www.gov.uk/government/news/veteran-suicide-figures-to-be-recorded-for-the-first-time
[144] Suicide Statistics for Scotland: Update of trends for the year 2020. Public Health Scotland 2021.
[145] https://www.publichealthscotland.scot/publications/suicide-statistics-for-scotland/suicide-statistics-for-scotland-update-of-trends-for-the-year-2020/

It can be seen that the highest risk in men is in the 4th and 5th decades of life, and slightly later for women. There is a known link between deprivation and suicide, with higher rates in more deprived areas.

9.1.2 Previous Military Studies

Suicide among military personnel and veterans has been the subject of extensive research but nonetheless no consensus has emerged, although the majority of recent studies have concluded that there is no overall increase in risk.[146, 147] However, an increased risk in women veterans was reported in the 2012 Scottish Veterans Health Study, in comparison with non-veteran women.[147] One previous study[146] reported that Early Service Leavers had higher rates of suicide, although the 2012 Scottish study found no indication that young veterans were at disproportionately high risk.

9.1.3 Suicide in Veterans

The findings of the Trends in Scottish Veterans' Health Study have recently been published in the journal Occupational and Environmental Medicine, from which the following data and graphs are taken.[148] By the end of the follow-up period of up to 37 years in 2017, 388 of the 78,157 veterans had taken their own lives, equating to 0.5% of veterans and 6.6% of all veteran deaths. This compared with 1531 (0.6%) of the 252,637 non-veterans, or 7.8% of the non-veteran deaths. Taking into account the different lengths of follow-up, there was no difference in risk between veterans and non-veterans, as can be seen in the graph below.

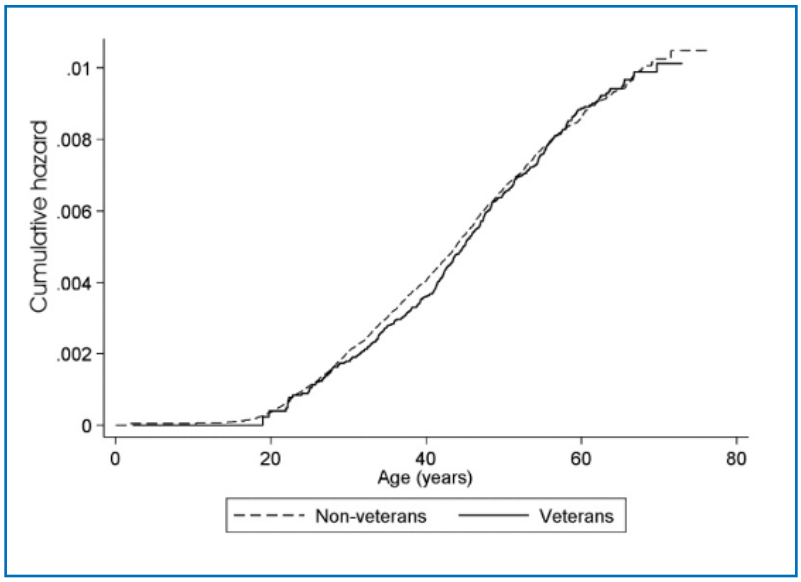


Figure 9-2 - Cumulative Hazard Graph for Suicide in Veterans Compared with Non-Veterans

When the data were analysed by sex, there was **no difference in risk for men**, but **women veterans were at increased risk**, as had been found in the 2012 study. However by now, the increased risk in women was confined to middle-aged women who had joined the Armed Forces up to 1990; there was no difference for younger women. The average (median) age for suicide in veteran men was 44 years, slightly older than non-veteran men for whom the median was 39 years. The difference was even more marked for women, where the median age was 50 years for veterans compared with 38 years for non-veterans. However the most important finding was that, contrary to concerns about young veterans, suicide was commonest **many years after leaving service** – an average of 22 years for men and 27 years for women. There was no increase in risk in veterans who had entered military service as juniors. The finding of an increased risk in Early Service Leavers was explained by deprivation; this group is known to be more likely to live in deprived areas, and once this was taken into consideration, the increase in risk became non-significant.

[146] Kapur N, While D, Blatchley N, Bray I, Harrison K. Suicide after leaving the UK Armed Forces—A cohort study. PLoS Medicine. 2009 Mar;6(3):e1000026.
[147] Bergman BP, Mackay DF, Smith DJ, Pell JP. Suicide in Scottish military veterans: a 30-year retrospective cohort study. Occupational Medicine. 2017 Jul 1;67(5):350-5.
[148] Bergman BP, Mackay DF, Pell JP. Suicide among Scottish military veterans: follow-up and trends. Occupational and Environmental Medicine. 2022 Feb 1;79(2):88-93.

Examination of suicide risk by birth cohort shows that for the majority of birth cohorts, there is no difference in risk between veterans and non-veterans.

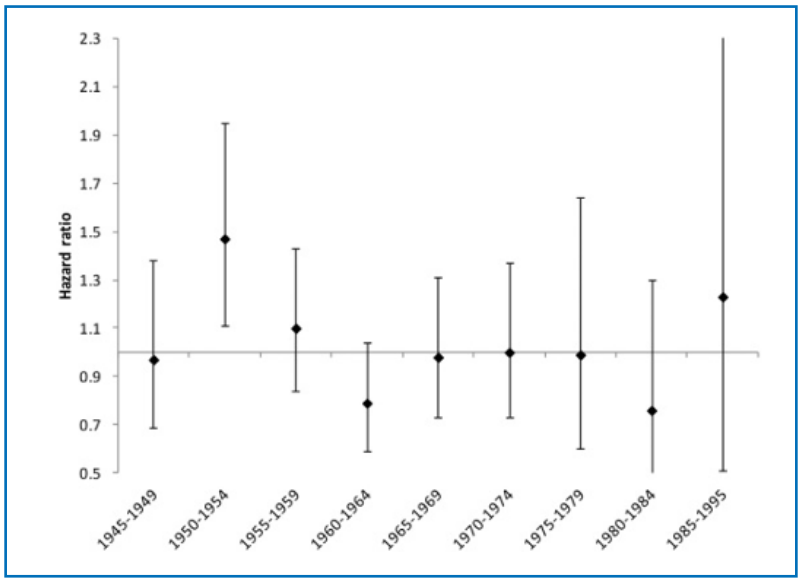


Figure 9-3 - Hazard Ratios for Suicide Risk by Birth Cohort

The exception is the 1950-1954 birth cohort, where there is a statistically significant increase in risk, mirroring the findings in the 2012 study. The reasons for this are not clear but this is the group who would have joined the Armed Forces between 1968 and 1973, at a time of high operational activity in Northern Ireland on Operation BANNER. It is possible that this is a legacy of service there, dating from a time when the mental health impacts of operational service were often overlooked.[149]

9.1.4 Long-Term Trend

Analysing the data to look at what would have been found if the study had been carried out at earlier dates, it can be seen from the following graph that earlier concerns that were raised about suicide in veterans were justified and there was indeed a higher risk. There was a gradual improvement from around 2000, and in the last 10 years, the risk in veterans overall has been no higher than in the wider community.

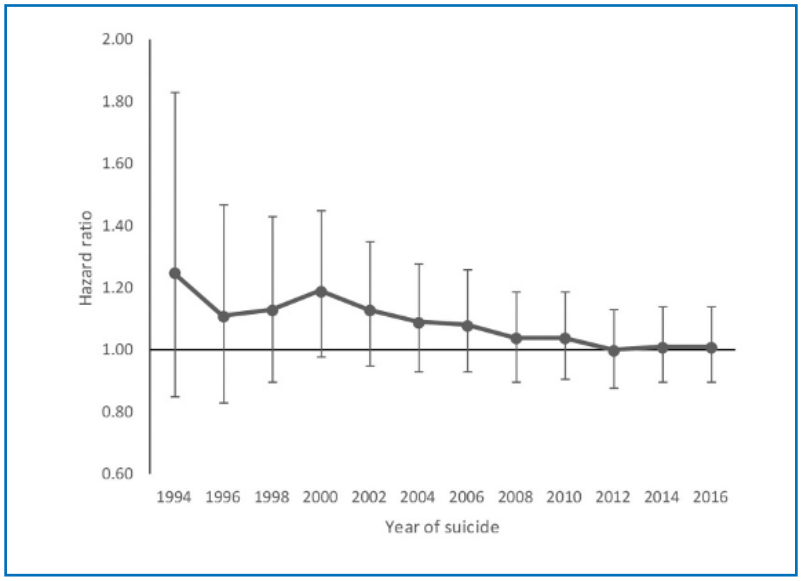


Figure 9-4 - Trends in Suicide Risk 1994-2016

[149] Owen-Smith, M. S. (1981) 'A computerised data retrieval system for the wounds of war: the Northern Ireland casualties', Journal of the Royal Army Medical Corps, 127, 31-54.

9.1.5 Implications and Lessons

One of the purposes of studying the long-term health of veterans is to identify areas of risk, and to provide a scientific evidence base on which policies can be developed. Over the years there has been much speculation about the risks of suicide in veterans. Recent studies have provided much-needed evidence which has highlighted that rather than the highest risk being in young, newly-transitioned, male veterans, it is the **middle-aged veterans**, including women, for whom support is needed. This has important implications as, having left service many years earlier, they may not identify with veteran services. In particular, veterans of the early years of Op BANNER, now in their late 60s and early 70s, may feel that their concerns are of less importance to service providers than those of veterans of Ops TELIC and HERRICK (Iraq and Afghanistan). There is also a concern that **women veterans** may not feel comfortable accessing the currently-provided services, and more research in this area is needed to identify whether women-specific veterans' services would better meet their needs. **Research** is also needed to explore issues underlying mental health difficulties in older women veterans, as there are many issues which could have affected women who served at that time.

