Which U.S. states pose the greatest threats to military readiness and public health? Public health policy implications for a cross-sectional investigation of cardiorespiratory fitness, body mass index, and injuries among U.S. Army Recruits.

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Abstract

Objective: Many states in the southern region of the United States are recognized for higher rates of obesity, physical inactivity, and chronic disease. These states are therefore recognized for their disproportionate public health burden. **The purpose of this study was to investigate state-level distributions of cardiorespiratory fitness, body mass index, and injuries among U.S. Army recruits in order to determine whether or not certain states may also pose disproportionate threats to military readiness and national security**.

Methods: **S**ex-specific, state-level values for injuries and fitness among 165,584 Army recruits were determined. Next, the relationship between median cardiorespiratory fitness and injury incidence at the state-level was examined using spearman correlations. Finally, multivariable Poisson regression models stratified by sex examined state-level associations between fitness and injury incidence, while controlling for BMI, and other covariates.

Main outcome measures: Cardiorespiratory fitness and training-related injury incidence.

Results: **A cluster of ten states from the South and Southeastern regions (AL, AR, FL, GA, LA, MS, NC, SC, TN, TX) produced male or female recruits who were significantly less fit and/or more likely to become injured than recruits from other U.S. states**. Compared to the "most fit states," the incidence of injuries increased by 22% (95% CI=17,28%; p<0.0001) and 28% (95% CI=19,36%; p<0.0001) in male and female recruits from the "least fit states," respectively.

Conclusions: The impact of policies, systems, and environments on physical activity behavior, and subsequently fitness and health, has been clearly established. Advocacy efforts aimed at active-living policies, systems and environmental changes in order to improve population health often fail. However, advocating for active-living policies in order to improve national security may prove more promising, particularly with legislators. **Results from this study demonstrate how certain states, previously identified for their disproportionate public health burden, are also disproportionately burdensome for military readiness and national security.**

Introduction:

Where one lives largely determines one's health status. Multiple ranking lists, report cards, and geospatial maps illustrate the prevalence of non-communicable diseases by region, state, or county across the U.S.[1] Reviewing these instruments over time shows two disturbing trends. First, non-communicable disease prevalence, such as heart disease, diabetes, and cancer continues to rise in the U.S. Second, disparate prevalence of non-communicable diseases among states exist, with many southern states having the highest prevalence of morbidity and mortality.[1,2] Many states with high non-communicable disease prevalence, including those in the south, also have high physical inactivity and obesity prevalence.[3,4] Physical inactivity and obesity are well-recognized among the most critical public health challenges of the 21st century.[5,6] As a result, southern states have been recognized for their disproportionate public health burden.[2]

Physical inactivity and obesity are often considered to be individual health behaviors over which the individual has complete control. However, decades of empirical studies unequivocally demonstrate how strongly physical inactivity and obesity are correlated with the policies, systems, and environments in which individuals live, work, play, commute, and learn.[7-10] Many of the most significant improvements in public health, such as decreased cancer rates as the result of limiting access to cigarettes and opportunities to smoke, have come as the result of policy change.[11] Therefore, favorably altering population levels of physical activity, physical fitness, obesity, and chronic disease, hinges upon the ability to successfully advocate for policy, systems, and environmental change that allow and inspire people to move more.

Inactivity and obesity have also become increasingly burdensome for the U.S. Department of Defense (DoD).[12] Physical inactivity and obesity have been shown to negatively impact military readiness, and therefore national security, in two important ways. First, the candidate pool of U.S. military recruits is dwindling. It is estimated that 27% of Americans 17- to 24-years are too overweight to qualify for military service, with obesity being the second highest disqualifying medical condition between 2010 and 2014[13] Furthermore, upon entering basic training 47% of males and 59% of females failed the Army's entry-level physical fitness test in 2010.[12] Second, among individuals who do meet basic requirements for military service, those with lower physical activity (PA) and/or physical fitness levels prior to military service are at increased risk for sustaining a training-related injury (TRI) during basic combat training.[14]

Rising incidence of TRIs among military recruits poses significant economic and tactical problems for the DoD.[14-16] The direct and indirect costs of treating TRIs, plus the additional costs associated with delayed graduation and higher attrition rates resulting from TRIs, limit the DoD's ability to fund other critical defense needs,[16] with each recruit lost to attrition costing the DoD $31,000 (2005 U.S. Dollars).[16] In 2001, the Veterans Administration provided over $5.5 billion in direct payments to military personnel with musculoskeletal injuries.[17] Tactically, TRIs have been characterized as the most significant medical impediment to military readiness.[18] Consequently, the DoD has allocated considerable resources towards preventing injuries, including injury prevention techniques and remedial physical fitness programs.[19] Despite these concerted efforts, high TRI incidence persists, likely due to

declining PA and physical fitness levels of their candidate pool. The percentage of American youth meeting current Federal PA guidelines of 60 minutes of moderate-vigorous PA per day are 42.0%, 8.0% and 7.6% for boys and girls ages 6-11 yrs, 12-15 yrs, and 16-19 yrs, respectively.[20] Additionally, fitness levels of youth (ages 12-15 yrs) have steadily declined since the year 2000.[21]

