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Service discharges among US Army personnel with selected musculoskeletal and skin conditions: a retrospective cohort study

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ABSTRACT

Objectives To determine the probability of discharge from military service among soldiers following an incident diagnosis of ankylosing spondylitis (AS), rheumatoid arthritis (RA), psoriasis or systemic lupus erythematous.
Methods All soldiers on active duty in the US Army between January 2014 and June 2017 were included in a retrospective cohort analysis. Termination from service was ascertained using personnel records. Diagnostic codes were used to identify incident cases of the four musculoskeletal and skin diseases and, for comparison, diabetes mellitus (DM). Time to discharge was modelled using sex stratified multivariate survival analysis.
Results The analysis included 657 417 individuals with a total of 1.2 million person-years of observation. An elevated risk of discharge was observed in association with each of the five chronic conditions studied. The increase in adjusted risk of discharge was highest among soldiers with AS (men, HR=2.5, 95% CI 2.1 to 3.0; women, HR=2.1, 95% CI 1.4 to 3.2) and with DM (men, HR=2.4, 95% CI 2.2 to 2.7; women, HR=2.2, 95% CI 1.8 to 2.5), followed by those with RA (men, HR=1.8, 95% CI 1.5 to 2.2; women, HR=1.8, 95% CI 1.4 to 2.4).
Conclusions Military discharges are consequential for the service and the service member. The doubling in risk of discharge for those with AS or RA was comparable to that for personnel with DM. Conditions that affect the spine and peripheral joints may often be incompatible with military readiness. Nevertheless, a substantial fraction of service members with these diagnoses continued in service.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Before this study, very little has been known about the military trajectories of those developing chronic musculoskeletal and skin conditions.
- ⇒ Using the total active-duty US Army population from 2014 to 2017, we found a doubling of the adjusted hazard of leaving military service following a diagnosis of ankylosing spondylitis and rheumatoid arthritis.
- ⇒ Conditions impacting the spine and peripheral joints may present challenges but do not appear invariably incompatible with continued military service.
- ⇒ Our results cannot necessarily be generalised to other US military branches or to service members of other nations.

INTRODUCTION

Chronic musculoskeletal and skin conditions may pose important challenges for military personnel. In many cases, affected individuals could be unable to carry out their military duties and would thus be given a medical discharge. Given the operational and economic costs of such discharges, as well as the human impact on the soldier from the onset of a chronic disease, it is critical to better understand typical career trajectories in the military following onset of these diseases.[1]

Although military clinicians are provided substantial guidance with respect to both diagnosing and managing musculoskeletal and skin disorders,[2] we were unable to identify prior research specifically addressing the risk of military service terminations associated with diagnoses of these diseases. Insufficient evidence could potentially lead to either hastening service discharges for those still ably serving under effective management or delayed actions that could permit disease progression associated with a subsequent service discharge.[2] Thus, determining the risk of military discharge, if any, associated with such conditions is important for the military mission as well as for clinicians and patients alike.

In this study, our objective was to characterise the associations between a selection of commonly encountered chronic musculoskeletal and skin conditions including ankylosing spondylitis (AS), rheumatoid arthritis (RA), psoriasis (Ps) and systemic lupus erythematosus (SLE), and discharge from service among active-duty service members when adjusting for a range of demographic, health-related and military-specific characteristics. For comparison, we also analysed the risk of discharge following diagnosis with diabetes mellitus (DM), which is among the most prevalent chronic diseases in the military population.

METHODS

Data sources

We used a longitudinal panel data set from the Stanford Military Data Repository, a de-identified data set comprising administrative and health-related data sets on the active-duty US Army. The current retrospective cohort analysis is based on person-months of active military service among individuals who served with the US Army between January 2014 and June 2017. Demographic and military service data, including terminations of active-duty service, were obtained from official personnel records provided by the Defense Manpower Data Center (DMDC).[3] The data sources used to identify individuals with our outcomes of interest were the Military Health System Data Repository or MDR[4] which includes records of outpatient and inpatient care provided to US service members in military as well as civilian facilities, and the 'eProfile' system,[4] the official system of record in which soldiers' duty restrictions and the clinical diagnoses warranting them are archived.