9.2 Non-Fatal Self-Harm

In the past, self-harm was considered to be on the same spectrum as suicide, but this is now considered to be an outdated view.[150] In recent years, there has been a growing recognition that although some self-harm episodes may represent failed suicide attempts, the majority, especially in young people, reflect a way of dealing with inner turmoil to provide an emotional release, with no intent to cause death. Examples include cutting, biting, hair-pulling and minor overdoses. A recent classification of non-suicidal self-injury (NSSI) is specific for physical harm and therefore fails to include episodes such as drug overdoses, therefore the older terminology is used here.

There has been a recent increase in the incidence of self-harm, especially among young people, with a concomitant increase in the sharing of graphic images of self-harm on social media.[151] A Royal College of Psychiatrists report estimates that 4.8% of men and 16.7% of women will self-harm at some point in their lives.[152]

9.2.1 Measuring Self-Harm

Many episodes of self-harm take place in private and never come to medical attention; therefore obtaining a valid measure of self-harm using routinely-collected data is problematic, other than from the more severe end of the spectrum where it is more likely that failed suicide attempts will also be captured. Information gained from surveys remains the only comprehensive measure of self-harm, although inevitably this will be subject to response bias as some respondents may be reluctant to admit to self-harming.

Since this study uses secondary care (hospital) data, it is therefore restricted to the more serious cases of self-harm. Nonetheless the comparison between rates in veterans and non-veterans is likely to be valid, as there is no plausible reason why the criteria for hospital admission should differ between veterans and non-veterans.

[150] Muehlenkamp JJ, Gutierrez PM. An investigation of differences between self-injurious behavior and suicide attempts in a sample of adolescents. Suicide and Life-Threatening Behavior. 2004 Mar 1;34(1):12-23.
[151] https://www.webmd.com/parenting/news/20211117/teen-social-media-posts-about-cutting-other-self-harm-are-soaring
[152] Self-harm and suicide in adults. RCPsych Report CR229. July 2020.

9.2.2 Trend in the Wider Community

Data from the UK Clinical Practice Research Datalink, covering over 10 million young people aged up to 20 years, showed a 2.25 times increase in risk of self-harm recorded in primary care between 2003 and 2018, with the majority of the increase occurring from 2012.[153] The authors of the study suggest that risk factors include rising levels of mental ill-health, social deprivation and increasing social media use, which in turn is linked to harassment, low self-esteem and poor body image.[153]

9.2.3 Self-Harm in Veterans

The 2012 Scottish Veterans Health Study showed that 2.9% of veterans had self-harmed, compared with 2.5% of non-veterans, representing an increase in risk averaged across all veterans of 27%, although this may have been an under-estimate. The highest risks were in Early Service Leavers who failed to complete initial training, where the increase in risk was as high as 69%, and also in the oldest veterans. The risk reduced with longer service, and there was a 60% reduction in risk of self-harm, compared with non-veterans, in veterans who had served for over 22 years.

The 2017 study showed that 5.1% of veterans had a record of self-harm, compared with 4.5% of non-veterans, an increased risk in the veterans of 44%. Adjusting for deprivation did not make much difference, only reducing it to 37%. The increase was greater in men than in women, the latter being 23%, compared with 47% for men. Once again the increased risk was only seen in those with the shortest service, and was as high as 89% in Early Service Leavers. This was reflected in the percentage who had self-harmed, which ranged from 7.6% of Early Service Leavers to just 1.1% of people with over 20 years' service. In marked contrast to suicide, where the peak period for suicide was not reached until around 20 years after leaving service, the peak for self-harm was 8 years after leaving for men and 6 years for women, although the picture was complex and the range began shortly after leaving.

There were two peaks of age at self-harm, for both veterans and non-veterans, at 22 and 34 years. The younger peak was higher for non-veterans, whereas there was little difference between veterans and non-veterans at the later peak.

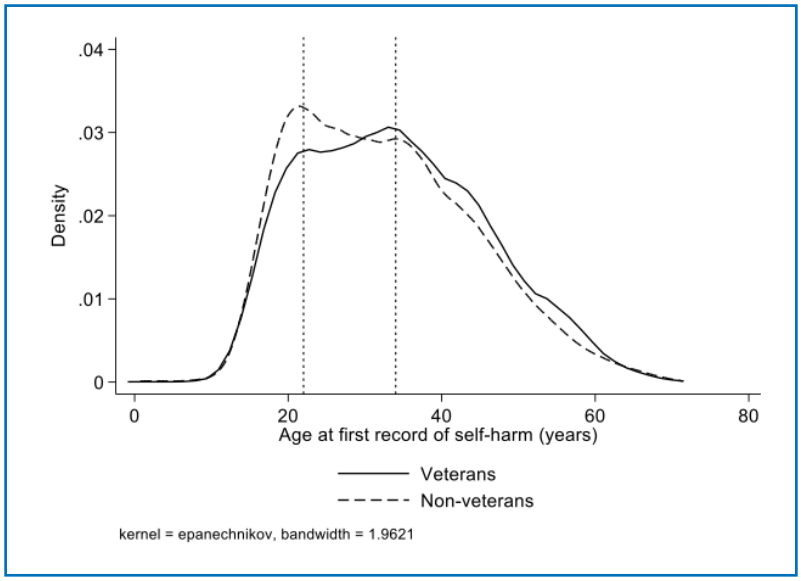


Figure 9-5 - Age at First Record of Self-Harm, Veterans and Non-Veterans

[153] Cybulski L, Ashcroft DM, Carr MJ, Garg S, Chew-Graham CA, Kapur N, Webb RT. Temporal trends in annual incidence rates for psychiatric disorders and self-harm among children and adolescents in the UK, 2003–2018. BMC Psychiatry. 2021 Dec;21(1):1-2.

Examination of the risk of self-harm by birth cohort revealed a change between the 2012 and 2017 cohorts. The overall pattern was similar, but there had been a worsening of risk in all birth cohorts apart from the oldest, and a sustained increase in risk in the newly-added younger veterans. This is consistent with the reported increase in self-harm in young people in the community. Of concern however is the change in the 1970 to 1979 birth cohorts. In 2012 there was no significant difference between these veterans and the corresponding non-veterans, but by 2017 the risk in veterans has increased to be about 50% higher than the non-veterans. As these individuals are in their 40s, they are unlikely to be affected by the issues influencing young people, although they may have been affected by the economic downturn of the 2008 recession. It may also be consistent with the poor mental health experienced by some middle-aged veterans which is reflected in the data for suicide, suggesting that some of these cases are in fact failed suicide attempts. This is also the same birth cohort which is showing the greatest increased risk of PTSD (Section 8.7).

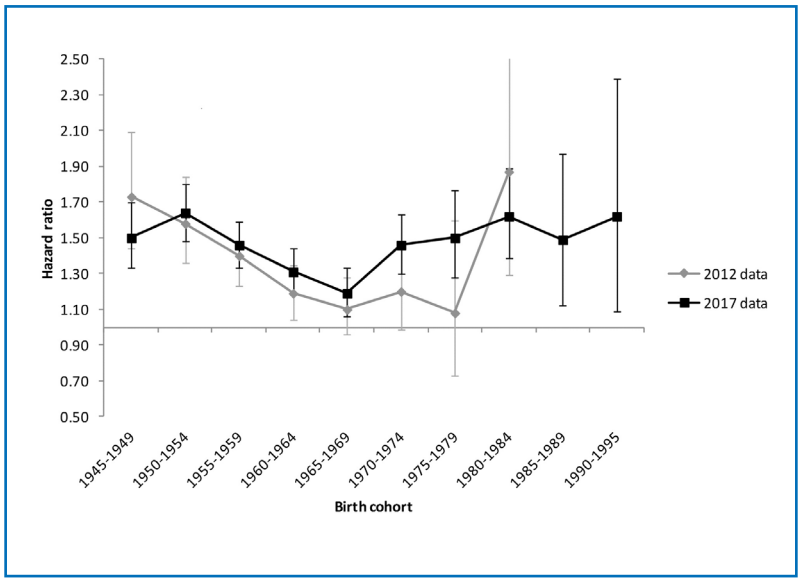


Figure 9-6 - Risk of Self-Harm by Birth Cohort, 2012 and 2017

9.2.4 Self-Harm, Mental Health and Suicide Risk

Around 40% of veterans who were admitted to hospital after self-harming also had a record of being admitted with a mental health condition. This was similar to non-veterans (38%). Mood disorders (depression) and anxiety were the commonest mental health diagnoses in both veterans and non-veterans who self-harmed, but 13.6% of veterans who self-harmed had a record of PTSD, as did 9.2% of non-veterans. However 53% of veterans and 56% of non-veterans who had a diagnosis of PTSD had an admission for self-harm – thus PTSD should be regarded as a major risk factor for self-harm.

Of the veterans who died as a result of suicide, 36.6% had a previous episode of self-harm, similar to the percentage in non-veterans (32.9%). By contrast, suicide after a previous episode of self-harm was much less common, affecting only 3.6% of veterans over the long-follow-up period, compared with 4.5% of non-veterans. There was a difference by age; for veterans aged under 30 at the time of self-harm, only 2.6% ever went on to suicide; whilst for those aged 30 and older, the figure was 4.3%. Age in non-veterans made little difference to the likelihood of subsequent suicide.