Previous research on military recruits has demonstrated associations among sex, cardiorespiratory fitness (hereafter referred to as fitness), body mass index (BMI) and TRIs[15,17], and shows that after controlling for sex, fitness is the strongest predictor of TRIs, whereas the association between BMI and TRIs is equivocal.[17,22] No previous research has investigated relationships between fitness, BMI, and TRIs based on the states from which recruits were recruited. Given previously-established associations between fitness, BMI, and TRIs in the military, and given the prevalence of low PA and fitness of American youth along with well-established state-level differences in prevalence of non-communicable diseases, obesity, and physical inactivity, it is conceivable that state-level differences in fitness, BMI, and TRIs among Army recruits may also exist. Therefore, the current study had two aims**.** The first aim was to describe state-level distributions of accession fitness, BMI, and TRIs sustained during basic combat training among U.S. Army recruits from 2010-2013. The second aim was to investigate possible associations between state-level BMI and state-level fitness with TRI incidence among recruits from each state**.**

Methods:

Data Source

Rosters of all recruits (17 - 35 yrs) who entered basic combat training from 2010-2013 were obtained from Army data systems and included recruits' demographics, home of record state, height, and weight (n=288,468). Height and weight were then used to calculate BMI (kg/m^2). Within the first 2 weeks of basic training, a subsample of recruits took a diagnostic Army Physical Fitness Test, which included a timed 2-mile run that was used to determine their entry-level fitness (n=165,584). This subsample of recruits on whom fitness was assessed was retained for the current analyses. Incidence of injuries sustained during training were obtained through medical encounter data from the Defense Medical Surveillance System at the Armed Forces Health Surveillance Branch of the Defense Health Agency. The Army Public Health Center (APHC) has primary responsibility to conduct routine systematic injury surveillance for the Army, which was deemed by the APHC Review Board to be public health practice. Release of de-identified data from this surveillance to The Citadel was approved by the APHC Review Board after The Citadel's study protocol (IRB #1314-15) was approved by its Institutional Review Board. Medical encounter data included visit date and diagnosis codes from the International Classification of Diseases, Revision 9, Clinical Modification (ICD-9-CM). Case definition for a TRI required a recruit to have experienced at least one medical encounter with a diagnosis code included in the pre-defined TRIs index set of diagnosis codes developed by the APHC (e.g. muscle strains, sprains, overuse injuries).

Statistical Analysis

Individual-level data were aggregated within each state to create state-level variables separately for males and females including: mean age, median fitness, median BMI, percent of white recruits, and incidence of TRIs (number of recruits with at least one TRI/total

number of recruits). State-level quartiles for fitness were created in each sex group based on median run times of recruits from that state. Additionally, state-level, sex-specific quartiles were created for TRI incidence. The relationship between median fitness and TRI incidence at the state-level was examined using spearman correlations. Two separate multivariable Poisson regression models were then used to test the association between the number of recruits experiencing a TRI within a state and state-level fitness: state-level fitness entered as 1) median fitness or 2) fitness quartile (with quartile 1 or most fit serving as reference group). All models were stratified by sex and included median BMI, mean age, and race as covariates. SAS version 9.4 (SAS Institute Inc., Cary, NC, USA) was used for all statistical analyses. Data were analyzed in June 2017.

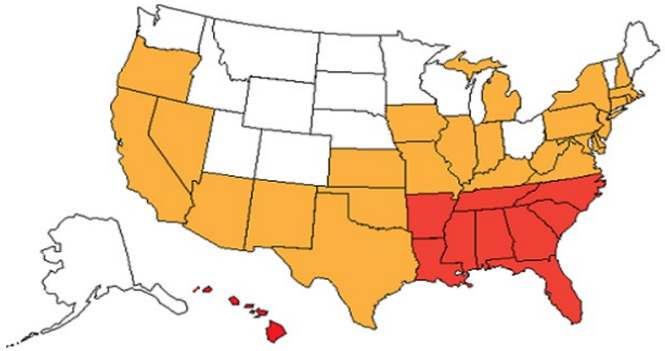
Results:

Descriptive characteristics for male recruits entering basic training from 2010-2013 (n=131,403) were as follows (values given as mean ± standard deviation or percent): age 21.1± 3.6 years; BMI 25.1± 3.7 kg/m^2; and 61.6% White. Descriptive characteristics for females (n=34,181) were: age 20.8±3.6 years; BMI 23.3± 2.6 kg/m^2; and 47.3% White. On average, male recruits had significantly ($p<0.0001$) higher fitness levels (mean 2-mile run time: 15.9±2.1 min) than female recruits (mean 2-mile run time: 19.3±2.8 min), while TRI incidence was over 2.5 times higher in females (39.4%) compared to males (15.6%).