To identify incident diagnoses of AS, RA, Ps, SLE or DM (either type 1 or 2), we first used the clinical data from the MDR. For encounters occurring between January 2014 and October 2015, conditions were identified using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) data. ICD-10 codes were used for encounters occurring between November 2015 and June 2017. For each condition, the ICD-9-CM and ICD-10 diagnosis codes were, respectively: AS, 720.0 and M45.x; RA, 714.x and M05.x, M06.x; Ps, 696.x and L40.x; SLE, 710.0 and M32.1x, M32.9x; and DM, 250.x and E.08.x–E.11.x, E13.x.

The second source for identifying incident cases was 'eProfile' due to the potential for some cases to solely be diagnosed in eProfile as a summative finding after deferred assignments of definitive diagnoses. Such trajectories could be seen, for example, if diagnoses were uncertain and were confirmed only by specialists late in the care process after initial primary care evaluation, at which time appropriate duty restrictions might be better understood. A free-text search algorithm was used to filter clinician entries of the selected medical conditions; the accuracy of captured diagnoses was then confirmed with a visual review.

Procedure

Subjects who began their military service during the observed time period were examined for incident diagnoses beginning at the outset of their service. Military enlistment policies require initial screening examinations. Any of the five conditions considered in this study (AS, RA, Ps, SLE and DM) normally disqualify an individual from induction into service (AR 40–501).[5] All new soldiers in the data set were therefore presumed to be free of known diagnoses of these conditions when they entered service.

The remaining individuals entered service at a wide variety of times prior to January 2014 and could therefore have been diagnosed with one or more of these conditions before our study period. Thus, for those soldiers enlisting prior to January 2014, we applied a 'wash-out' or 'run-in' period in which at least 12 initial months of observation were required. This wash-out period was used to rule out follow-up care for previously diagnosed conditions in their health records and duty restrictions. The 1-year duration of the period was chosen because each member is required to undergo an annual Periodic Health Assessment, a health screening[6] in which major medical problems are typically identified. Observation for incident conditions thus began in January 2015 among those entering service prior to January 2014.

Dependent variable

The primary outcome variable was a discharge from service for any reason. The discharge information was identified from the DMDC personnel records.

Independent variables

We included a wide range of independent variables to minimise possible confounding of the associations between the selected disorders and service discharges. Independent variables whose values varied with time were continuously updated in each subject's longitudinal data.

The covariates included sex, age, race, marital status, statement of tobacco use at a prior health encounter, active-duty service time and military pay grade, which captures soldiers' socioeconomic status.[7]

We categorised the two quantitative variables. We divided individuals into approximate quartiles on the basis of age. For active-duty service time, we categorised in such a way as to capture typical career eras for soldiers. Specifically, we employed a category for <4 years to capture those in their first term of service and a 4–10 years category for people who may be in the decision window before choosing whether to remain in service until retirement. We then divided the remaining subjects into two subgroups: those with >10–16 and >16 years.

In addition, we created a dichotomous variable to capture whether each member held a combat-focused occupation versus functioning in a support role. We also included an additional categorical variable to account for the type of military unit in which the subject served to adjust for any related systematic difference in exposures. The categories were: combat deployable units; those involved in training and administrative functions; special operations forces; medical units; and all other or unknown unit types.

Patient and public involvement

Study participants were not involved in the design, recruitment or conduct of the study, as this was a retrospective analysis of passively collected data on military service members. All service members will be able to view the study results on publication of the paper.

Statistical analysis

To provide a descriptive overview of the study population, we examined subjects at the last-available, person-specific monthly observation and stratified on the presence or absence of service discharge. We tested for differences in categorical variable distributions using χ^2 tests.

To estimate adjusted associations between the selected conditions and service discharge, we computed multivariable survival models. The models used the Weibull distribution to estimate adjusted HRs for service discharge. Because of possible differences between men and women in the rates of the conditions being studied and in rates of separation of the Army, the unadjusted and adjusted analyses were sex stratified.

All analyses were conducted using Stata statistical software V.14.2 (StataCorp, College Station, Texas, USA). We considered p values≤0.05 to be statistically significant.

RESULTS

The analysis included 657 417 eligible subjects who were observed for a total of 1.2 million person-years of time at risk for the regression models. On average, each subject was observed for 1.8 years (median: 2.4; SD: 0.9). We found that small percentages of subjects with each of the selected medical conditions were additionally detected when using the eProfile data in addition to MDR information. The relevant findings were as follows for each of the conditions, with the format representing the total number of affected subjects, the number of additional cases solely identified in eProfile and, in parentheses, the percentage of total cases detected solely in eProfile: for AS, 322, 15 (4.7%); for RA, 734, 7 (1.0%); for DM, 2541, 44 (1.7%); for Ps, 2658, 17 (0.6%); and for SLE, 236, 8 (3.4%).

