

The Impact of Deployment and Combat Exposure on Physical Health Among Military Personnel: A Systematic Review of Incidence, Prevalence, and Risks

Alina E. Teplova, MD, MSc^{*}; Heilwine A.H.M. Bakker, Dr[†]; Sander I.B. Perry, MSc[‡]; Faridi S. van Etten-Jamaludin, Bc[§]; Marie-Christine J. Plat, PhD^{||}; Margaretha B.M. Bekkers, PhD^{||}

ABSTRACT

Objectives:

The impact of deployment and combat on mental health of military personnel is well described. Less evidence is available to demonstrate and summarize the incidence, prevalence, and risks of these exposures on physical health. This study aims to (1) systematically review the available literature to determine the incidence and prevalence of physical health conditions among military personnel during and after deployment and (2) investigate the risks of deployment and combat exposure on physical health.

Methods:

A systematic review using the PubMed and EMBASE databases was performed. The literature search was limited to articles written in English, published from 2000 through 2019. The quality of studies was assessed with the Joanna Briggs Institute Appraisal Checklist. The results were grouped per system or condition of physical health and presented by forest plots without a combined effect size estimate.

Results:

Thirty-two studies were found eligible for this review. We identified a wide variety of incidence and prevalence rates of numerous physical health conditions and a high heterogeneity across the included studies. Acute respiratory symptoms, diarrhea, musculoskeletal injuries, pain, and tinnitus were found to be the most incident or prevalent conditions. Except for hearing loss, no associations with deployment and physical health problems were observed. An increased risk for asthma, headache, hearing loss, and pain was reported in relation to the combat exposure.

Conclusion:

Given the characteristics of included studies and extracted data, the magnitude of the found differences in incidence and prevalence rates is most likely to be due to methodological heterogeneity. The specific exposures (e.g., infrastructure, environmental conditions, and activities during deployment) are suggested to be the determinants of (post) deployment physical health problems and need to be addressed to decrease the impact of deployment. Findings from this systematic review highlight which conditions should be addressed in response to service members' health and wellness needs in the (post)deployment phase and may be used by clinicians, researchers, and policy-makers. However, knowledge gaps regarding the potential risk factors during deployment and combat still exist. Studies using consistent methods to define and measure the physical health conditions and specific exposures are needed.

^{*}Department of Physical, Medicine and Rehabilitation, Basalt Rehabilitation, Medical Centre Haaglanden: Medisch Centrum Haaglanden, The Hague 2512 VA, The Netherlands

[†]Balans and Impuls Clinic Psychological Health, The Hague 2595 CA, The Netherlands

[‡]Department of Data Science and Epidemiology, University of Amsterdam, University Medical Center Amsterdam, Amsterdam 1105 AZ, The Netherlands

[§]Research Support, Medical Library AMC, University of Amsterdam, University Medical Center Amsterdam, Amsterdam 1105 AZ, The Netherlands

^{||}Expertcentre Force Health Protection, Military Healthcare Organisation, Ministry of Defence, Doorn 3941 PW, The Netherlands

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INTRODUCTION

There is increasing concern regarding health problems among veterans and military personnel related to their (post)deployment.^{1,2} A broad range of symptoms can arise during and after deployment. Changes in mental and physical health may result in significant personal and social burdens and decreased quality of life difficulties in vocational rehabilitation.^{3,4} Numerous studies of military personnel describe the aggregated rates of the leading mental health disorders in veterans such as posttraumatic stress disorder (PTSD), traumatic brain injury (TBI), depressive disorders, anxiety, and substance (alcohol or drugs) dependence.⁵⁻⁷ However, fewer studies have systematically examined data regarding physical health of deployed veterans.

The interest in non-mental health of militaries in the scientific community increased after the Persian Gulf War (1990-1991) as a wide range of physical symptoms were linked to this war.⁸ At least 25% of Gulf War veterans

from different countries have experienced persistent physical health problems since returning home, such as pain, fatigue, and gastrointestinal symptoms.^{9–11} A range of hypotheses have been proposed for the mechanisms of persisting health changes after being deployed in war theaters: (persistent) infection, abnormal immune response, administration of multiple vaccinations within a short period of time, use of malaria chemoprophylaxis, exposure to blasts, noise, central sensitization, toxicological substances, and environmental factors.^{12–15} Moreover, changes in sympathetic–parasympathetic balance and the tone of the hypothalamic–pituitary–adrenal axis, stress and behavioral responses are also believed to be important factors in pathogenesis.^{16,17} Although understanding of etiology of “War symptoms” is of great interest, a better understanding of their incidence and prevalence rates is of similar importance. The heterogeneity of the results for physical health problems makes it difficult to determine whether the differences among the countries of origin, location, duration, and type of deployment (combat vs. noncombat) are real or due to a variety of methodological issues. A better understanding of incidence and prevalence rates is necessary to educate, monitor trends in disease burden, inform treatment strategies, and project healthcare needs and costs. Therefore, the objectives of this study were to systematically review the available literature to determine the incidence and prevalence of physical health problems among military personnel during and after deployment and investigate the risks of being afflicted with these conditions after being deployed relative to nondeployed military personnel and being exposed to combat situation relative to noncombat setting.