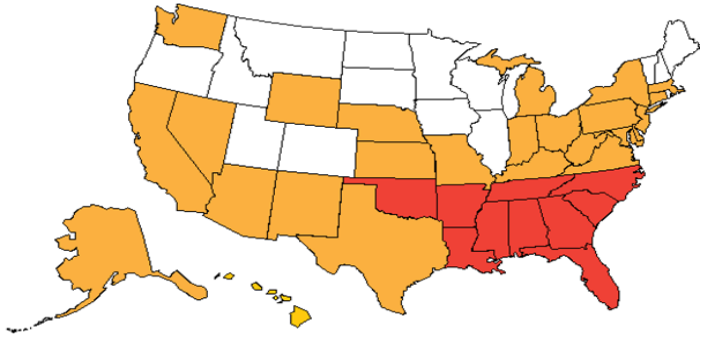
The distribution of median fitness levels of recruits across states is shown in Figure 1A and 1B. Of the 12 states (AL, AR, DE, FL, GA, HI, LA, MS, NC, OK, SC, TN) plus Washington D.C. whose male or female recruits had the lowest median fitness (i.e., bottom

25% or 4th quartile), 10 of them (AL, AR, FL, GA, LA, MS, NC, OK, SC, TN) were in the bottom quartile for both males and females, including nine from the South/Southeastern region (AL, AR, FL, GA, LA, MS, NC, SC, TN).

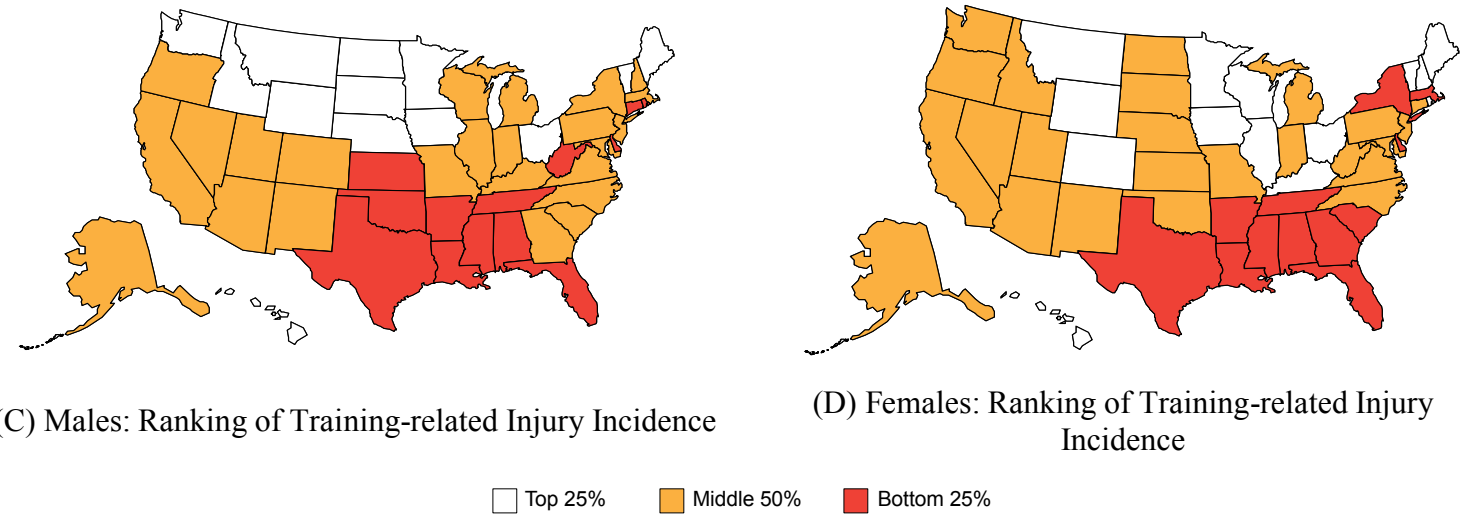
Differences in the TRI incidence of male and female recruits across states are shown in Figure 1C and 1D. Within the 15 states (AL, AR, CT, FL, GA, KS, LA, MA, MS, NY, OK, SC, TN, TX, WV) plus Washington D.C. in the bottom quartile for TRIs for males or females, 11 of these (AL, AR, FL, GA, LA, MS, OK, SC, TN, TX, WV) are located in the South/Southeastern regions, with 7 states appearing in the bottom quartile for both sexes (AL, AR, FL, LA, MS, TN, TX).