Table 1 presents the unadjusted results for demographic and health behaviour variables while table 2 presents the unadjusted results for military characteristics. Tobacco users were significantly more likely to be discharged than non-users in both sexes (table 1).

In terms of military characteristics (table 2), men in combat-focused professions were at the highest unadjusted probability of discharge (33.5% of these men; p<0.001) whereas no association was observed between occupation and discharge among women. Crude associations between military unit type and discharge also varied by sex. Men in medical units had the highest proportion of those discharged (34.6%); among women, those in training and administrative units were most likely to be discharged (40.6%).

Table 1 Demographic and health behaviour characteristics of the US Army study population, 2014–2017 (N=657 417) as of the last person-specific observation. Values represent numbers (percentages).

	Males; n=560 243 (85.2)		Females; n=97 174 (14.8)	
Factor	No discharge 386 436 (69.0)	Discharged 173 807 (31.0)	No discharge 66 833 (68.8)	Discharged 30 341 (31.2)
Age, years	P<0.001*		P<0.001*	
≤22	98 351 (69.1)	43 912 (30.9)	17 941 (64.8)	9754 (35.2)
23–27	102 712 (66.1)	52 620 (33.9)	18 487 (68.3)	8591 (31.7)
28–35	101 863 (72.0)	39 570 (28.0)	17 733 (72.8)	6621 (27.2)
≥36	83 510 (68.9)	37 705 (31.1)	12 672 (70.2)	5375 (29.8)
Race	P<0.001*		P<0.001*	
White	269 731 (68.2)	126 022 (31.8)	32 726 (66.8)	16 256 (33.2)
Black	75 041 (69.5)	32 972 (30.5)	24 364 (69.1)	10 899 (30.9)
Asian or Pacific Islander	22 021 (75.0)	7322 (25.0)	5112 (76.0)	1612 (24.0)
Native American or Alaska Native	2711 (66.2)	1381 (33.8)	616 (62.9)	364 (37.1)
Multiracial, other or unspecified	16 932 (73.5)	6110 (26.5)	4015 (76.8)	1210 (23.2)
Marital status	P<0.001*		P=0.001*	
Married	222 598 (70.3)	94 033 (29.7)	32 376 (69.3)	14 350 (30.7)
Never married	148 065 (67.6)	70 942 (32.4)	26 584 (68.5)	12 243 (31.5)
Formerly married	15 773 (64.1)	8832 (35.9)	7873 (67.8)	3748 (32.2)
Tobacco use	P<0.001*		P<0.001*	
No	229 160 (71.3)	92 056 (28.7)	52 010 (69.8)	22 503 (30.2)
Yes	157 276 (65.8)	81 751 (34.2)	14 823 (65.4)	7838 (34.6)

*Results of χ^2 tests.

Table 2 Military characteristics of the US Army study population, 2014–2017 (N=657 417) as of the last person-specific observation. Values represent numbers (percentages).

Factor	Males; n=560 243 (85.2)		Females; n=97 174 (14.8)	
	No discharge 386 436 (69.0)	Discharged 173 807 (31.0)	No discharge 66 833 (68.8)	Discharged 30 341 (31.2)
Military pay grade	P<0.001*		P=0.001*	
≤E-4	170 482 (62.9)	100 574 (37.1)	30 841 (61.5)	19 310 (38.5)
E-5 and E-6	101 670 (72.5)	38 602 (27.5)	15 433 (74.8)	5200 (25.2)
E-7 to E-9	41 859 (74.1)	14 635 (25.9)	5464 (75.2)	1801 (24.8)
W-1 to O-3	48 957 (78.6)	13 346 (21.4)	10 544 (79.1)	2793 (20.9)
≥O-4	23 468 (77.9)	6650 (22.1)	4551 (78.6)	1237 (21.4)
Active service time	P<0.001*		P<0.001*	
<4 years	168 536 (68.8)	76 450 (31.2)	32 520 (67.7)	15 502 (32.3)
>4–10 years	102 350 (66.4)	51 694 (33.6)	17 546 (66.6)	8780 (33.4)
>10–16 years	59 802 (77.2)	17 675 (22.8)	9063 (78.6)	2466 (21.4)
>16 years	55 748 (66.6)	27 988 (33.4)	7704 (68.2)	3593 (31.8)
Combat-focused	P<0.001*		P=0.255*	
No	245 696 (70.5)	102 832 (29.5)	63 017 (68.7)	28 704 (31.3)
Yes	140 740 (66.5)	70 975 (33.5)	3726 (69.5)	1637 (30.5)
Military unit type	P<0.001*		P<0.001*	
Combat-deployable	182 518 (66.0)	94 133 (34.0)	28 819 (68.4)	13 291 (31.6)
Training/administration	68 369 (67.5)	32 949 (32.5)	11 832 (59.4)	8097 (40.6)
Special operations	28 852 (82.2)	6249 (17.8)	1567 (83.2)	317 (16.8)
Medical	15 894 (65.4)	8402 (34.6)	8794 (70.6)	3654 (29.4)
Other/uncertain	90 803 (73.9)	32 074 (26.1)	15 821 (76.0)	4982 (24.0)