METHODS

A prespecified PROSPERO database was followed (reference 164397). To be included in the review, studies had to be written in English; published after 2000; observational with a cohort or cross-sectional design; and related to deployed military personnel (all branches). For the first objective, we searched the incidence and prevalence of physical health problems based on definitions of the International Classification of Functioning and Medical Subject Headings (MeSH) terminology. We grouped the outcomes in disorders of cardiovascular, gastrointestinal, hematologic and lymphatic, musculoskeletal (MS), nervous, respiratory, and sense organs and urogenital systems. Conditions such as dizziness, fatigue, headache, and tinnitus were specified separately as they can be a symptom of several syndromes/diseases. For the second objective, we searched the odds ratios (ORs), hazard ratios (HRs), and relative risks (RRs) for the above-mentioned systems and conditions, for deployment vs. nondeployment and combat vs. noncombat situations. Studies were excluded if they provided only the TBI and PTSD incidence and prevalence; investigated the Gulf War as it was shown that the Gulf War differed from other conflicts and invasions in many respects such as biological and chemical exposure, used medical countermeasures, and perceived neglect of health surveillance and research.¹⁴

We searched the PubMed and EMBASE databases for the following terms: “military personnel,” “military medicine,” “veterans” AND “warfare and armed conflicts” AND “respiratory tract diseases,” “nervous system diseases,” “heart diseases,” “gastrointestinal diseases,” “musculoskeletal system,” “musculoskeletal diseases,” “bone diseases,” “cartilage diseases,” “sensation disorders,” “visual acuity,” “amputation,” “urogenital system,” “pain,” “headache,” “tinnitus,” “dizziness,” “fatigue,” “hematologic diseases,” “lymphatic diseases” AND “incidence,” “prevalence.” Both text and MeSH subject heading were used. Supplementary Appendix 1 shows the full search strategy. The search strategy was performed in October 2019. The first and second authors independently reviewed and assessed the abstracts and full-text articles considered relevant to identify studies meeting our inclusion criteria. The reference lists of reviewed articles were also searched. Any conflicts were resolved through discussion or by the last author if necessary. Data extraction was performed by the first and second authors independently.

The quality of studies investigating the first objective were assessed by using the Joanna Briggs Institute (JBI) Appraisal Checklist for Studies reporting Prevalence Data as this checklist was developed for studies of prevalence and incidence.¹⁸ This checklist can be applied to both cohort and cross-sectional studies.¹⁹

Statistical Analysis

In case three or more studies with the same outcome for a given condition were identified, we performed a meta-analysis for those outcomes, using random-effects model method (DerSimonian and Laird). When pooling the proportions (e.g., incidence and prevalence) a transformation of the data is required.¹⁸ In cases the proportions were <0.2 or >0.8 the logit transformation is applied.^{20,21} The resulting statistics were then reverse-transformed. Direct proportions were used in analysis when the observed effect size was between 0.2 and 0.8. The I^2 expressed heterogeneity among studies, tau-square (between study variation) and chi-square of Q ($P > .05$) tests. $I^2 > 50\%$ was considered substantial. In this case the results per condition were presented by forestplot (plotting individual study effects without a combined effect estimate) (Cochrane, chapter 9, 2019). In case less than three studies with the same outcome for a given condition (or system) were identified, the results were presented by forest plot per condition (or system). In case of one study per condition or system the results were described. Analyses were performed in R studio version 3.6.1, using packages metafor and meta.²⁰

RESULTS

Included Articles

A total of 1,687 articles were retrieved. Four articles were identified through additional search. After excluding the double references, 1,672 records remained for screening according to title and abstract. Through the screening 1,559 articles were excluded for various reasons and 113 articles were found