(A) Males: Ranking of Cardiorespiratory Fitness



(B) Females: Ranking of Cardiorespiratory Fitness



(C) Males: Ranking of Training-related Injury Incidence

(D) Females: Ranking of Training-related Injury Incidence

Figure 1. States ranked by quartiles of cardiorespiratory fitness of males (A) and female (B) U.S. Army recruits and training-related injury incidence of male (C) and female (D) U.S. Army recruits entering basic training from 2010-2013.

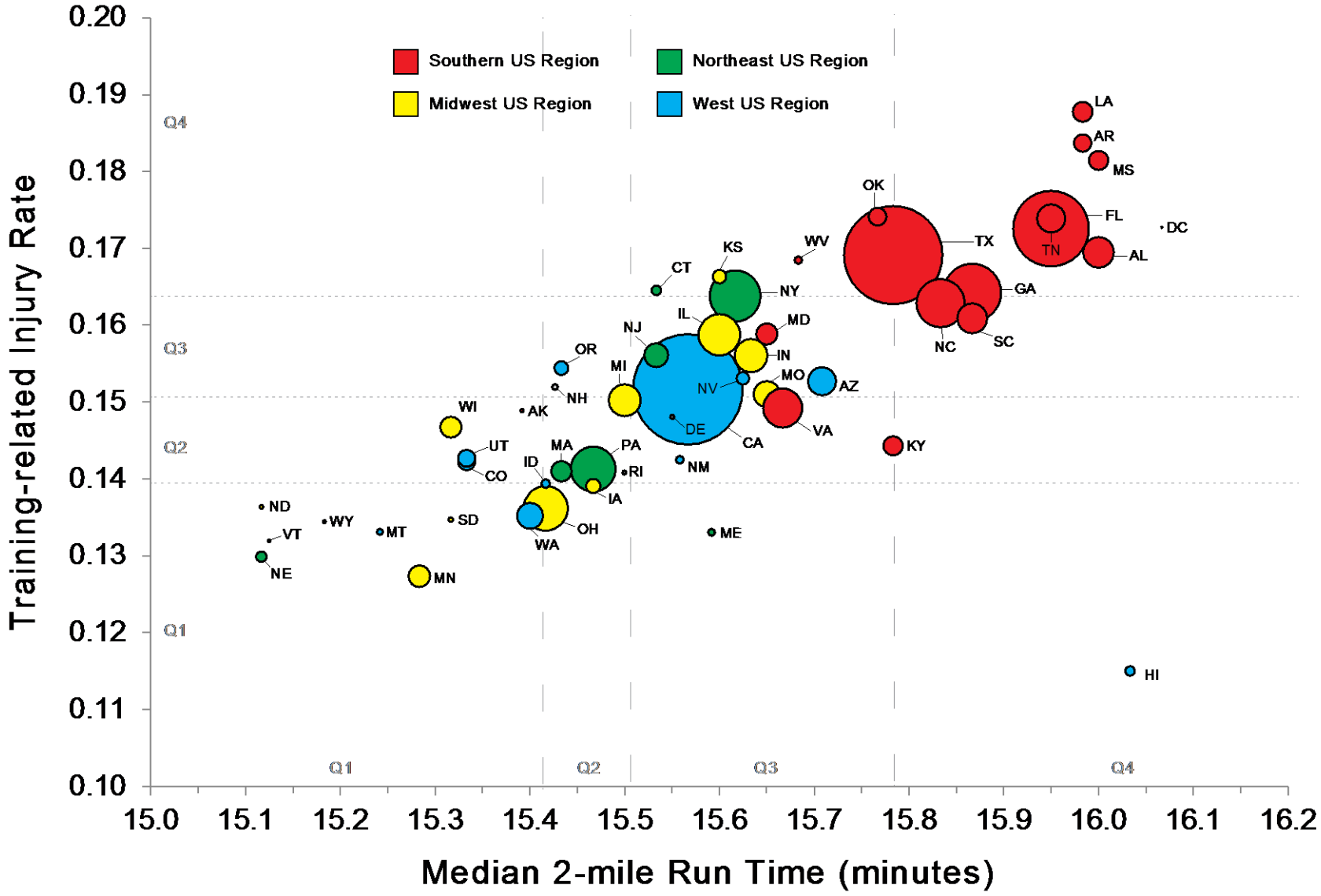
When comparing the distribution of entry-level fitness and TRIs across states, male and female recruits from 6 southern states (AL, AR, FL, LA, MS, TN) were in the bottom quartile for both TRI incidence and median fitness. The individual values for median fitness and TRI incidence for males and females from each state can be found in Table 1.