*Results of χ^2 tests.

Table 3 presents the unadjusted distributions of service discharges organised by diagnosis category. Overall, 31.0% of men and 31.2% of women without the conditions of interest were discharged during the follow-up time. A significantly higher proportion of those with a diagnosis of AS, RA and DM were discharged. Discharges were most common among patients with AS with 44.7% of men and 43.1% of women discharged. Among the patients with RA, 37.9% of the men and 37.8% of the women were discharged. Among those with DM, 44.5% of the men and 38.9% of the women were discharged. No significant difference in the unadjusted probability of discharge was observed in association with either Ps or SLE. Men and women with Ps experienced the lowest discharge rates among subjects with the selected conditions, respectively, involving 30.2% and 31.7% of subjects with those diagnostic histories.

The results of the adjusted models are shown in table 4. An elevated risk of discharge was observed in association with each of the five chronic conditions studied, relative to soldiers without these conditions during the same time period. The increase in adjusted risk of discharge was highest among soldiers with AS (men, HR=2.5, 95% CI 2.1 to 3.0; women, HR=2.1, 95% CI 1.4 to 3.2) and with DM (men, HR=2.4, 95% CI 2.2 to 2.7; women, HR=2.2, 95% CI 1.8 to 2.5), followed by those with RA (men, HR=1.8, 95% CI 1.5 to 2.2; women, HR=1.8, 95% CI 1.4 to 2.4). For those with Ps, the adjusted hazard of discharge was 40% higher (men, HR=1.4, 95% CI 1.3 to 1.5; women, HR=1.4, 95% CI 1.2 to 1.7). For those with SLE, the adjusted hazard of discharge was 70% higher among men (HR=1.7, 95% CI 1.2 to 2.3) and 50% higher among women (HR=1.5, 95% CI 1.0 to 2.1).

Considering the other predictors, the probability of discharge increased significantly with both age and service time (table 4). Compared with those in the Asian/Pacific Islander category, individuals in each of the other race categories were significantly more likely to be discharged. Relative to those in special operations, hazard of discharge was significantly higher in each of the other types of military units. Finally, those in a combat-focused occupation were slightly but significantly more likely to be discharged than those occupying administrative or support roles.

DISCUSSION

In this large study of the total US Army population between 2014 and 2017, we found that those service members with AS and RA were approximately twice as likely to be discharged in comparison to peers without

Table 3 Military service discharges in relation to musculoskeletal and skin conditions, stratified by sex, in the US Army study population, 2014–2017 (N=657 417). Values represent numbers (percentages).

	Males; n=560 243 (85.2)		Females; n=97 174 (14.8)	
Factor	**No discharge 386 436 (69.0)**	**Discharged 173 807 (31.0)**	**No discharge 66 833 (68.8)**	**Discharged 30 341 (31.2)**
Ankylosing spondylitis				
Yes	146 (55.3)	118 (44.7)	33 (56.9)	25 (43.1)
No	386 290 (69.0)	173 689 (31.0)	66 800 (68.8)	30 316 (31.2)
	P<0.001*		P=0.051*	
Rheumatoid arthritis				
Yes	303 (62.1)	185 (37.9)	153 (62.2)	93 (37.8)
No	386 133 (69.0)	173 622 (31.0)	66 680 (68.8)	30 248 (31.2)
	P=0.001*		P=0.026*	
Psoriasis				
Yes	1534 (69.8)	664 (30.2)	314 (68.3)	146 (31.7)
No	384 902 (69.0)	173 143 (31.0)	66 519 (68.8)	30 195 (31.2)
	P=0.408*		P=0.811*	
Systemic lupus erythematosus				
Yes	59 (62.8)	35 (37.2)	95 (66.9)	47 (33.1)
No	386 377 (69.0)	173 772 (31.0)	66 738 (68.8)	30 294 (31.2)
	P=0.193*		P=0.629*	
Diabetes mellitus				
Yes	1175 (55.5)	942 (44.5)	259 (61.1)	165 (38.9)
No	385 261 (69.0)	172 865 (31.0)	66 574 (68.8)	30 176 (31.2)
	P<0.001*		P=0.001*	