Only 2.6% of veterans under 30 who self-harmed later died from suicide

9.2.5 Long-term Trend

Looking at the data to estimate what would have been found if the study had been carried out at earlier dates shows that there was a much higher risk of self-harm in veterans compared with non-veterans in the past, and that the excess has gradually reduced although the rate of change has slowed in recent times. It is impossible to tell from the graph whether this should be interpreted as a reduction in numbers of veterans who have self-harmed, or a greater increase in the non-veterans. The underlying data suggest a complex picture in which there has been a reduction in recorded episodes in both, but more so in the veterans. As this contrasts with the CPRD general practice findings, it may reflect a trend towards more treatment in the community rather than admission to hospital, and illustrates the challenges in drawing conclusions from hospitalisation data since the numbers are known from surveys to have increased in the wider community.

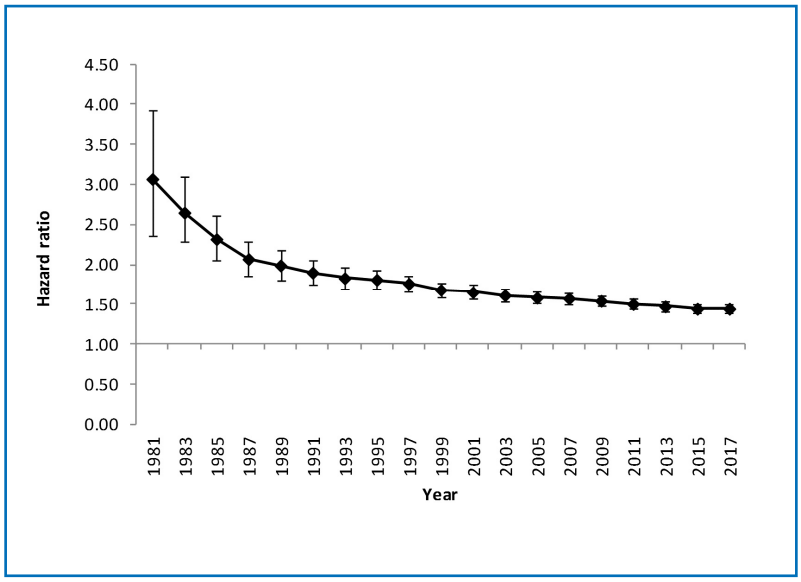


Figure 9-7 Trends in Self-harm Risk 1981-2017

9.2.6 Conclusion

Although this study has shown that a substantial number of veterans have self-harmed, this is also an issue in the wider community, and the trend data suggest that the difference between veterans and non-veterans is reducing, with the picture in veterans becoming more like the wider community. It also illustrates the challenges of interpreting trends in a condition where presentation to a healthcare provider may be complicated by underlying psychological issues. Importantly though, the data provide reassurance that an episode of self-harm in a young person should not be regarded as a precursor to suicide as the risk of that outcome in the longer term remains small. PTSD however is associated with a high risk of self-harm, which should be borne in mind by those providing support to veterans with mental health disorders.

9.3 Substance Misuse - Alcohol

9.3.1 Historical Background

The deliberate fermentation of fruits, cereals and vegetables to produce an intoxicating drink for human consumption can be traced back many thousands of years, and has played an important part in ritual and social activity throughout history.[154] In medieval times, low-strength alcoholic drinks (predominantly ale/beer and wine) were commonly consumed instead of water, providing a measure of protection against the water-borne diseases that were common at that time. Despite the amounts consumed by most people (2-6 pints per day was not unusual) the concentration of alcohol was too low for harm to be an issue. Nonetheless, by the 15th century there are many accounts of drunkenness associated with nights spent in the taverns.[155] It was the introduction of the distillation process for making spirits which began to change the impact of drinking alcohol. At first the popularity of distilled spirits increased only gradually, but by the beginning of the 18th century, encouraged by Government legislation to utilise surplus grain production, vast quantities of gin were being produced, resulting in widespread social harm as encapsulated in Hogarth's 1751 engraving "Gin Lane".

Gin Lane - Hogarth (1751)

9.3.2 Alcohol and the Armed Forces

The military was not immune to the impact of alcohol. In 1780 Monro recommended adding wine or spirits to the water to render it safe to drink in the field,[156] and sailors received a ration of one gallon of beer per day although this was gradually replaced by a daily half-pint of rum (taken diluted 1:4 with water) following the British conquest of Jamaica in 1655.[157] As part of the Army reforms of 1880, the beer ration was replaced with 'beer money', an addition to pay which had the unfortunate effect of increasing the use of taverns by soldiers. However, during the Crimean War (1854-1856) there had been a marked increase in the misuse of alcohol, by now much more intoxicating than the 'small beer' of earlier times, largely as a result of the increase in available cash which each soldier now had.

[154] Liu L, Wang J, Rosenberg D, Zhao H, Lengyel G, Nadel D. Fermented beverage and food storage in 13,000 y-old stone mortars at Raqefet Cave, Israel: Investigating Natufian ritual feasting. Journal of Archaeological Science: Reports. 2018 Oct 1;21:783-93.
[155] Warner J. Before there was Alcoholism: Lessons from the Medieval Experience with Alcohol. Contemp. Drug Probs.. 1992;19:409.
[156] Monro, D. (1780) Observations on the Means of Preserving the Health of Soldiers, London: J Murray & G Robinson.
[157] http://theses.gla.ac.uk/7144/

Already, military public health doctors were aware of the problem. Edmund Alexander Parkes (1819-1876), the first Professor of Military Hygiene, in his textbook of public health[158] said much about avoiding an excess of beer and wine, and recommended that if wine were to be taken at all, it should be as low in alcohol as possible. His observations that "when beer is taken in excess, it produces gradually a state of fullness and plethora[159] of the system", and on wine, "that most persons . . . take too much is highly probable" are as valid today as when he wrote them. It is rarely remembered that it was Parkes' own research paper, published in 1871,[160] which first recommended that alcohol intake should be limited to one fluid ounce (ie 3 units in modern terminology) per day. Parkes found no justification for the use of spirits at any time, and concluded that " . . the British army bears the unhappy character of the most intemperate army in Europe". An unenviable reputation, which modern military health promotion has done much to allay,[161] although the problem is by no means resolved.

Nonetheless, the bulk of the military comprises young adult men, who are traditionally a high-risk group for consuming alcohol. Furthermore, the availability of tax-free cheap alcohol in Germany under the 1951 NATO Status of Forces Agreement[162] provided an environment in which a culture of heavy drinking could flourish, especially in the 1960s, 1970s and early 1980s. Drinking to excess was often associated with a macho bravado. For the majority of people, exposure to this environment represented a 'passing phase' but for a small number, serious harm resulted including road traffic accidents and sometimes falls from barrack-room windows whilst drunk.[163]

9.3.3 The Research Perspective

Many academic papers have been written on alcohol and the Armed Forces, and have generally shown a higher level of alcohol misuse than in the general population, with more people drinking at harmful and potentially harmful levels. A pilot study in 2014 based on a standard alcohol use questionnaire[164] administered at the discharge medical examination showed 65% of people to be in the 'higher risk drinking' group.[165] As this represents the group who are in the process of becoming veterans, it indicates the potential for alcohol-related harm in the veteran community. A later study showed similar results, especially in comparison with the general population, but also indicated the complexity of the interrelationship between military service, deployment, mental health and alcohol.[166] Care is needed in interpretation and comparison of reports as the cutoff values for risk and harm may vary between studies. Where possible, actual AUDIT scores should be examined to obtain meaningful comparisons.

[158] A Manual of Practical Hygiene (1864)
[159] A ruddy complexion
[160] Parkes EA, Wollowicz CC. Experiments on the action of red Bordeaux wine (Claret) on the human body. Proceedings of the Royal Society of London. 1871 Dec 31;19(123-129):73-89.
[161] https://www.arrse.co.uk/community/threads/drinking-culture-in-the-re.301445/ presents a 'soldier's eye view' of the changing attitude to alcohol
[162] https://bfgnet.de/sofa.html
[163] The Author: Personal recollection.
[164] The Alcohol Use Disorders Identification Tool – Concise (AUDIT-C) tool
[165] Aguirre M, Greenberg N, Sharpley J, Simpson R, Wall C. Alcohol consumption in the UK armed forces: are we drinking too much? BMJ Military Health. 2014 Mar 1;160(1):72-3
[166] Rhead R, MacManus D, Jones M, Greenberg N, Fear NT, Goodwin L. Mental health disorders and alcohol misuse among UK military veterans and the general population: a comparison study. Psychological Medicine. 2020 Aug 10:1-1.

9.3.4 Alcohol Misuse in Scotland

Misuse of alcohol in Scotland has almost legendary status, and is a common if arguably inappropriate theme for entertainers. The reality is more serious, although recent figures give rise to guarded optimism. In 2003, 34% of adults exceeded the low-risk weekly guideline for alcohol consumption; this had declined to 24% by 2019. In 2019, 1,020 people died from an alcohol-attributable condition, although the figure was the lowest since 1996. Nonetheless these rates were around 70% higher than for England and Wales. Alcohol-related death was strongly associated with deprivation, being most frequent in the most-deprived communities. The figure was much higher for deaths in which alcohol consumption played a part, for example those cancers which are known to be associated with alcohol. This equated to 6.5% of all deaths in Scotland. Hospital admissions were much greater, at 23,675 people (0.4% of the population), highest in the 55-64 year age group and in the most deprived areas. Men were 2.4 times more likely to be admitted to hospital with an alcohol-related diagnosis than women.[167]

9.3.5 Alcohol-Related Harm in Veterans

The risk of alcoholic liver disease in veterans compared with non-veterans was examined as a measure of the more severe end of the spectrum of alcohol-related harm. In 2012, the condition had been recorded in 1.2% of veterans and 1.3% of non-veterans. The difference overall only equated to a 3% reduction in risk in the veterans, which was not statistically significant, but after making allowances for deprivation, there was a significant 9% reduction in risk. The risk in women was only about half that for men, in both veterans and non-veterans. In 2017, the results were very similar, with a 3% overall reduction in risk, or 8% after adjusting for deprivation. The graph shows the solid line for veterans running slightly below the dashed line for non-veterans, confirming their slightly lower risk.