PRISMA 2009 Flow Diagram

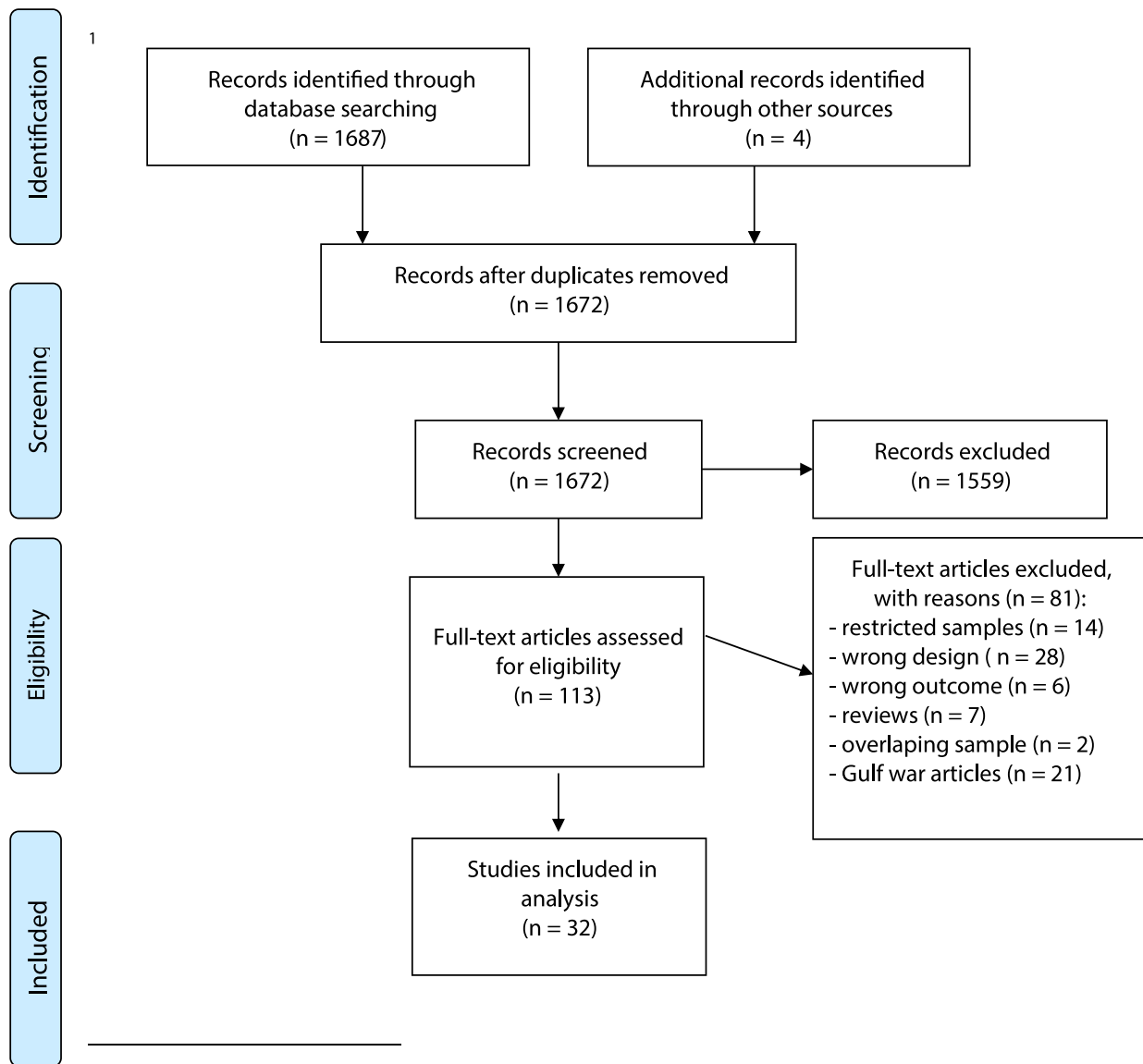


FIGURE 1. From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097.

eligible for full-text review. Eventually 32 studies, describing 13 physical health conditions or systems, fulfilled all inclusion criteria and were included in the analysis. Figure 1 provides a flowchart depicting the search and selection procedure.

Study Characteristics

From 32 included studies 23 were conducted in the USA, two in the UK, two in Sweden, and one each in the following countries: Australia, France, Denmark, Poland, and

the Netherlands. Most²⁷ studies investigated the impact of deployment to Iraq and/or Afghanistan on physical health of military personnel. In one study medical assessments were performed. In eight studies the data were collected from medical records, in 23 studies questionnaires were used of which five applied both methods. From these 23 studies, 14 reported the response rate; in seven studies the response rate ranged from 34% to 37.7%, whereas in the other seven the response rate ranged from 49% to 78%. Sixteen studies out

of 32 reported the time frame of data collection, ranging from directly after to 8 years after deployment. Supplement 1 provides an overview of included studies.

Assessment of Heterogeneity

For the following conditions or diseases we identified three or more studies with the same outcome: the prevalence of fatigue, the incidence and prevalence of pain, the incidence of asthma, and the incidence of (acute) respiratory symptoms (Fig. 2b and g–j). Random-effects model results indicated substantial heterogeneity (I^2) of 98–100% in all five outcomes. Q statistics confirmed the high level of heterogeneity, and P -value was in all four cases significant, $<.0001$. Results of the studies were presented in forest plots without a combined effect. We were unable to perform subgroup analyses as the data on location, duration, and the calendar year of deployment were reported/recorded inconsistently.

The results for the second objective were described as we identified one study per outcome of a given condition. Due to this reason, the investigation of heterogeneity was not applicable.

We aimed to present the results for the second objective according to the same methods, depending on the number of studies per outcome. No transformation of data is needed for this type of outcome.

In case of adjusted OR, RR, or HR, the variables which the results were adjusted for were described.

Methodological Quality

Supplement 2 provides an overview of quality of included studies using the JBI Critical appraisal Checklist for studies reporting prevalence data. As no cutoff scores exist for the JBI Checklist, we discussed the results and its impact on our review. The main concern regarded the validity of questionnaires and reliability of, and differences in, the measurement methods of the conditions (questions six and seven of JBI Checklist, Supplementary Table S2). Moreover, the description of settings (i.e., deployment of combat exposure) was in most studies incomplete or not reported (question four). We also observed a difference in the definition of “veteran” and “combat” across different countries.