Table 1. Median fitness and training-related injury rate by state in the total sample and by sex (n=165,584).

			Median Fitness (2-mile run time in minutes)				Training-related injury incidence			
State	# male recruits	# female recruits	Males	Quartile-Males	Females	Quartile-Females	Males	Quartile-Males	Females	Quartile-Females
AK	356	112	15.39	1	18.78	2	0.1489	2	0.375	2
AL	3286	931	16.00	4	20.07	4	0.1695	4	0.445	4
AR	1829	463	15.98	4	19.72	4	0.1837	4	0.460	4
AZ	3006	705	15.71	3	18.85	2	0.1527	3	0.393	3
CA	11730	2944	15.57	2	18.67	2	0.1517	3	0.374	2
CO	1828	450	15.33	1	18.39	1	0.1422	2	0.351	1
CT	1027	278	15.53	2	18.83	2	0.1646	4	0.378	2
DC	110	46	16.07	4	19.45	4	0.1727	4	0.413	4
DE	412	74	15.55	2	19.63	4	0.1481	2	0.392	3
FL	8048	2290	15.95	4	19.57	4	0.1726	4	0.443	4
GA	6125	2131	15.87	4	19.78	4	0.1642	3	0.432	4
HI	1017	293	16.03	4	19.25	3	0.1150	1	0.321	1
IA	1517	349	15.47	2	18.38	1	0.1391	1	0.332	1
ID	904	184	15.42	1	18.29	1	0.1394	1	0.375	2
IL	4416	1053	15.60	3	18.88	3	0.1587	3	0.358	1
IN	3531	866	15.63	3	18.78	2	0.1560	3	0.366	2
KS	1419	298	15.60	3	18.88	3	0.1663	4	0.383	2
KY	2044	404	15.78	3	19.07	3	0.1443	2	0.347	1
LA	2109	630	15.98	4	20.23	4	0.1878	4	0.437	4
MA	2149	436	15.43	2	18.62	2	0.1410	2	0.431	4
MD	2247	594	15.65	3	18.97	3	0.1589	3	0.384	3
ME	744	140	15.59	3	18.38	1	0.1331	1	0.329	1
MI	3441	716	15.50	2	19.03	3	0.1502	2	0.390	3
MN	2301	654	15.28	1	18.32	1	0.1273	1	0.304	1
MO	2814	595	15.65	3	19.00	3	0.1510	2	0.388	3
MS	2039	638	16.00	4	20.01	4	0.1815	4	0.423	4

MT	616	164	15.24	1	18.21	1	0.1331	1	0.348	1
NC	5139	1445	15.83	4	19.50	4	0.1629	3	0.403	3
ND	418	87	15.12	1	17.93	1	0.1364	1	0.391	3
NE	1124	200	15.12	1	18.75	2	0.1299	1	0.405	3
NH	612	114	15.43	2	18.25	1	0.1520	3	0.246	1
NJ	2569	730	15.53	2	18.88	3	0.1561	3	0.389	3
NM	814	214	15.56	2	18.48	2	0.1425	2	0.397	3
NV	1352	388	15.63	3	19.10	3	0.1531	3	0.379	2
NY	5433	1499	15.62	3	19.12	3	0.1638	3	0.430	4
OH	4739	1049	15.42	1	18.78	2	0.1386	1	0.354	1
OK	1901	453	15.77	3	19.33	4	0.1741	4	0.389	3
OR	1483	357	15.43	2	18.43	1	0.1544	3	0.364	2
PA	4770	1237	15.47	2	18.87	2	0.1413	2	0.368	2
RI	419	76	15.50	2	18.49	2	0.1408	2	0.408	3
SC	3182	1094	15.87	4	19.77	4	0.1609	3	0.411	4
SD	490	137	15.32	1	18.43	1	0.1347	1	0.365	2
TN	3019	647	15.95	4	19.58	4	0.1739	4	0.431	4
TX	10465	3018	15.78	3	19.23	3	0.1691	4	0.422	4
UT	1829	254	15.33	1	18.45	1	0.1427	2	0.358	2
VA	4141	1187	15.67	3	19.17	3	0.1492	2	0.388	3
VT	288	89	15.13	1	17.97	1	0.1319	1	0.303	1
WA	2766	607	15.40	1	18.58	2	0.1352	1	0.367	2
WI	2249	651	15.32	1	18.33	1	0.1467	2	0.286	1
WV	831	146	15.68	3	18.88	3	0.1685	4	0.384	2
WY	305	64	15.18	1	18.73	2	0.1344	1	0.266	1

Results from spearman correlations showed state-level median fitness was strongly correlated ($p<0.0001$) with the incidence of TRIs in males ($\rho=0.75$) and females ($\rho=0.70$) (Figure 2A and 2B).