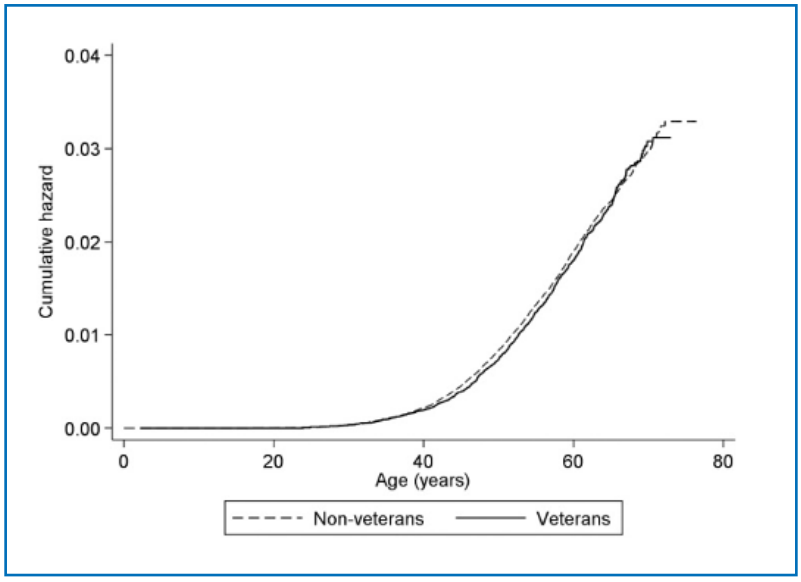


Figure 9-8 - Cumulative Hazard Graph for Alcoholic Liver Disease, Veterans and Non-Veterans

[167] Figures from 'Monitoring and Evaluating Scotland's Alcohol Strategy: Monitoring Report 2021'. Public Health Scotland.

There was a marked difference between untrained and trained Early Service Leavers. Untrained ESL had exactly the same risk as non-veterans, but after training the difference rose to 21% higher in the ESL veterans. Trained ESL constituted the only group of veterans to show an increased risk of alcoholic liver disease. Among the ESL, there was also a difference with age at entry; those who joined below age 20 had only a 20% increase in risk, whereas the increase in ESL who joined between ages 20 and 25 has a 60% increase in risk compared with non-veterans of the same age. In a further complexity, this increased risk was only seen in those trained ESL born before 1960. However all these differences, even in ESL, disappeared once the figures were adjusted to take account of deprivation. In other words, people discharged as ESL took on the alcohol risk of the environment in which they had settled. For veterans who had served for at least the minimum engagement, they had a 12% reduction in risk after adjusting for deprivation.

People discharged as ESL take on the alcohol risk of the community in which they settle

This graph shows the risk of alcoholic liver disease by length of service, without any adjustment for deprivation.

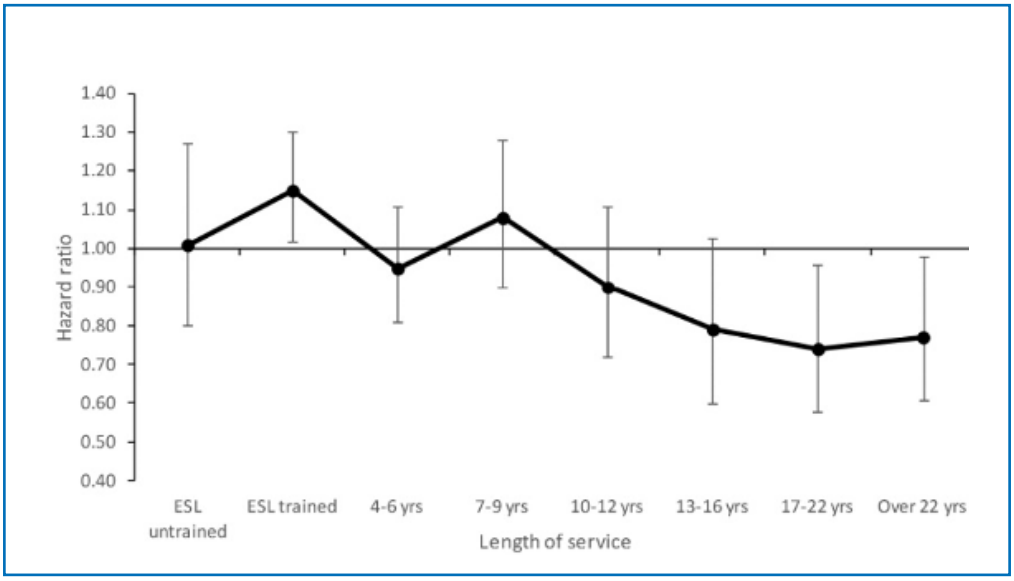


Figure 9-9 - Hazard ratios for alcoholic liver disease by length of service

The increase in risk in trained ESL can be seen, and there is a small increase in risk in people who have served for 7-9 years although the vertical confidence interval bars[168] show that it is not significant. For longer-serving veterans, there is an overall reduction in risk, a pattern which is seen in a number of other conditions and is consistent with a 'healthy worker' effect.

The birth cohort graph shows that the increased risk is also only seen among the oldest veterans, born 1945-1949. As the median age for developing alcoholic liver disease among veterans was 52 years (compared with 50 years in non-veterans), this is not an 'age effect' as it would also be expected to be seen in those born in the 1950s and 1960s who, by now, fall within the at-risk age-group.

[168] See paragraph 4.2.3.3 for an explanation of confidence intervals

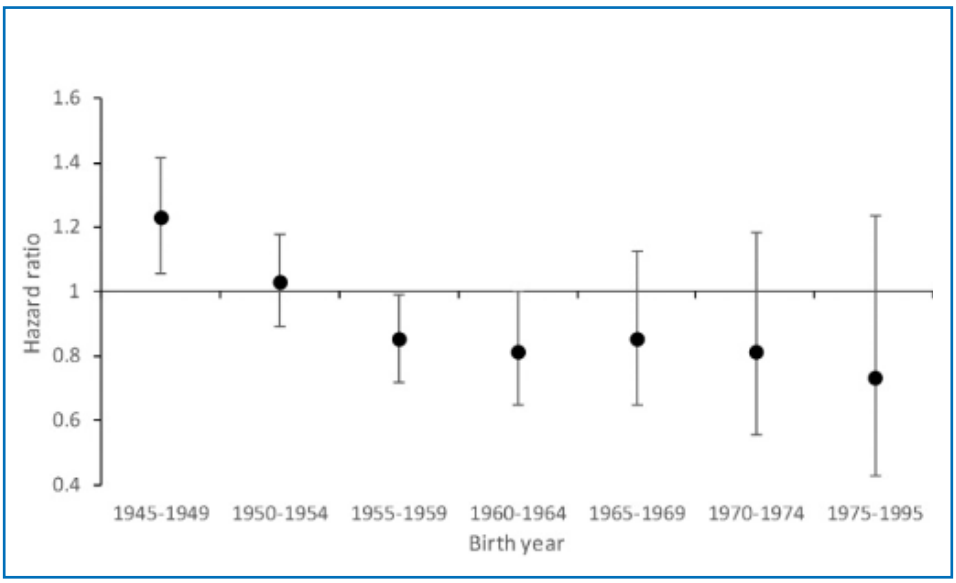


Figure 9-10 - Hazard ratios for alcoholic liver disease by birth cohort

The following trend graph, looking at what would have been found if the data had been analysed at earlier dates, shows an initially erratic pattern as there are very few cases. As the pattern settles down, it is clear that there is an increased risk of alcoholic liver disease in the late 1980s and 1990s, perhaps reflecting the heavy drinking habits of some 20 years earlier, but by 2000 the excess risk is clearly reducing and by 2005 the hazard ratio is very close to the 'neutral' line, dropping below it after 2011. The second graph shows an expanded view of the left-hand graph from the year 2000 onwards.

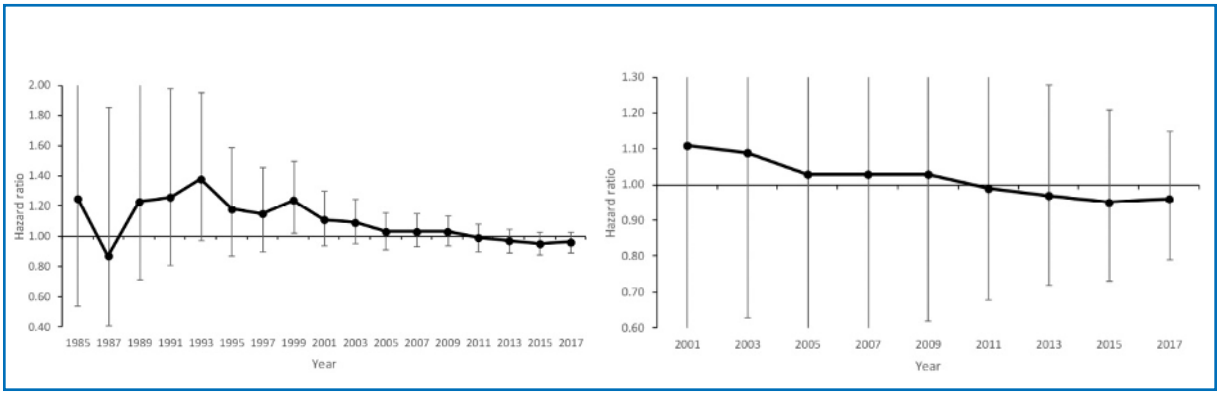


Figure 9-11 - Trend in Risk of Alcoholic Liver Disease 1985-2017 and detail 2001-2017

9.4 Substance Misuse – Drugs

9.4.1 Hepatitis C and Drug Misuse

Measuring drug misuse is problematic as much use is clandestine, and only comes to official notice if criminal justice proceedings result, or if there is healthcare involvement. Hepatitis C infection is sometimes used as a proxy measure for injecting drug use as this is now the main risk factor for the disease. Hepatitis C is a blood-borne virus infection which is readily spread through needle-sharing, and in 2019-2020, 55% of injecting drug abusers in Scotland had evidence of past or present infection.[169] A study in 2004 estimated that 1% of the Scottish population had hepatitis C, of whom 85-90% were injecting drug users. Many people are asymptomatic, but may be diagnosed through screening which is available to drug users, or incidentally during treatment for another condition. There is also a testing programme which operates in Scottish prisons. Hepatitis C is treatable, but untreated it can lead to liver failure or even liver cancer.