Incidence and Prevalence of Physical Health Systems and Conditions

Two studies on the cardiovascular system were included. One reported the incidence of acute myopericarditis and pericarditis,²² whereas the other studied the prevalence of coronary heart disease or artery disease (AD), and hypertension (HT),²³ Figure 2a. Dizziness was investigated in one study which reported a prevalence of 2.37% of vestibular and nonspecific dizziness among deployed military personnel.²⁴ One study regarding endocrine system²³ reported the prevalence of diabetes mellitus (DM) of 2.48% (no data available regarding the type of DM). Three studies on the prevalence

of fatigue^{23,25,26} are included in Figure 2, in which different measurement methods are used: questionnaires,²³ the Checklist Individual Strength scale,²⁵ and the 13-item fatigue scale.²⁶ Six studies on gastrointestinal system were included, reporting the incidence and prevalence of diarrhea^{27–30} and irritable bowel syndrome (IBS),^{23,29,31} Figure 2c. Three studies reporting the incidence and prevalence of headache were included,^{23,32,33} Figure 2d. Musculoskeletal (MS) system was investigated in seven studies which reported the incidence of combat injuries,³⁴ diseases of MS system (joint trauma, fractures, low back pain, and muscle injuries),²⁷ and non-battle injuries²⁸ and the prevalence of MS complaints and injuries,³⁵ arthritis,²³ painful MS conditions (back problems, joint disorders, and connective tissue disorders),³⁶ and noncombat injuries,³⁰ Figure 2e. One study regarding nervous system was included, reporting the prevalence of multiple sclerosis, repeated seizures or convulsion, and stroke,²³ Figure 2f. Eight studies on the incidence^{27,32,37,38} and the prevalence of pain^{38–42} were found eligible. Rates were plotted separately, Figure 2g and h, respectively. Ten studies on respiratory system fulfilled the inclusion criteria, some of which reported more than one respiratory condition or outcome. Figure 2i shows the incidence rates of asthma^{27,43,44} and Figure 2j the incidence of (acute) respiratory symptoms.^{27,28,44,45} Four studies reported the prevalence of different respiratory conditions: chronic lung diseases (chronic obstructive pulmonary disease, asthma, and interstitial lung disease),⁴⁶ respiratory diseases (asthma, bronchitis, and sinusitis),⁴⁷ acute respiratory illnesses (ARIs),⁴⁸ and respiratory illnesses (cough or cold),³⁰ Figure 2k. Three studies on sense organs and tinnitus were included, two reporting the incidence and prevalence of hearing loss^{23,49} and the prevalence of tinnitus,⁵⁰ Figure 2l. We included one study on urogenital system²³ reporting the prevalence of frequent bladder infections of 1.8%.

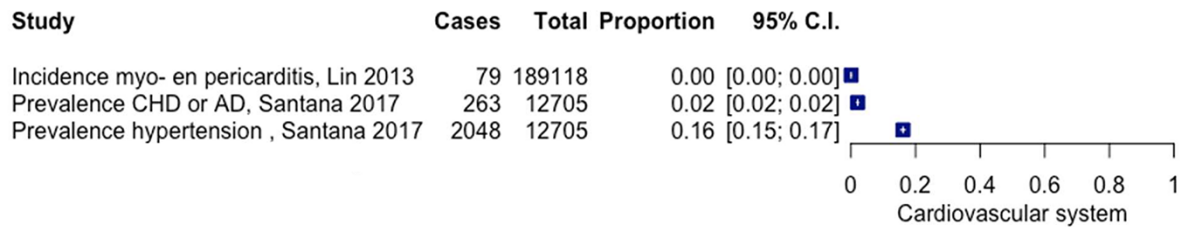
Physical Health Risks

Table I presents the results of the second objective, the risks of various conditions after being deployed relative to nondeployed military personnel and after being exposed to combat setting.

DISCUSSION

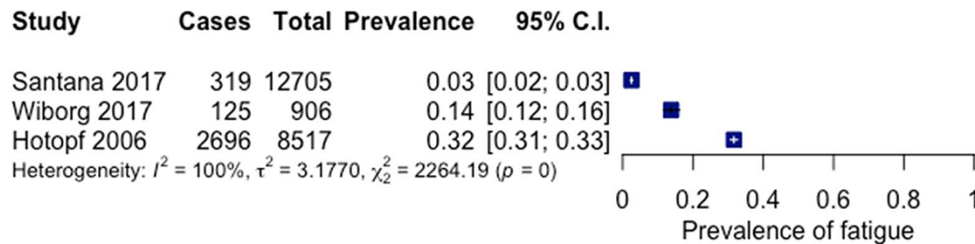
This review of 32 studies summarizes the incidence and prevalence of various physical health problems during or after deployment and highlights the conditions which were investigated in relation to deployment and combat. Acute respiratory illness (ARI), diarrhea, musculoskeletal injuries, pain, and tinnitus were found to be the most incident or prevalent conditions. However, the estimates were inconsistent for almost all identified conditions and systems (except asthma). The main findings regarding the impact of deployment were increased risk for hearing loss and decreased risk for DM, migraine, IBS, and arthritis among deployed personnel relative to nondeployed. The combat exposure is shown to be an increased risk for asthma, headache, hearing loss, and pain, relative

a. Cardiovascular system (summary of incidence and prevalence rates without pooling)