*Results of χ^2 tests.

these diagnoses. The increase in risk of military discharge was very similar to those soldiers with the comparison condition of DM. Significant elevations in the risk of military discharge were observed in association with each of the conditions studied, ranging from 40% increases for soldiers with Ps or SLE to 150% increases among men or women with AS. It is clear that diagnoses of these conditions are strongly associated with a decreased likelihood of remaining on active-duty military service.

The differences in effect sizes for the selected conditions may be related to occupational limitations, the current state of treatment options and the possibility that military readiness activities might make the condition worse. For example, given the importance of spine health to military service, AS may be the most limiting, regardless of treatment.[8] It could also be more concerning with respect to the impact of military exposures on disease progression or to the risk of trauma causing spinal fracture. Multiple studies have shown that spinal fractures occur in patients with AS at a higher frequency in all ages and disease durations; although most are low impact, many are localised to the cervical spine which in turn could cause serious injury to the spinal cord and result in death.[9–15] Such risks may be elevated in the military, given the physical conditioning and duties required; service members and clinicians may thus act more conservatively when the diagnosis of AS is made.

Similarly, it would be expected that the diagnosis of RA would represent a challenge to military readiness in both male and female soldiers. RA affects the hands, knees and feet in such a manner that produces pain, stiffness and diminished mobility with profound effects, in the untreated patient, on locomotion and fine manipulation.[16]

We observed a slightly smaller increase in risk of discharge associated with a diagnosis of SLE, which may reflect the heterogeneity of the condition. Patients with SLE may not have visible signs of the disease; at the same time soldiers with SLE may experience minimal effects of the disease on the musculoskeletal system, which may often be easily managed with anti-inflammatory agents. Alternatively, error with regard to the SLE diagnoses may account for the lower rates of service discharge in this group relative to AS or DM. Anti-nuclear antibodies are necessary for the diagnosis of SLE, but it has been shown that the rate of antinuclear antibody (ANA) positivity in the general population is increasing in recent years even in the absence of SLE.[17] It is possible that the comparatively lower rate of discharge of subjects with SLE in this study could reflect misclassification of these subjects with

Table 4 Adjusted HRs (aHR) with 95% CIs from sex-stratified multivariable Weibull regression models for military service discharge (N=657 417)

	Males; n=560 243		Females; n=97 174	
Factor	**aHR***	**95% CI**	**aHR***	**95% CI**
Had ankylosing spondylitis	2.5***	2.1 to 3.0	2.1***	1.4 to 3.2
Had rheumatoid arthritis	1.8***	1.5 to 2.2	1.8***	1.4 to 2.4
Had psoriasis	1.4***	1.3 to 1.5	1.4***	1.2 to 1.7
Had systemic lupus erythematosus	1.7**	1.2 to 2.3	1.5*	1.0 to 2.1
Had diabetes mellitus	2.4***	2.2 to 2.7	2.2***	1.8 to 2.5
Age, years (referent: ≤22)				
23–27	1.3**	1.1 to 1.5	0.9	0.8 to 1.1
28–35	1.4***	1.2 to 1.6	1.0	0.8 to 1.2
≥36	1.7***	1.5 to 2.0	1.2	1.0 to 1.4
Race (referent: Asian or Pacific Islander)				
White	1.3***	1.3 to 1.4	1.5***	1.4 to 1.6
Black	1.2***	1.2 to 1.2	1.2***	1.1 to 1.3
Native American or Alaskan	1.3***	1.2 to 1.5	1.5***	1.3 to 1.7
Multiracial, other or unspecified	1.2***	1.1 to 1.2	1.1*	1.0 to 1.2
Marital status (referent: married)				
Never married	1.2***	1.2 to 1.2	0.9*	0.8 to 1.0
Formerly married	1.3***	1.2 to 1.3	1.1***	1.0 to 1.1
Military pay grade (referent: ≥O-4)				
≤E-4	6.6***	5.7 to 7.6	5.4***	4.7 to 6.1
E-5 and E-6	2.0***	1.8 to 2.2	1.8***	1.5 to 2.0
E-7 to E-9	1.2**	1.1 to 1.3	1.1	0.9 to 1.2
W-1 to O-3	1.6***	1.4 to 1.7	1.4***	1.3 to 1.6
Active military service time, years (referent: <4)				
>4–10	2.1***	1.9 to 2.2	2.1***	1.9 to 2.2
>10–16	1.9***	1.8 to 2.1	1.7***	1.5 to 2.0
>16	3.8***	3.4 to 4.2	3.5***	3.0 to 3.9
Held a combat-focused occupation	1.2***	1.1 to 1.4	1.2*	1.0 to 1.4
Military unit type (referent: special operations)				
Combat-deployable	1.9***	1.8 to 2.0	1.7***	1.4 to 2.0
Training/administration	2.2***	1.8 to 2.8	2.8***	1.9 to 4.0
Medical	2.3***	1.9 to 2.7	1.7***	1.4 to 2.1
Other/uncertain	1.4***	1.2 to 1.7	1.2	1.0 to 1.6
Self-reported tobacco use	1.4***	1.3 to 1.5	1.3***	1.2 to 1.3