Southern US Region
Northeast US Region
Midwest US Region
West US Region
Training-related Injury Rate
Median 2-mile Run Time (minutes)
0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
15.0
15.1
15.2
15.3
15.4
15.5
15.6
15.7
15.8
15.9
16.0
16.1
16.2
Q1
Q2
Q3
Q4
LA
AR
MS
OK
FL
DC
TN
AL
TX
GA
NC
SC
WV
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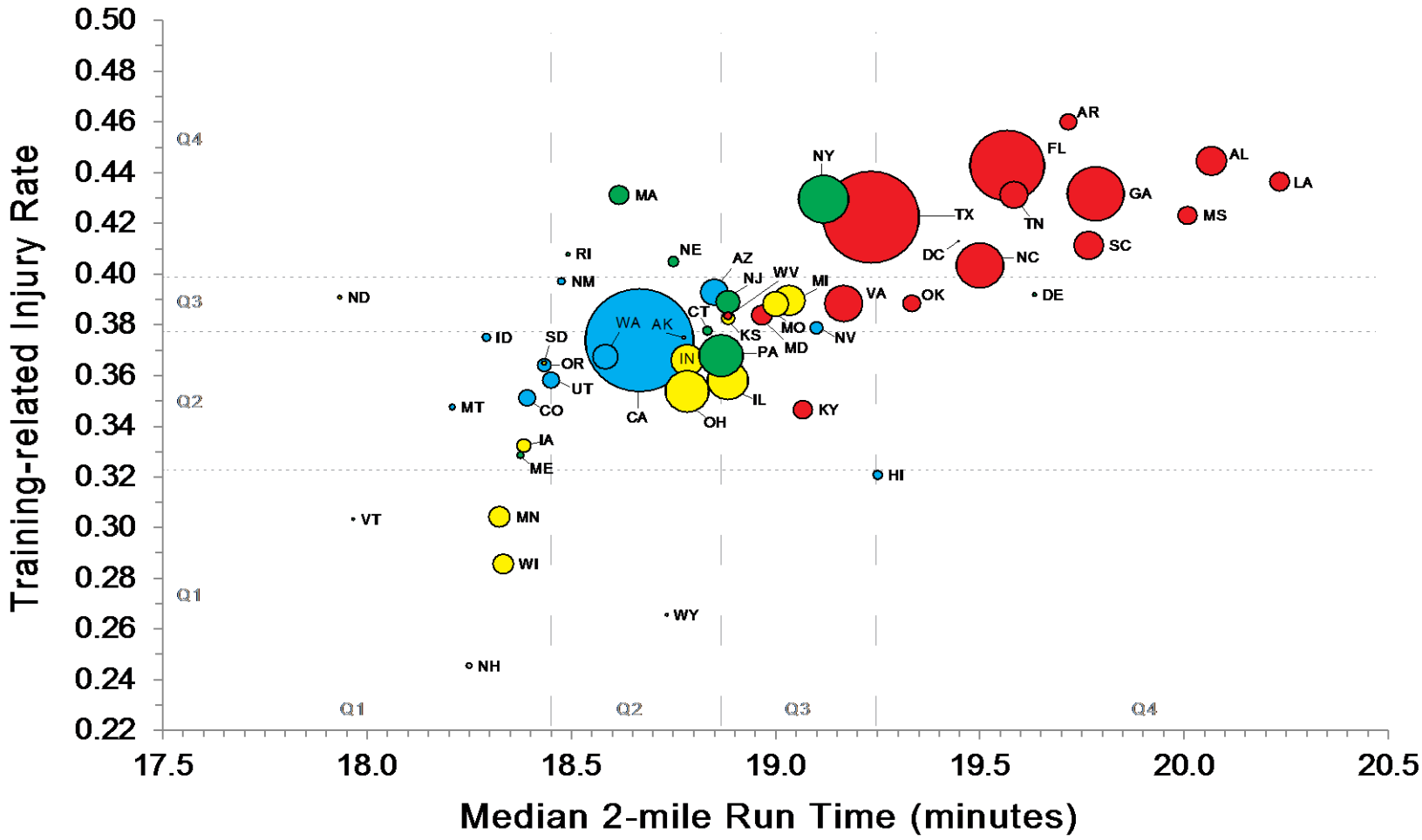
Males (A)



Females (B)

Figure 2. Correlation between the incidence of a recruit experiencing a training-related injury and median 2-mile run time in (A) male and (B) female Army recruits from each state and Washington D.C.