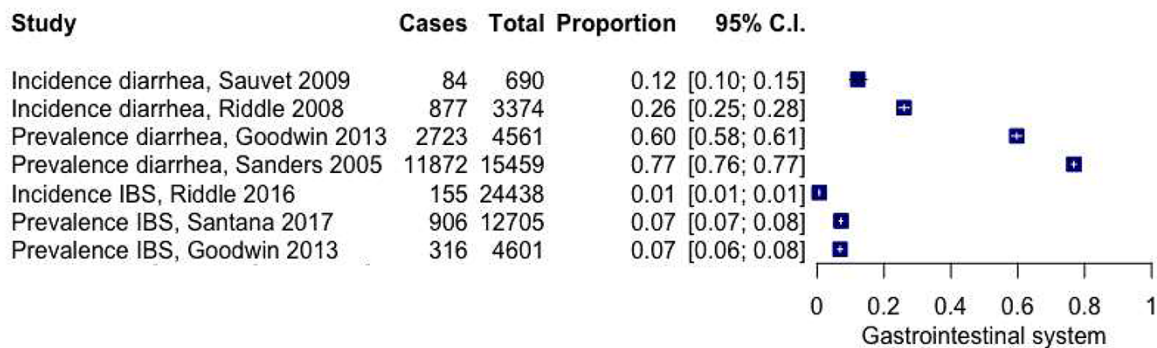


* CHD: coronary heart disease; AD: artery disease, HT: hypertension

b. Fatigue (plotting individual study effects without a combined estimate)



c. Gastrointestinal system (summary of incidence and prevalence rates without pooling).



d. Headache (summary of incidence and prevalence rates without pooling) *.

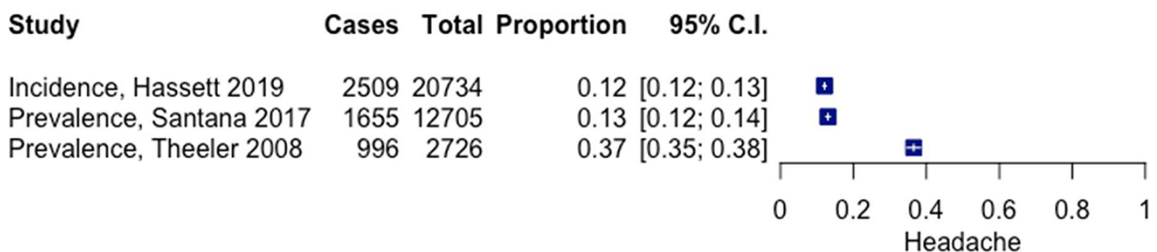
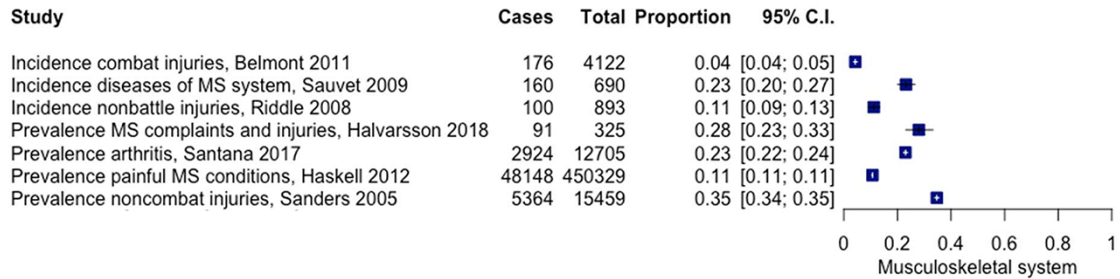


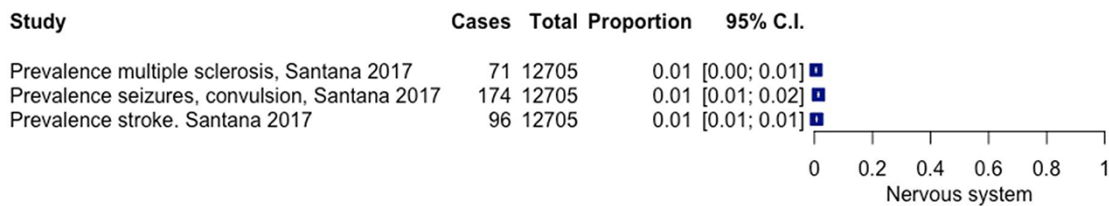
FIGURE 2. (continued)

* all cases of headache were counted together, including migraines and possible migraines for simplifying and summarizing of the results; also due to variety of definitions of migraine and headache used across the studies.

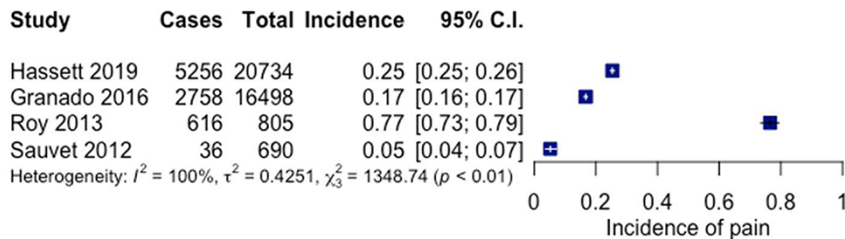
e. Musculoskeletal system (summary of incidence and prevalence rates without pooling).