9.4.2 Military Drug Misuse

The Armed Forces have had a zero-tolerance policy in respect of drug misuse for many years, based around a compulsory drug testing (CDT) programme. A single positive test normally results in discharge from the Armed Forces, although there are specific circumstances when a more lenient view may be taken as detailed in JSP 835. The number of positive cases is not routinely published, but a Freedom of Information (FOI) request[170] revealed that in the first half of 2017, there were 300 positive results out of nearly 38,000 tests (0.8% positives), of which 200 were for cocaine, 20 for ecstasy, 80 for cannabis and 10 for steroids. None were identified having taken heroin, benzodiazepines (eg Valium), ketamine or amphetamines. A total of 170 soldiers were discharged as a result of a positive test in the same period. The number so dismissed is increasing, and a media report based on a more recent FOI showed around 660 discharges for this reason in 2019.[171] A compulsory discharge following a positive drugs test can have serious consequences, including an increased risk of homelessness, unemployment and mental health problems, as identified by a recent comprehensive study by Galahad SMS Ltd in conjunction with Anglia Ruskin University.[172]

9.4.3 Prevalence of Drug Misuse in the Community

Misuse of drugs is common in the wider community. Data from the Office for National Statistics covering England and Wales to March 2020, prior to the pandemic, show an estimated 9.4% of adults aged 16-59 having taken a drug of abuse in the previous year; this increased to 21% for 16-24 year-olds. The corresponding figures for Class A drugs (including heroin, cocaine and ecstasy) were 3.4% of 16-59 year-olds and 7.4% of 16-24 year-olds. Against that community background, it is easy to see why some members of the Armed Forces take a chance on not being detected through CDT, perhaps after a weekend away with civilian friends. Furthermore, many have pre-service experience of drug use; as many as two thirds of participants in the "Fall Out" study had used drugs prior to service.

9.4.4 Hepatitis C in Veterans

The first Scottish Veterans Health Study showed a very low incidence of hepatitis C in veterans at 0.19% over the period of follow-up to 2012, much lower than the corresponding incidence of 0.36% in non-veterans. On follow-up to 2017, the rate was similar in veterans at 0.18%, although slightly increased in non-veterans at 0.40%. The hazard ratio showed a 50% reduction in risk in veterans overall. The following graph shows the much lower risk in veterans compared with non-veterans, at all ages.

[169] Hepatitis C in the UK 2020. Public Health England.
[170] FOI2017/07239 dated 15 August 2017
[171] https://www.theguardian.com/uk-news/2020/aug/24/rise-in-number-of-british-soldiers-being-sacked-for-drug-use
[172] "Fall Out": Substance misuse and service leavers: a qualitative investigation into the impact of a Compulsory Drugs Test (CDT) discharge. March 2021.

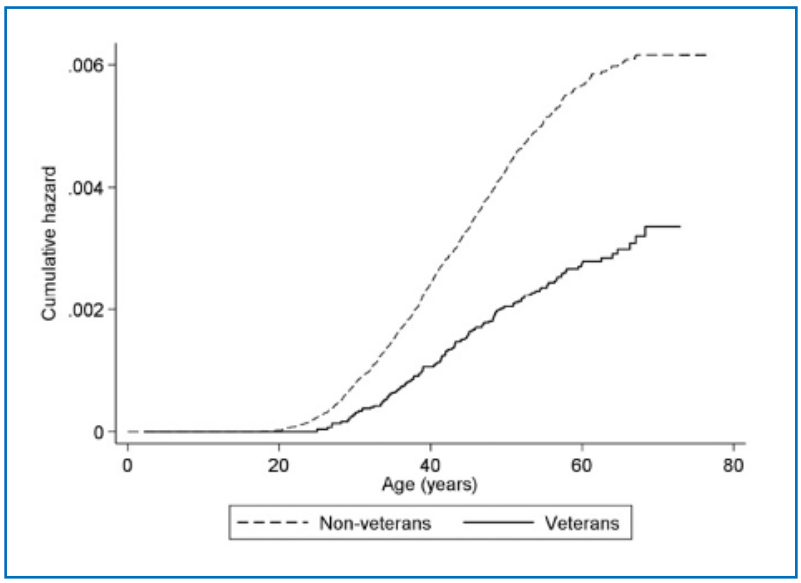


Figure 9-12 - Cumulative hazard graph for hepatitis C

On detailed breakdown, veterans who had completed at least a minimum term of engagement were at 65% reduced risk of hepatitis C, whilst for Early Service Leavers, the reduction compared with the wider community was only 14% and was not statistically significant. The majority of cases were in male veterans; less than 0.1% of female veterans had a diagnosis of hepatitis C. Although the overall case numbers were small, PTSD was strongly associated with hepatitis C in veterans, leading to a tripling of risk compared with all non-veterans and a six times increase in risk compared with veterans who did not have PTSD.

9.4.5 Interpretation

Although the reported discharge of around 600 personnel annually for CDT failure sounds alarming, it represents less than 0.5% of the strength of the Armed Forces. Compared with the prevalence of drug misuse in the community, it suggests that the vast majority of military personnel comply with military policy and eschew the drugs of abuse. The data for risk of hepatitis C in veterans, as a proxy measure for injecting drug abuse, indicate that this avoidance of drug misuse persists into post-service life. The data also suggest that Early Service Leavers have a risk profile which is closer to that of the wider community. Data on CDT failure by length of service were not available but it is plausible that Early Service Leavers, who have had less time to absorb the military ethos, are over-represented in this group.

The association between hepatitis C, and therefore probable drug misuse, and PTSD is of concern. Although the numbers are small, representing only around 2% of the veterans with a record of severe PTSD, it provides a further indication of the need for a holistic approach to the health of anyone with a PTSD diagnosis, ensuring that a history of drug abuse is sought and that testing for hepatitis C is made available.

10 Conclusions And Recommendations

10.1 Understanding Veterans' Health

As will have been seen from the preceding chapters, understanding veterans' health is not a simple matter. There is often a **complex interaction** between a number of factors. **Year of birth** determines wider issues in childhood and the early years, such as increasing rates of parental divorce in the 1960s, and later, when leaving school, youth unemployment in the late 1970s and early 1980s which may have disproportionately affected the non-veteran community. **Length of service** is crucially important; it can influence exposure to in-service hazards, especially in the years before concern about occupational health and safety, but also affects the length of exposure to beneficial workplace health promotion. There is clear evidence of the well-recognised 'healthy worker effect', as well as its converse, the 'less healthy leaver effect'.[173] Increasing rank, which could not be measured in this study, generally goes hand in hand with higher educational attainment, which in turn is often associated with better long-term health. Living in an area of **high deprivation** after returning to civilian life can have profound effects on health; some apparent adverse health risks in veterans disappear entirely when this is taken into consideration, indicating that the health of the affected veterans is simply reflecting background risks in the community in which they settle.

Understanding veterans' health is not a simple matter

Understanding ESL: "Healthy workers" and "less healthy leavers"

Impact of deprivation

Precise targeting of health improvement initiatives

This complexity means that any temptation to generalise veterans' health must be resisted entirely. Broad-brush solutions will, at best, only hit a small part of their target, and precious resources will be squandered. Thanks to over 40 years of high quality health data collection in Scotland, there is now sufficient information to understand not only the main issues affecting veterans' health, but also to identify the groups affected, enabling much more precise targeting of health improvement initiatives and thus much more efficient use of resources.

An epidemiological study such as this is necessarily based on whole populations rather than individuals. It is important to remember that **'less likely' does not mean 'never'**, and even within low-risk groups, there will be at-risk individuals. Work with small numbers, which cannot be published for confidentiality reasons, suggests for example that there might be 100-200 longer-serving individuals who are nonetheless at higher risk. They may well be living relatively isolated lives, and be hard to reach. They cannot be identified from an anonymous study such as this, and it is incumbent on local resources and providers to be aware that they may exist, and to be ready to reach out to them.

[173] Bergman BP, Macdonald EB, Mackay DF, Pell JP. Healthy workers or less healthy leavers? mortality in military veterans. Occupational Medicine. 2019 Dec 31;69(8-9):570-6.