In multivariable Poisson regression models, state-level median 2-mile run time was positively associated with the incidence of TRIs. For every one-minute increase in median 2-mile run time, TRI increased by 40% (incidence-ratio: 1.4, 95% CI: 1.3-1.5) and 17% (incidence-ratio: 1.17, 95% CI: 1.13-1.21) in males and females, respectively. Race and BMI were not associated with incidence of TRIs in either sex, while age was positively associated with TRIs in females only (incidence-ratio: 1.07, 95% CI: 1.02-1.11). In multivariable Poisson regression models that examined state-level fitness quartiles by sex, we found that compared to the first quartile of fitness (i.e., most fit) the incidence of TRIs increased respectively by 6 and 10% in the second quartile, by 15 and 16% in the third quartile, and by 22 and 28% in the fourth quartile in male and female recruits (Table 2). The exponentiated parameter estimates and 95% CI for all variables in the Poisson models can be found in Supplementary Table S1.

Table 2. Poisson regression results for incidence-ratio of training-related injuries across state-level quartiles of fitness.

	State Fitness Quartile			
Sex	Q1 (Highest Fitness)	Q2	Q3	Q4 (Lowest Fitness)
Male Injury Incidence Ratio	1.0 (reference)	**1.06** (1.01 to 1.12)	**1.15** (1.10 to 1.20)	**1.22** (1.17 to 1.28)
Female Injury Incidence Ratio	1.0 (reference)	**1.10** (1.03 to 1.19)	**1.16** (1.08 to 1.24)	**1.28** (1.19 to 1.36)

Boldface indicates statistical significance ($p<0.0001$).

Discussion:

The most significant finding from this study was that a cluster of eleven southern/southeastern states (AL, AR, FL, GA, LA, MS, OK, SC, TN, TX, WV) were among sixteen states to produce Army recruits who were significantly more likely to become injured during basic combat training. The second most important finding was that state-level fitness was highly correlated with state-level TRI incidence in both males and females, and that low state-level fitness was the strongest predictor of state-level TRIs, even when controlling for BMI and race. To the best of our knowledge, this is the first study to have demonstrated state-level differences in TRI incidence and state-level fitness among Army basic training soldiers. Given the economic and tactical impact of TRIs on military readiness,[17,18,23] results from this study demonstrate the disproportionate burden that certain states are having on national security.

These results are generally consistent with previous investigations of individual-level factors associated with TRIs in military populations. For example, previous research has shown sex and physical fitness to be the strongest predictors of TRIs among military recruits.[17,24,25] Previous studies have also shown that obese recruits, and recruits with lower PA levels prior to military service, were at increased risk for sustaining a TRI during basic combat training.[15,22] The current study found no state-level association between BMI and TRIs, and was not able to investigate associations between PA levels of recruits and injuries as prior PA data of recruits were not available.

Results from this study have important implications for public health policy as it relates to population-levels of PA and fitness. Many of the states identified here as being in the highest quartile for TRI incidence and/or the highest quartile for low fitness are also well-recognized for their comparatively high prevalence of non-communicable diseases,[1,2] obesity,[4] and physical inactivity,[3] and subsequently their disproportionate public health burden. Low PA and cardiorespiratory fitness are among the most significant public health challenges of our time.[6] Numerous epidemiological studies have shown in both men and women that cardiorespiratory fitness, which was the fitness measure used in the current study, is a more powerful predictor of risk for adverse health outcomes and mortality than traditional risk factors such as smoking, hypertension and diabetes.[26,27] Notably, small improvements in cardiorespiratory fitness, which can be achieved through modest increases in PA, have been associated with significant reductions in mortality.[26,28,29]

As a result, policy and environmental approaches aimed at increasing population-levels of PA and fitness are recognized as critically important to public health.[10] Evidence suggests that implementation of active-living policies in specific settings can yield improvements in PA. For example, policies affecting the frequency and quality of physical education in schools,[30] active transportation policies including Complete Streets, Safe Routes to School and bike/pedestrian infrastructure,[31] and physicians prescribing PA to patients[32] have all been shown to increase activity levels. However, these policies are not consistently and fully implemented across the country. For example, there are significant regional differences in Complete Streets implementation with

lower rates in the deep South, likely due to historical development patterns, urban sprawl, and lower levels of funding for active transportation.

Some of the greatest public health achievements have come as the result of state-level policy change. State-level regulations around sanitation, fluoridated water, and the use of safety belts have all yielded significant improvements in health outcomes.[33] However, state-level support for active living policies remains low in the U.S.[34] This lack of support is likely due to framing physical inactivity and low fitness predominantly as public health problems, which generally do not resonate with the agenda of lawmakers.[10] Evidence from the area of tobacco control demonstrates that the framing of tobacco as having economic, social, cultural, and geopolitical consequences provided the impetus for legislative policy interventions that have yielded significant changes in tobacco behavior across the population.[11] This is consistent with other public health issues and theories of the public policy process, which demonstrate the importance of framing issues in ways that resonate with policy makers.[35,36] Therefore, perhaps framing physical inactivity and low fitness as matters of military readiness and national security, in addition to or instead of public health, could advance advocacy efforts aimed at increasing population-levels of physical activity and physical fitness.