f. Nervous system (summary of incidence and prevalence rates without pooling).



g. Incidence pain (plotting individual study effects without a combined estimate)



h. Prevalence of pain (plotting individual study effects without a combined estimate)

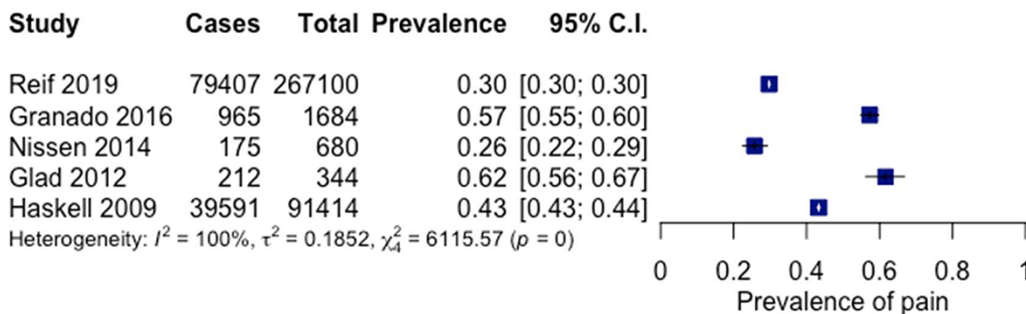
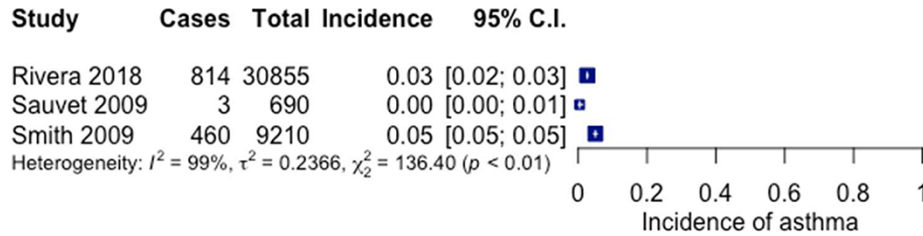
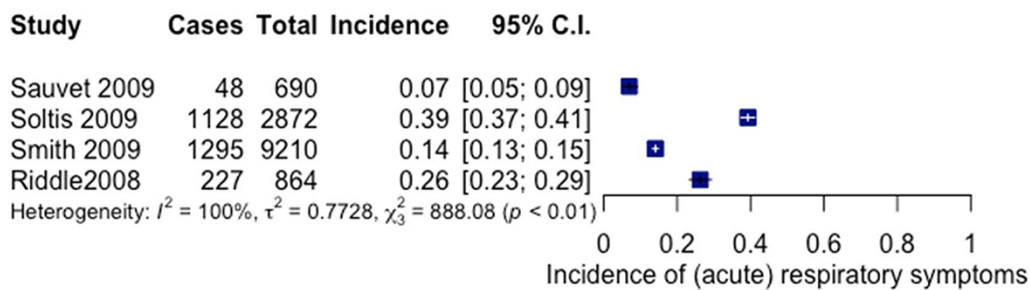


FIGURE 2. (continued)

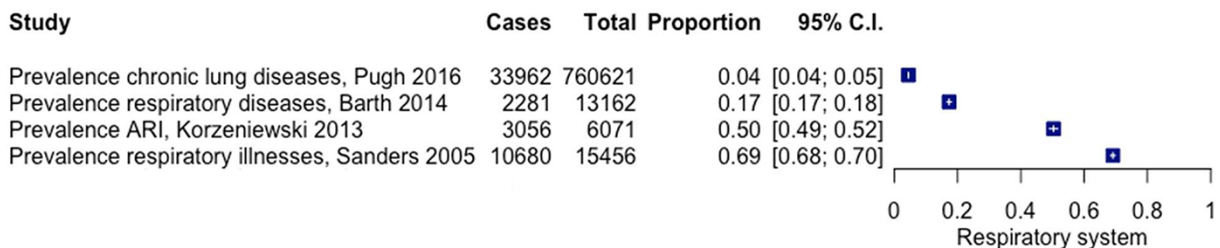
i. Incidence of asthma (plotting individual study effects without a combined estimate)



j. Incidence of (acute) respiratory symptoms (plotting individual study effects without a combined estimate)



k. Prevalence of respiratory system (summary of incidence and prevalence rates without pooling)



l. Sense organs (summary of incidence and prevalence rates without pooling)

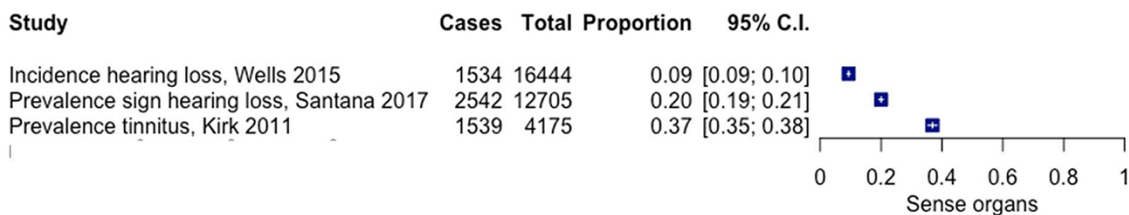


FIGURE 2. Forestplot per system or condition.

to noncombat setting. It should be noticed that three studies regarding risks of combat included a nondeployed group as a reference for both deployed groups, those deployed with and

without combat.^{43,49,53} As no significant risk was found for deployed without combat relative to nondeployed, we assume that combat risks were measured in these cases.