10.2 Veterans and Smoking

The biggest single influence on veterans' health that this study has identified is **tobacco smoking**. The 2017 study has shown that over a maximum of 37 years' follow-up, 5.4% of the cohort of Scottish veterans were diagnosed with COPD. We have seen in Chapter 6 that a further 1% of the veterans had been diagnosed with lung cancer, and in Chapter 5 that 4% of veterans had had a heart attack and 1.3% had been diagnosed with peripheral arterial disease. For all these conditions, smoking is the biggest risk factor. There are many other smoking-related conditions where the risk in veterans exceeds that in non-veterans, such as duodenal ulcer and cancer of the mouth and throat, which were out of scope for this publication although they are included in the 2012 study report.[174] Even allowing for some overlap for people with more than one condition, **at least one in 20 veterans**, and possibly closer to **1 in 10**, has experienced a major smoking related disease with life-long (and possibly life-limiting) consequences. And that is in a cohort in which many people have not yet reached the peak age for these conditions. The message could not be clearer. **The greatest modifiable threat to veterans' health is tobacco smoking**. And stopping smoking at any age, even into older age, reduces the risk.

The greatest modifiable threat to veterans' health is tobacco smoking

For all these conditions, the risk is highest in the veterans whose service is the shortest, especially the **Early Service Leavers** (ESL) who left service without completing the initial minimum engagement. A study in 1989 showed that current smoking was highest in people with the lowest rank, whilst the number of people who had never smoked, or were ex-smokers, rose steadily with rank as seen in Figure 10-1.[175]

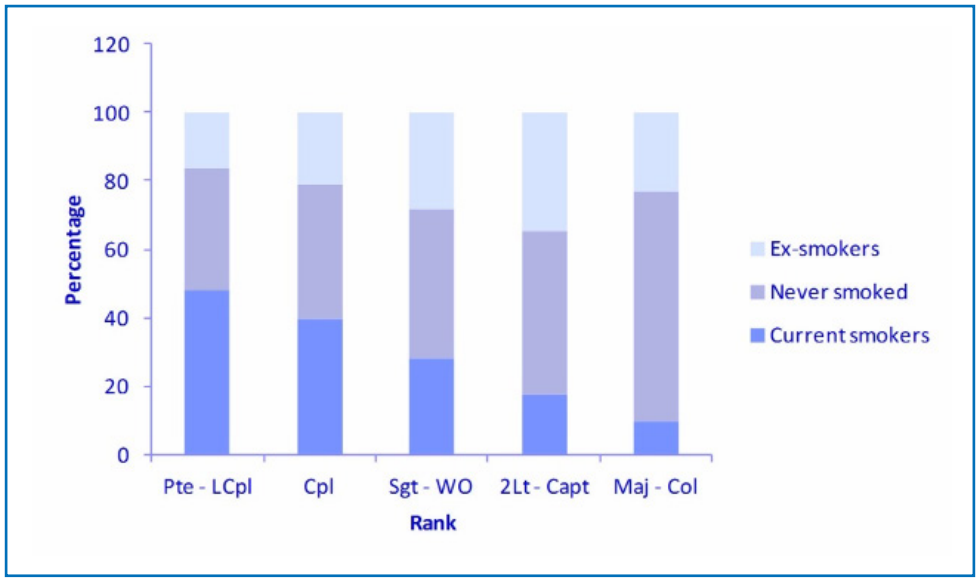


Figure 10-1 - Smoking Prevalence by Rank

[174] The Scottish Veterans Health Study http://theses.gla.ac.uk/7144/
[175] Adapted from Lodge LH. Tri-service Health Questionnaire-1989. Journal of the Royal Army Medical Corps. 1991 Jun 1;137(2):80-3.

Other studies have shown that the driver for in-service smoking is not operational stress, as is sometimes surmised, but 'bonding'(especially in recruits), boredom and a desire for self-control,[176] exacerbated in the past by the availability of cheap duty-free cigarettes on overseas postings. Occupational stress due to low job control and high job demand, especially being 'messed about', was another factor. For people who leave early, there is minimal opportunity during service to influence change of behaviour though health promotion and health education. Many will **already be smokers by the time they join the Armed Forces**; a study published in 1961, when the oldest people in the Scottish study cohort were recruits, showed that 22% were regular smokers by the age of 13, and by 15 years of age as many as 58% were smoking regularly, with adult smoking habits generally established by the age of 17.[177] Thus the only opportunity to change habits in-service for those at highest risk is for **smoking to be prohibited altogether during recruit training**; by doing so, it may be possible to break the habit in people who are already smoking, and prevent non-smokers from being encouraged to start. Otherwise, the responsibility and initiative for smoking cessation encouragement and support to those at highest risk necessarily falls to the civilian sector, during the post-service phase of life.

RECOMMENDATION 1
Smoking cessation is the single most effective measure which can be taken to improve veterans' health.

RECOMMENDATION 2
Smoking during recruit training should be prohibited in order to break the link between 'bonding' and tobacco.

RECOMMENDATION 3
Recognising the unique nature of the military environment in which many veterans commenced smoking, cessation services specifically aimed at veterans should be made available, and healthcare providers should be encouraged to refer veterans of any age into these services in order to reduce the burden of smoking-related disease.

10.3 Veterans and Alcohol

No overall increase in long-term risk of alcoholic liver disease

Although many studies have shown potentially harmful levels of drinking among serving personnel and to a lesser extent veterans,[178] reassuringly the long term follow-up data do not indicate that this pulls through into an overall increased risk of one of the most serious consequences, alcoholic liver disease. An increased risk has been demonstrated in the oldest veterans, now in their 70s, and also in Early Service Leavers who completed training, but in the latter case, the increase is explained by a greater likelihood of people in this group living in a deprived area and adopting the drinking patterns of their local environment.

The trend over time is also encouraging. There was an increased risk in the 1980s and 1990s as identified in the 2012 study, which would have corresponded to heavy drinking in the 1960s and 1970s since on average there is around a 20-year lag between heavy drinking as a young person and developing alcoholic liver disease. This would have been the period when the oldest veterans were being diagnosed. However the graph at Figure 9-11 shows that since around 2010, the risk in veterans has been the same as the non-veteran population, suggesting that by about 1990, even if people were drinking heavily in-service, that pattern of heavy drinking did not persist for long enough in most people to do lasting damage.

[176] Hodgson, H. "Who's There but Cigarette?" Unpublished MSc thesis, University of London 1997.
[177] Richards HJ, Crowdy JP. Smoking habits of young soldiers. British Journal of Preventive & Social Medicine. 1961 Apr;15(2):84.
[178] Murphy D, Palmer E, Westwood G, Busuttil W, Greenberg N. Do alcohol misuse, service utilisation, and demographic characteristics differ between UK veterans and members of the general public attending an NHS general hospital?. Journal of Clinical Medicine. 2016 Nov;5(11):95.

That is not to say that harm from drinking did not occur, and indeed it still does – only that the risk of long-term harm now appears to have fallen back to the level of the general population. **Low risk does not mean never**, and even a short period of heavy drinking in-service risks acute harm such as **accidental injury or assault which could have lifelong consequences**. However, society's relationship with alcohol is changing, especially among young people, and it is likely that wider societal trends will drive future military drinking patterns. Whilst generally alcohol is less of a feature of young people's lives today, the reverse may be true for young women.[179] Mental health disorders, and especially PTSD, also increase the risk of alcohol misuse.[180] Therefore although the risk in veterans may now be no higher than in the non-veteran community, it is likely to remain an issue for the foreseeable future and efforts to **minimise harm**, and to identify and treat those whose lifestyle has exposed them to alcohol-related harm, will need to be continued, recognising the specific circumstances which may have been the driver for harmful drinking in some veterans.

'Low risk' does not mean 'never'

RECOMMENDATION 4
Some veterans may misuse alcohol because of Service-related mental health disorders. Their needs may not be best met by routine addiction services in the community. Services aimed at veterans are likely to be a better fit for their needs.

10.4 Mental Health

In recent years, the mental health of Service personnel has been the subject of a hitherto unprecedented volume of research, stimulated initially by concerns about the emergence of what was to become widely known as Gulf War Illness or Gulf War Syndrome in the aftermath of the first Gulf conflict. Over time it became clear that the occurrence of medically-unexplained symptoms had been described following every major conflict for which records existed, at least as far back as the Crimean War (1854-1856). The nature of the symptoms which developed changed over time, but tended to be tied to currently prevailing health concerns.[181]

The Trends in Scottish Veterans' Health Study has demonstrated a worsening in the mental health of specific groups of veterans between the 2012 and 2017 studies, although there was little change in the overall difference in risk, and indeed there has been a lessening of the difference from the wider community in other groups. Whilst it is tempting to attribute any worsening to the intensity of operations in Iraq and Afghanistan, many of the poorest outcomes have been in the Early Service Leavers, and in particular those whose time in service was restricted to initial training. This latter group cannot have deployed operationally, and as the recruit training establishments are strictly controlled with regard to health, safety and good management practice, these mental health outcomes are highly unlikely to have resulted from their military service.

[179] Shipton D, Whyte B, Walsh D. Alcohol-related mortality in deprived UK cities: worrying trends in young women challenge recent national downward trends. Journal of Epidemiology & Community Health. 2013 Oct 1;67(10):805-12.
[180] Debell F, Fear NT, Head M, Batt-Rawden S, Greenberg N, Wessely S, Goodwin L. A systematic review of the comorbidity between PTSD and alcohol misuse. Social Psychiatry and Psychiatric Epidemiology. 2014 Sep;49(9):1401-25.
[181] Jones E, Hodgins-Vermaas R, McCartney H, Eeritt B, Beech C, Poynter D, Palmer I, Hyams K, Wessely S. Post-combat syndromes from the Boer war to the Gulf war: a cluster analysis of their nature and attribution. BMJ. 2002 Feb 9;324(7333):321.