John Kingdon's "Multiple Streams Model" highlights the importance of appropriately framing problems in order to drive significant policy change forward.[37] In this well-accepted model of the policy process, Kingdon proposes that when a problem stream (e.g. low physical fitness and PA as threats to public health) converges with a policy stream (e.g. state governments providing incentives for

adopting mixed-use zoning laws), and with the politics stream (e.g. national mood or turnover in government), a "policy window" opens and significant policy change occurs. Public health researchers, practitioners, and advocates have little-to-no influence over the politics stream, however they can directly influence the policy and problem streams. As described previously, public health researchers, practitioners, and advocates have primarily used the relationship between physical inactivity and low fitness on public health as "the problem" and this has proven to have been insufficient for achieving state- and federal-level legislative policy change.

Initiatives such as the National Physical Activity Plan, Healthy People 2020, and the Step it Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities include state- and federal-level, evidence-based policy recommendations aimed at increasing population-levels of PA and fitness. However, the limited uptake of the policy recommendations contained within these initiatives suggests that the "policy window" has remained shut. According to Kingdon's theory, this implies that while the policy stream for PA and fitness may be robust, it has not yet meaningfully converged with the problem and politics streams.

Military readiness and national security have been cornerstones of American governmental policy since its inception.[38] Perhaps now, more than ever, lawmakers and the general public (e.g. the politics stream) are deeply concerned with military readiness and national security. The outcome of this study, which establishes state-level differences between fitness and TRIs in Army recruits, allows for the framing of low fitness as problematic for military readiness and national security, not just public health. Consequently, this allows for the creation of a new problem stream for physical inactivity and low fitness that aligns with the current politics and active-living

policy streams, and for the three streams to converge. With that convergence, the policy window for state- and federal-level active-living policies may open.

Limitations

This study has some limitations. The cross-sectional nature of our data precludes us from determining what policies, systems, and environments within the states identified here caused the observed differences in fitness and TRI incidence among recruits from those states. However, we controlled for likely confounders, such as age, race, and BMI, and were still able to demonstrate a strong association between state-level fitness and injury risk. Furthermore, we cannot account for temporality. However, it is plausible that either the absence, or suboptimal nature, of active-living policies and environments within the states identified here may explain the lower fitness levels and increased injury risk of recruits coming from those states. Another potential limitation to the current study is its large sample size. Given a sample size of nearly 170,000 individuals, statistically significant differences are easily detectable and potentially not practically relevant. However, given the economic and tactical implications of a single training-related injury, and that male recruits coming from states with the highest prevalence of low fitness (4^{th} quartile) were 22%, 15%, and 6% more likely to become injured than males coming from states in the first, second, third quartiles, respectively, the results are both statistically significant and practically relevant. Results from female recruits are similarly significant and relevant given that female recruits coming from states in the fourth fitness quartile were 28%, 16%, and 10% more likely to become injured than females coming from states in the first, second, and third fitness quartiles, respectively.

Conclusions:

In conclusion, we found that eleven of sixteen states from which Army recruits were most likely to become injured were clustered in the south/southeastern region of the U.S. We also found that state-level fitness was the strongest predictor of state-level injury incidence, and that ten of thirteen states in the lowest fitness quartile were also clustered in the south/southeastern region. Given the economic and tactical impact that training-related injuries have on military readiness, our results suggest that the states identified here pose a greater threat to military readiness than do other states. Furthermore, many of the states identified here have been previously identified for their disproportionate public health burden given the high prevalence of non-communicable diseases, obesity, and physical inactivity within those states.

Implications for policy and practice:

Active living policies should be vigorously pursued to improve public health and national security outcomes in all states, but particularly in the states identified in the current study. Individuals and organizations advocating for local-, state, and/or federal-level active living policies may benefit from using results from this study to reframe low physical activity and low fitness as national security concerns, in addition to being public health concerns.

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Figure Titles

Figure 1. States ranked by quartiles of cardiorespiratory fitness of males (A) and female (B) U.S. Army recruits and training-related injury incidence of male (C) and female (D) U.S. Army recruits entering basic training from 2010-2013.

Figure 2. Correlation between the incidence of a recruit experiencing a training-related injury and median 2-mile run time in (A) male and (B) female Army recruits from each state and Washington D.C.

Supplementary Table Titles

Supplementary Table S1. Association between state-level injury incidence and state-level