TABLE I. Physical Health Risks

Deployment vs. nondeployment		
	Effect size; 95% CI deployed relative nondeployed	Adjusted for
Significantly increased risk		
1. Sinusitis ⁴⁹	aOR 1.30; 95% CI 1.13, 1.49	Sex, birth year, race/ethnicity, education, smoking status, service branch and unit component for 1; adjusted for gender, birth year, race/ethnicity, education, military unit component, and VA healthcare user status for 2
2. Hearing loss ²⁰	aOR 1.42; 95% CI 1.29, 1.56	
Significantly reduced risk		
1. DM ²⁰	aOR 0.67; 95% CI 0.55, 0.80	Gender, birth year, race/ethnicity, education, military unit component, and VA healthcare user status for 1, 2, and 3
2. Migraines ²⁰	aOR 0.88; 95% CI 0.80, 0.97	
3. Arthritis ²⁰	aOR 0.84; 95% CI 0.77, 0.92	
4. IBS ³¹	univariate HR—1 deployment: 0.58; 95% CI 0.44, 0.75; 2+ deployments: 0.45; 95% CI 0.34, 0.60	
No significantly increased risk		
1. AD and HT ²⁰	aOR for AD 0.85; 95% CI 0.67, 1.06; aOR for HT 0.92; 95% CI 0.83, 1.01	Gender, birth year, race/ethnicity, education, military unit component, and VA healthcare user status for 1, 2, 4, and 5. Age, sex, rank, educational and marital status, service branch, and fitness to deploy for 3. No data on adjustment for covariates were reported for 6. Sex, birth year, race/ethnicity, education, smoking status, service branch, and unit component for 7
2. Fatigue ²⁰	aOR 1.04; 95% CI 0.83, 1.30	
3. Fatigue ²³	aOR 1.04; 95% CI 0.94, 1.15	
4. Neurological conditions ²⁰	aOR multiple sclerosis 0.77; 95% CI 0.49, 1.2	
	aOR repeated seizures of blackouts 0.82; 95% CI 0.62, 1.09	
	aOR stroke 0.80; 95% CI 0.53, 1.19	
	aOR 1.07; 95% CI 0.86, 1.32	
5. Frequent bladder infections ²⁰		No data on adjustment for covariates were reported for 6.
6. Crohn's disease ⁵¹	aHR 1 deployment: 0.82; 95% CI 0.44, 1.53; 2+ deployments 0.72; 0.37, 1.40	
7. Asthma and bronchitis ⁵²	aOR asthma 1.08; 95% CI 0.89, 1.30. aOR bronchitis 1.12; 95% CI 0.96, 1.30	
Combat vs. noncombat		
Significantly increased risk		
1. Back pain ³⁸	OR 1.38; 95% CI 1.28, 1.50, combat relative noncombat	Age, sex, rank, educational and marital status, service branch, and fitness to deploy
No significantly increased risk		
1. Fatigue ²⁶	aOR 1.05; 95% CI 0.90, 1.23, combat relative noncombat	
Deployment with combat vs. nondeployed ^a		
Significantly increased risk		
1. Headache ⁵³	Deployed with combat relative to nondeployed aOR for women 1.84; 95% CI 1.55, 2.18 and aOR for men 1.71; 95% CI 1.55, 1.90	Age, military pay grade, service branch, alcohol-related problem, PTSD, depression, panic of other anxiety symptoms, and bodily pain for 1
2. Asthma ⁴⁰	Deployed with combat relative to nondeployed aRR for men 1.30; 95% CI 1.14, 1.47 and for women 1.24; 95% CI 1.05, 1.46	Demographic factors, military service branch, and service component (active duty or reserve/guard) for 2
3. Hearing loss ⁴⁹	Significantly increased risk of new-onset hearing loss for deployed with combat relative to the same group of nondeployed (aOR 1.63; 95% CI 1.49, 1.77)	Sex, birth year, marital status, smoking status, pay grade, service component, service branch, occupation, and use of personal protective equipment for 3

^aIn all three cases, no significantly increased risk was found for deployed without combat, relative to the same group of nondeployed.

Abbreviations: AD, artery disease; aHR, adjusted hazards ratio; aOR, adjusted odds ratio; aRR, adjusted relative risk; CI, confidence interval; DM, diabetes mellitus; HT, hypertension; IBS, irritable bowel syndrome; PTSD, posttraumatic stress disorder; VA, Veterans Affairs.

This review is the first synthesis of all available evidence regarding the incidence and prevalence of various physical health conditions and risks related to deployment and combat

exposure. We identified previous studies which summarize a smaller specter of physical complaints, such as a systematic literature review of prevalence of tinnitus and hearing

impairment in deployed military personnel.⁵⁴ The authors confirmed the wide range of prevalence rates. We found two studies that confirmed our findings regarding the increased risks of combat setting. McCutchan et al.⁵⁵ supported the increased risk of developing multiple physical symptoms after combat compared with noncombat deployment. Porter et al.⁵⁶ reported an association of combat exposure with poorer physical health functioning.