Over the same period, there has been a marked worsening in mental health in the community, especially among young people.[182] It is likely that the factors influencing mental health in the wider community are also operating within the veteran community, however further research is needed to identify why the veteran community appears to be disproportionately affected. It may not be a negative finding, as in-service health promotion aims to encourage Service personnel to seek help for mental health issues. It may therefore be that the higher rates of admission for treatment in veterans reflect **better help-seeking**, and are **reducing the hidden burden of untreated conditions** within the veteran community.

A particular concern is the 1970-1979 birth cohorts, where there was no statistically significant difference from the wider community in 2012 but by 2017, there is a highly significant difference, which cannot readily be explained (see Section 8.4). Further research is needed to explore what is driving this trend, in veterans who are now in or approaching middle age.

RECOMMENDATION 5
Research is needed to explore the substantial increase in risk of mental ill-health in veterans born between 1970 and 1979.

10.4.1 Individual Mental Health Diagnoses

10.4.1.1 Mood Disorder (Depression)

Depression illustrated the complex factors which underlie the top-level statistics. An overall 22% higher risk of hospitalisation for a severe depressive illness in the 2012 study reduced to 16% after taking deprivation into consideration, and further reduced to 9% after excluding people who also had PTSD. The 2017 study showed a small reduction in excess risk overall, but this was made up of a reduction in the oldest veterans and an increase in the youngest. Early Service Leavers made up the majority of the increase, and if they were excluded, there were no differences from the wider community among male veterans, and a decrease in risk in female veterans, as described at Section 8.5.

10.4.1.2 Anxiety

Anxiety showed a similar pattern to depression, with the increase in risk predominantly confined to younger Early Service Leavers.

10.4.1.3 Post-Traumatic Stress Disorder

In both the 2012 and 2017 studies, veterans had a higher risk of PTSD overall than non-veterans, but the gap widened between the two studies, with the greatest change in the veterans born in the late 1970s and early 1980s. Perhaps reassuringly, the risk has reduced slightly in the most recent 1985-1995 birth cohort, but longer follow-up will be needed to establish whether this is maintained as these birth cohorts reach middle age. In the meantime, more research is needed concentrating on the high-risk group who are now middle-aged to try to establish what is driving the deterioration. As far as can be established from the Scottish Veterans datasets, many of them had left service before the start of operations in the Gulf, but without access to individual service records or specific survey data, no greater detail is available.

RECOMMENDATION 6
There is an urgent need for research into the mental health of middle-aged veterans to establish the reasons for the worsening increase in their risk of PTSD.

[182] Mental Health of Children and Young People in England, 2020. NHS Digital.

It is clear from the foregoing that the dominant difference in mental health outcomes is underpinned by PTSD, and furthermore that this diagnosis is associated with increased risks of a number of serious long-term physical conditions including cardiovascular disease, lung cancer and diabetes. The association between PTSD and these conditions is widely recognised in the medical literature, and it is likely that lifestyle factors such as smoking, lack of exercise and an unhealthy diet play a major part. The provision of care to veterans with mental health difficulties opens up an opportunity to address these issues and thereby minimise the risks of serious life-limiting consequences.

RECOMMENDATION 7
It is imperative that there is a holistic approach to the provision of care to veterans with mental health disorders. Screening for diabetes is essential, as is the provision of general lifestyle advice and access to smoking cessation and weight management services as appropriate. Although there may be a reluctance to embark on these interventions, perhaps because of a perception that smoking and dietary excess are 'comforting', such concerns are misplaced and lifestyle advice should be regarded as an important adjunct to mental health care.

10.4.2 "Fourteen Years to Treatment"

In 2007, an audit by Combat Stress showed that the average delay from leaving service to presenting with a Service-related mental health problem was 14 years.[183] This has been widely interpreted as indicating that veterans are reluctant to seek treatment for mental health issues and, by extension, that earlier identification of problems would facilitate more timely intervention. Analysis of the Scottish Veterans data shows that the average age of leaving service is 26 years, whilst the average age to receive a specialist mental health diagnosis is around 40 years – **a difference of 14 years**. The Scottish Veterans studies have shown that there is no difference between veterans and non-veterans in the age at which a mental health diagnosis is made. Thus the finding of a 14-year interval from leaving service may simply be a reflection of the age at which mental health problems become most prevalent. This study has also shown that the peak age for suicide in veterans in is the forties, as it is in the wider community.

Support for middle-aged veterans is critically important

There has been much recent emphasis on the mental health of young veterans, and whilst it is essential that their needs are met, it is critically important that **support for middle-aged veterans** is not overlooked. It may not be true to assume that their problems could be picked up earlier; the problems faced by the middle-aged veteran may simply not have been present in earlier years. The challenges of the middle years, across the community, include children leaving home, relationship breakdown (the 'empty nest' divorce in couples who have stayed together only 'for the sake of the children'), job loss, especially where the post-service employment was in one of the other age-limited uniformed services, financial hardship and much else. Memories of in-service trauma, if present, may resurface if the personal factors contribute to loneliness, boredom and consequent rumination, and **may only add to the burden**.

RECOMMENDATION 8
Middle age has been identified as a high-risk period for mental ill-health and suicide in veterans. They may not identify with current service provision, which they may perceive as being targeted at young veterans of more recent conflicts. There is a need to reach out to this age-group and provide services tailored to their needs and experiences. Women veterans may benefit from separate dedicated support.

[183] Busuttil, W. (2010) 'Combat-related stress' in Conrad, D. W., Alan, ed. Promoting Men's Mental Health, Abingdon: Radcliffe Publishing Ltd, 132.

10.5 Achieving Change

As noted in the opening chapter, factors impacting adversely on the health of veterans can operate in any of three periods; pre-service, in-service, and post-service. The pre-service factors encompass both genetic makeup, which cannot be changed in the present state of medical knowledge, and those factors operating during childhood and adolescence such as exposure to adversity, substance misuse and the impact of poverty. These form a baseline from which the recruit joins the Armed Forces, and will ultimately influence future health as a veteran. There is only a limited extent to which the effect of pre-service factors can be mitigated.

In-service factors have the greatest potential for achieving change in long-term health potential, something which has been recognised for many years. It has been said that the health of veterans used not to be a concern of the military, as long as they remained fit enough to give a few years' service. However it is clear from early books on military health that this negative view is an over-simplification. At a time when life expectancy in the wider community was limited,[184] infectious disease was a major cause of death, and the causes of many chronic diseases were unknown, the concept of 'workplace health promotion', aimed at protecting future health, still lay in the future although a few far-sighted and philanthropic employers were beginning to see the benefits of looking after the health of their workers.[185] It was not until the early 1970s that this began to change across the community, with the passing into law of the **Health and Safety at Work Act 1974**, which placed a responsibility on employers to ensure that people were not adversely affected by their work. By now, improvements in sanitation, immunisation and treatment meant that **infectious diseases were no longer such a great threat**. The causes of some serious or chronic diseases were also beginning to be understood, with research in the 1950s having identified the link between smoking and lung cancer. With occupational ill-health beginning to be addressed, there was a gradual realisation that **lifestyle 'choices'** such as smoking, exercise and nutrition played an important part. Whilst these were challenging for the majority of employers to address, the Armed Forces were in the unique position of providing not only an occupation but also a living environment. At around the same time, the UK's first health promotion strategy had been published, and the Ministry of Defence took the first steps towards what would become the **Defence Health Strategy** in 1978 with the introduction of the Basic Fitness Test. Since then, mandatory health promotion has been an integral part of military life.

Mandatory health promotion is now an integral part of military life

10.5.1 Is It Proving Effective?

Many of the graphs show that people who were born in the first two or three birth cohorts, between 1945 and 1954 or 1959, had poorer long-term health outcomes than their civilian peers. They would have generally started their service between 1960 and the mid-1970s, when there was little emphasis of either health promotion or health protection (apart from routine vaccinations). Furthermore, at least in the earlier part of that period, many of the senior NCOs would have seen service in the Second World War, which may have impacted on their attitude to risk.

[184] By 1950, the average life expectancy in Europe was still only 60 years
[185] For example, Robert Owen at New Lanark (1800), George Cadbury at Bourneville (1900), and Joseph Rowntree at York (1904)
[186] "Prevention and Health: Everybody's Business". Department of Health (1976)

Longer service is generally beneficial to health

The generation who were born from 1960 onwards joined for service in the late 1970s, at the time that health promotion was becoming embedded in military life. Forty or more years on, the impact is clearly visible in the birth cohort graphs, where for many conditions the risk becomes no greater (and sometimes lower) than the general population in the 1960+ birth cohorts, and in the trend graphs. For these same conditions, generally there is a negative gradient of risk with longer service, in other words the longer people have served, the lower their health risk. This clearly points to a beneficial effect of in-service health promotion; those who have served longest have the greatest exposure to it. The converse is seen with Early Service Leavers; discharged after only a short period of service, they have not served for long enough to benefit. It is reasonable to conclude that longer service is generally beneficial to health.

Early Service Leavers have not served for long enough to benefit

10.5.2 Demonstrating Change

Many long-term conditions, by their nature, only **develop many years after exposure**. It make take 30-50 years from starting to smoke before lung cancer develops; alcoholic liver disease may occur some 25 years after starting to drink heavily. Mesothelioma as a result of exposure to asbestos often takes 30 or more years to develop. Thus it may be many years before the **impact of a change** in a health-related policy affecting young people can be seen and measured. The Armed Forces policy on smoking cessation[187] was founded on work done in the late 1950s and early 1960s[188] which demonstrated that young soldiers were smoking around 20% more than civilians. It took **50 years** for the Scottish Veterans Health Study to be able to demonstrate that this pulled through into a 20% higher risk of lung cancer and other smoking-related diseases.[189] More recent work demonstrates that **the excess risk is now falling**, especially in the post-1960 generation of military personnel although their smoking rates still remain higher than the wider population.