Models adjusted for all listed variables.
*Statistical significance: ***p<0.001; **p<0.01; *p<0.05.

a positive ANA as having a bonafide diagnosis of SLE as opposed to a false-positive test in the subject's health record.

We also observed, comparatively, a relatively minimal impact of Ps on military discharge rates. In the most recent report of the National Health and Nutrition Examination Survey population-based survey of Ps prevalence in adults in the USA, Ps was quite common (3%) and prevalence has remained largely unchanged over the last two decades.[18] However, the majority of patients with a diagnosis of Ps had very few symptoms or findings at the time of the survey suggesting that Ps was mild in most cases. If the same pattern were to hold for the Army population, this could explain the relatively minimal increase in discharge likelihood in association with a Ps diagnosis. Interestingly, while we observed no significant difference in the percentages of soldiers discharged with either SLE or Ps in the univariate analyses, our adjusted analyses showed significant increases, although reasonably modest, in association with each of these conditions. This indicates confounding by one or more of the covariates we included in our adjusted regression model.

We used another chronic disease, DM, as a comparison condition for our study of musculoskeletal and skin conditions. Interestingly, though not a condition that typically impacts the musculoskeletal system, we observed very comparable increases in discharge rates in association with DM compared with AS. It is possible that the complexities of disease management of this condition pose challenges in the military operational context.

Our results must be interpreted in light of several limitations. First, the analysis was limited to the Army. It is possible, but not certain, that our results would generalise to the other military branches given commonalities across branches with regard to career-associated physical demands. Further research is needed to clarify the treatment and disease progression trajectories for the selected conditions, many of whom (including RA and AS) can be managed early and aggressively with modern drugs producing an almost disease-free condition with full activity capabilities.

A second limitation is that the analyses depended on administrative data taken from Army records systems rather than, for example, being done with a chart review. For this reason, the diagnoses were not validated, and we had limited visibility on treatments. Our limited access to clinical findings is an unavoidable constraint. Third, we do not have access to the codes associated with military separation; some discharges may be due to non-medical causes.

In conclusion, our study found elevated risks of discharge from the US Army in association with selected musculoskeletal and skin conditions, several of which have an autoimmune aetiology. Such discharges may well reflect basic incompatibilities of some features of these conditions with military readiness in the Army. It should be noted, however, that although discharge rates were elevated following diagnoses, discharge was by no means universal, with a large fraction of individuals remaining in service following diagnosis for the period of our study. Symptoms for each of the conditions manifest on a spectrum of severity, and it is encouraging that many soldiers were able to remain in service despite diagnoses of these chronic medical conditions.

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Patient consent for publication Not applicable.

Ethics approval The study was approved by the institutional review board at Stanford University (Protocol 31161) and underwent secondary review by the human research protections office of the Defense Health Agency.

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Data availability statement No data are available. The data used in this study were provided via agreements with the Defense Health Agency and with the US Army Office of the Surgeon General. These agreements preclude us from making the data available.

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