Implications

It is important to state that the observations of risks of physical health problems in relation to deployment and combat only demonstrate an association, but not causation. Specific factors and exposures during deployment are found to be the determinants and causes of (post)deployment physical health problems. For example, the local infrastructure (e.g., proper sanitation and handwashing stations) and procurement of safe water and food, as well as access to flush toilet^{28,30,45,59} were suggested to be the determinants of differences in the incidence and prevalence rates of ARI and diarrhea. With regard to respiratory conditions, semi-acquired immunity among those military personnel who participated in multiple deployments, vaccination rates against common respiratory viruses, exposures to environmental conditions like severe sandstorms, burning trash, human waste, smoke from oil-well fires, open-air burn pits, and blasts^{57,58} were suggested. In regard to pain, the pain complaints before deployment, time spent wearing body armor, exposure to heavy work with lifting, vibrations and traumatic situations, and having PTSD are suggested to be potential risk factors associated with increased reporting of pain.^{37,38,59}

Several factors need to be taken into account while interpreting the impact of deployment on physical health of military personnel. First, many of the included studies mention “a healthy warrior or soldier effect.”^{23,52,60} A healthy warrior effect means that the deployed personnel are considered to be fitter and healthier than those who did not deploy.⁶¹ Secondly, the reporting of complaints and/or seeking help may be impacted by a specific coping strategy of military personnel named “fear to stigma” or “avoidance coping,” which can be a potential barrier to seeking help or disguising the health complaints.⁶² Thirteen of 32 included studies used the medical records for data collection; thus, these study populations consisted of “help seekers.” Thirdly, seeking help and thus reporting the health problems may also be impacted by access to field or base hospitals.²⁹

Strengths

This systematic review is unique in its focus on the synthesis of the current knowledge regarding the incidence and prevalence of all physical health conditions and risks of deployment and combat exposure. These findings, summarized in one study, highlight which conditions need to be addressed in response to service members health and wellness needs in

(post)deployment phase. Moreover, we summarized which exposures are well-known factors associated with physical health problems during and after deployment. The information reported in current review may be used by clinicians, researchers and policy-makers.

Limitations

This review has several limitations. Firstly, excluding the studies with restricted samples (e.g., PTSD and TBI) may have potentially resulted in underestimating of the incidence, prevalence, and odds of physical health conditions which are related to mental disorders and TBI, such as cardiovascular diseases, IBS, headache, hearing impairment, pain, and tinnitus.^{51,63–67} Thus, our findings may not be representative and applicable for those with PTSD and/or TBI. Secondly, only studies in English were included.

Impact of Methodology of Included Studies

Interpreting our results is difficult due to variation across the studies in definition of measured conditions (e.g., headache and migraine), measurement methods (e.g., different scales of fatigue), and sample sizes. Data of specific exposures during the deployment, the year, the duration, the purpose of mission (e.g., peacekeeping or war-fighting operation), performed duties or activities, and period of data collection were not reported or reported inconsistently. Thus, we would suggest that the findings of one particular study probably only depict the investigated population and destination(s) and should not easily be generalized to other regions and populations of military personnel. Moreover, several biases could have impacted the estimates of incidence and prevalence in included studies. In case of a low response rate there could be an indication for recall bias, especially differential recall bias (i.e., those with an illness or injury may be more likely to recall exposures) and reporting bias. A selection bias may be an issue in case when medically evacuated personnel due to severe illness or injury would have been unavailable for a survey, or when the medical records are used for data collection (i.e., the population consisted only of “help seekers”).

The main conclusion regarding the critical appraisal was that the above-mentioned differences in methodology, and especially used classifications and methods of measurements but not the level of risk of bias, impacted our results. Due to high heterogeneity between studies or a small amount of studies per condition, no meta-analyses of both objectives were performed.

CONCLUSION

This review summarizes the current knowledge regarding the incidence and prevalence of physical health problems, highlighting those that should be included in medical assessments of military personnel in (post)deployment phase. Acute respiratory symptoms, diarrhea, musculoskeletal injuries, pain, and tinnitus were found to be the most incident or prevalent

conditions. However, we would not suggest that these health problems need to be addressed the most as a less incident/prevalent condition may also impact the quality of life and vocational rehabilitation to the same of even greater extent. An increased risk for hearing loss was found to be related to the deployment, and an increased risk for asthma, headache, hearing loss, and pain was observed in relation to the combat exposure. The specific exposures (e.g., infrastructure, environmental conditions, and activities during deployment) are suggested to be the determinants of (post) deployment physical health problems and need to be addressed to decrease the impact of deployment.

For future studies we would recommend a better consistency in classification of medical conditions, registration of and reporting on characteristics of the deployment, combat and exposures. This would allow the better comparability and analyzing the results. More research is needed to understand the impact of specific exposures during deployment to elucidate the risk factors and adapt the environment of deployment setting for the new generation of military personnel.

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SUPPLEMENTARY MATERIAL

Supplementary material is available at *Military Medicine* online.

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CONFLICT OF INTEREST STATEMENT

None declared.

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