It is therefore necessary to **manage expectations**. Often when interventions are being funded, there is a requirement to **demonstrate benefit** in order to justify the expenditure. As has been shown in this report, it may simply not be possible to do that within any reasonable timeframe. The **natural history of disease**, and especially the diseases of lifestyle which are most amenable to intervention, operates on a much longer timescale. Of course that is not a reason for inaction; interventions to improve long term health, aimed at young people but only producing tangible results many years later, are an investment for the future. In the short term, the only possible evaluations may have to be based on the **interventions delivered**, or immediate **behaviour changes**. Evaluation of the ultimate goal of reducing the burden of chronic illness in later life will be for future generations of researchers. In the meantime, routine monitoring of the health of veterans is recommended in order to identify emerging trends and ensure that services can be matched to need.

Interventions to improve long-term health are an investment for the future

RECOMMENDATION 9
Statistics on the health of the veteran community should be routinely monitored and published by national statistical organisations. This should be greatly facilitated by the recent inclusion of the "Are you a veteran?" question in the decennial census.

[187] Initially encouraging medical and dental staff to provide support to smoking cessation, with a later (2006) ban on indoor smoking
[188] Richards HJ, Crowdy JP. Smoking habits of young soldiers. British Journal of Preventive & Social Medicine. 1961 Apr;15(2):84.
[189] Bergman BP, Mackay DF, Morrison D, Pell JP. Smoking-related cancer in military veterans: retrospective cohort study of 57,000 veterans and 173,000 matched non-veterans. BMC Cancer. 2016 Dec;16(1):1-9.

1 Technical Appendix 1 - Methodology

1.1 Selecting the Veterans

Trends in Scottish Veterans' Health is a retrospective cohort study of all veterans born between 1 January 1945 and 31 December 1995 who were identified on the National Health Service Central Registry database as having been registered with National Health Service (NHS) Scotland both pre- and post-service. All those who join the Armed Forces from Scotland are notified to NHS Scotland by the recruiting offices, which results in a cipher for "Exit to Armed Forces" being added to the record. Re-registration of that individual with NHS Scotland after service results in a "Rejoin from Armed Forces" cipher being added to the record. Selection of veterans for the study was on the basis of this pair of ciphers. As a result, 78,385 veterans were identified; this figure is believed to be reasonably complete for the eligible age-group, although there is a possibility that some people who joined in the 1990s may have been missed owing to a change in the registration process at that time.

1.2 Selecting the Non-Veterans

A comparison group of people with no record of service was then selected, by running a process script on the NHS Scotland central database to select four people without the Service-related ciphers for every veteran, matched on postcode sector of residence (mean population 5,000), year of birth and sex. This generated some duplicates among the non-veterans; elimination of the duplicates resulted in the required output file of approximately 3:1 non-veterans:veterans, comprising 252,637 matched individuals with no record of service. As there were fewer women than men to be matched, less duplicates arose and therefore fewer female records required removal. This gave rise to ratios of 3.17:1 for men and 3.83:1 for women; it is unlikely that this slight oversampling of matched non-veteran women has introduced any appreciable selection bias.

1.3 Data Linkage

Data linkage was then performed by eDRIS (Public Health Scotland) to link the demographic data at an individual level to clinical records held on the Scottish Morbidity Record (SMR) 01 (hospital admissions), SMR 04 (psychiatric hospital admissions and day cases), SMR 06 (cancer registrations) and specific disease registers (diabetes, multiple sclerosis and renal failure). Data on deaths, including ICD-coded principal cause, was obtained by linking with the National Registers of Scotland (NRS) records. The maximum period of follow-up was from the start of Scotland's computerised health records on 1 January 1981 (or date of leaving the Armed Forces, for veterans, if later) to 31 December 2017. Length of service was derived from the dates of the armed forces ciphers, and socio-economic status was obtained from the last recorded postcode of residence, using quintiles of the Scottish Index of Multiple Deprivation (SIMD) classification.

1.4 Ethics

The study was approved by the Public Benefit and Privacy Panel of the Information Services Division of NHS Scotland (now eDRIS), approval number 1718-0133. As a pseudo-anonymised secondary data study, consent from the individual study participants was not required. All analyses were conducted within the NHS Scotland Safe Haven, and all outputs were approved by an Information Governance assessor prior to release to ensure that they were non-disclosive.

1.5 Coding

Clinical outcomes were coded using the International Classification of Diseases (ICD) codes; version 9 (ICD-9) for outcomes to 31 December 1996 and ICD-10 for outcomes from 1 January 1997. Surgical procedures were coded using the Office for Population Censuses and Surveys (OPCS) Classification of Interventions and Procedures codes; version 3 (OPCS-3) for procedures undertaken prior to 1992, and OPCS-4 for later procedures. Details of the codes used in the Trends in Scottish Veterans' Health study are shown in Technical Appendix 2.

1.6 Statistical Methods

The majority of the statistical analyses were undertaken using survival analysis, predominantly Cox proportional hazard models, to examine the association between veteran status and each specific outcome, using age as the time-dependent variable, age at first record of the outcome as the failure time, and death (if no record of the specific outcome) as the censor time. Where appropriate, the analyses were stratified by sex, birth cohort and length of service, the latter generally using intervals based on common terms of engagement. Hazard ratios and p values were calculated, and the a priori rejection level was set at 0.05. Proportionality was tested using methodology based on Schoenfeld residuals. In order to assess trends over time, sensitivity analyses were performed to examine the notional hazard ratios that would have been found if the data analyses had been performed at earlier points in time. Co-morbidities were examined using odds ratios. All statistical analyses were performed using Stata ® v.16, and Excel 2007 was used in the preparation of graphical outputs.

2 Technical Appendix 2 – Codes Used in Data Fields

Data field	ICD10 codes	ICD9 codes	Location
Acute myocardial infarction	I21	410	SMR1 principal position or death certificate underlying cause
Stroke	I61-I64 I60	430, 431, 432, 434, 436	SMR1 principal position or death certificate underlying cause
Peripheral arterial disease	I702 I73-I79	443.9, 440.2	SMR1 principal position or death certificate underlying cause
Any cancer	C00-C97 D00-D09	140-239 less 210-229	SMR1/SMR6 any position or death certificate any position
Colorectal cancer	C18-C21	153-154	SMR1/SMR6 any position or death certificate any position
Lung cancer	C33 & C34	162	SMR1/SMR6 any position or death certificate any position
Breast cancer	C50	174-175	SMR1/SMR6 any position or death certificate any position
Prostate cancer	C61	185	SMR1/SMR6 any position or death certificate any position
Testicular cancer	C62	186	SMR1/SMR6 any position or death certificate any position
Hodgkins lymphoma	C81	201	SMR1/SMR6 any position or death certificate any position
Non Hodgkins lymphoma	C82-C85	200, 202	SMR1/SMR6 any position or death certificate any position
Leukaemia	C90-C95	203-208	SMR1/SMR6 any position or death certificate any position
Malignant melanoma	C43	172	SMR1/SMR6 any position or death certificate any position
Intracranial cancer	C71	191	SMR1/SMR6 any position or death certificate any position
Dementia	G30, F00-F03	290, 331.0	SMR1/SMR4 any position or death certificate any position
Mood disorders	F30-F39	296	SMR1/SMR4 any position or death certificate underlying cause
Anxiety	F40-F48	300, 308-309	SMR1/SMR4 any position or death certificate underlying cause
COPD/asthma	J40-J46	490-496 less 494 & 495	SMR1 principal position or death certificate underlying cause
Alcoholic liver disease	K70	571.0, 571.1, 571.2	SMR1 principal position or death certificate underlying cause
Hepatitis C	B17.1,B18.2	070.7, 070.4, 070.5	SMR1 principal position or death certificate underlying cause
Peptic ulcer	K25-K27	531-533	SMR1 principal position or death certificate underlying cause

Oropharynx/larynx cancer	C00-C14, C32	140-149, 161	SMR1/SMR6 any position or death certificate any position
Non-melanoma skin cancer	C44	173	SMR1/SMR6 any position or death certificate any position
Mesothelioma	C38.4, C45	163	SMR1/SMR6 any position or death certificate any position
Multiple sclerosis	G35	340	SMR1 principal position or death certificate underlying cause
Motor neuron disease	G12.2	335.2	SMR1 principal position or death certificate underlying cause
Diabetes	E10-E14	250	SMR1 principal position or death certificate underlying cause
Self-harm/suicide	X60-X84, Y87.0, Y10-Y34, Y87.2	E950-E959, E980-E989	SMR1/SMR4 any position or death certificate underlying cause

Data field	OPCS-4 codes	OPCS-3 codes	Location/notes (all codes include subcodes where appropriate)
Colon/rectum resection	H04-H11 H29	460-461 471-472	
Lower gastrointestinal diagnostic endoscopy	H22	468	
Coronary artery bypass graft	K40-K46	304	
Coronary angioplasty/ stent	K49, K50 K75	304	
Prostatectomy (open)	M61	630-635 excl. 633	
Prostatectomy (endoscopic)	M65	633	
Mastectomy & partial mastectomy	B27, B28 B41	381-385	
Primary total hip replacement	W37-W39 W93-W95	910	
Primary total knee replacement	W40-W42	812	
Amputation (lower leg)	X095	873	
Amputation (upper leg)	X09 excl. X95	870-872	
Amputation (foot)	X01	874	
Amputation (toe)	X11	875	
Smoking cessation therapy	E98	~	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