Health Spillovers in the Workplace: Evidence from Conditional Random Assignment to Army Units*

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Abstract

Over the last 20 plus years the increasing rates of obesity have led to a growing body of literature attempting to explain changes in physical health. This paper explores the impact of workplace peers' fitness on individual fitness and weight status. Using conditional random assignment of Army soldiers to units, I look at the impact of within unit peers' physical fitness on soldier physical fitness and weight status. Being assigned to a more fit unit increases individual fitness and decreases the likelihood of having obesity. The impact on soldier obesity is particularly note worthy as it persists for at least three years following the dissolution of the peer group. Using a unique instrumental variables approach, I show that changes in peers' time varying fitness behaviors can cause spillovers separate from peers' time invariant ability. Further analysis shows that the impact of having peers with greater fitness or having a greater percentage of highly fit peers appears to be independent of the peers' weight status or other characteristics. Finally, I find that the results are driven by individuals competing with their top performing peers rather than being motivated to not be the least fit individual in the unit.

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1 Introduction

In the last 20 years there has been growing concern with an epidemic of obesity in the United States. Obesity currently affects over 40% of American adults, as compared to only 14% in the 1970's (CDC 2022a). According to the CDC (2022b), obesity increases the risk of high blood pressure, high cholesterol, type 2 diabetes, sleep apnea, asthma, and joint issues all of which costs approximately $173 billion a year in related medical care. There has been a range of explanations for this trend including changes in food production, increases in fast food restaurants, and changes in individual physical activity (Cohen-Cole and Fletcher 2008 and Chruch et al. 2011). These concerns have led more and more employers, insurers, and governments to take steps to target factors that may harm metabolic health and increase associated costs. Examples of these measures include changes to workplaces to increase physical activity, such as standing desks, employer/insurer provided gym memberships, insurance wellness plans that incentivize physical activity and consumption of healthy foods, and local government taxes of sugar sweetened beverages (Mattke et al. 2013 and Center 2024). One under explored mechanism which could drive the large changes in physical health as well as impact the effectiveness of these measures are peer effects. If individual health behaviors, including physical activity, are impacted by the characteristics or behaviors of their peers, then small environmental changes could create a positive feedback loop leading to large changes in physical health as seen in the increase in obesity.

This paper examines the potential for the physical fitness of workplace peers to impact physical health among Army soldiers. I find that being assigned to a company with higher fitness scores has a short-run positive effect on soldier fitness scores and a longer-run negative impact on the soldier's BMI and likelihood of being obese. The Army setting is uniquely situated to address common issues in identifying causal peer effects including endogenous peer selection, reflection, and isolating peer effects from common environmental shocks (Manski 1993). Endogenous peer selection is when individuals select peers with specific attributes. Peer selection causes individual and peer characteristics and outcomes to be correlated absent of any potential peer effect. Meanwhile, reflection occurs when an individual's characteristics impact their peers' outcomes which then is reflected in the relationship between the individual's outcome and the peer measure making it difficult to estimate the size of any potential spillover. The final concern is that individuals and their peers share a common environment that impact both the peer measure and the individual's outcome causing the peer measure and the individual outcomes to be correlated outside of any potential causal peer effect.

In the US Army, soldiers are conditionally randomly assigned to companies of approximately 100 service members. Soldiers go through semi-annual testing for both physical fitness and body composition. This enables me to examine the impact of being assigned to companies with higher fitness test scores on own fitness and weight status. The conditional random assignment of soldiers to units addresses concerns with endogenous peer selection as soldiers cannot influence who their peers are. I address reflection by generating measures of company fitness in each quarter and using the measure for the soldier's company prior to the soldier's arrival to the unit. Since this measure is determined prior to the soldier's arrival to the company and soldiers are conditionally randomly assigned to units, soldiers cannot impact their peer measure.[1] Finally, similar to other peer effect papers, I can isolate the effect of peers from other environmental factors by controlling for time varying characteristics of soldier's location. I can also address concerns with environmental factors by instrumenting for peers' current fitness scores with their most recent fitness scores from their prior units. Under the assumption of conditional random assignment to companies, this isolates the variation in peer fitness that is uncorrelated with the conditions of the current company.

The Army setting is advantageous for it's rich data and ability to follow individuals for an extended period. The military is fairly unique in having collected standardized fitness data on a large group of adults that has been connected to other health and demographic information and follows individuals for at least several years. Prior studies of peer effects of fitness or weight status follow individual outcomes for one year after the formation of the peer group. My setting allows me to look at results up to six years after assignment to the peer group. This time period is important because soldiers change units every two to three years. This means I will be able to see if peer fitness impacts soldier outcomes after the soldier no longer interacts with any of the original peer group. While this is generally important when studying peer effects, it is of particular significance when examining the impact of peers on individual weight status as patients enrolled in weight loss interventions typically regain most or all of their lost weight following the end of the intervention (Ayyad and Andersen 2001, Rubino et al. 2021, and Aronne, Sattar, and Horn 2024).

The characteristics of enlisted soldiers also provide some advantages to this setting. Enlisted soldiers are typically high school graduates without college experience with in-

[1]Using a preexisting peer group also addresses the concerns with using peer group average characteristics to study peer spillovers brought by Angrist (2014). Appendix B discusses this in more detail.

come similar to the average full time worker.[2] The fact that enlisted soldiers are economical representative of the average worker is important for examining impacts on physical fitness and weight status as physical activity and having a healthy weight status are positively correlated with income and educational attainment (Elgaddal, Kramarow, and Reuben 2022 and Cutler and Lleras-Muney 2006).

I find that a one standard deviation increase in peer fitness leads to a 0.08 standard deviation increase individual fitness 1 year after joining the company, and that this effect fades out 5 to 6 years later. Meanwhile, a one standard deviation increase in peer fitness decreases the likelihood that the individual is obese 3-6 years later by 0.33-0.6 percentage points (4% of the mean). Further exploration of the results supports peer effects as the primary mechanism as opposed to common environmental factors as well as the ability of changes in peer behaviors to create spillovers. I also find that individuals are more motivated to try to keep up with their top performing peers as opposed to not being in the bottom of their peer group and that the impact of peer fitness is unchanged when controlling for other peer characteristics including peer weight status.

Prior evidence on peer effects in physical fitness is limited. Carrell, Hoekstra, and West (2011) examines the impact on the fitness of first year students at the Air Force Academy of being randomly assigned to squadrons (groups of 20-30 other students). They find evidence of positive peer effects of physical fitness on individual fitness one year after the formation of the peer group. It remains to be studied whether peer fitness has a different effect for a less selective population, has lasting impacts on individual fitness, impacts individual weight status, if the impact of peer fitness is influenced by peer weight status, or if changes in peer fitness behaviors can lead to spillovers independent of peer ability.[3]

A broader literature exists that has looked at the related question of the impact of peer weight status on individual weight status. While the social contagion hypothesis of obesity (popularized in part by Christakis and Fowler 2007) argues that having peers

[2]Soldier income is based on regular military compensation (RMC) which includes base pay, basic allowance for housing (BAH), and basic allowance for subsistence (BAS) as well as the tax benefit from the BAH and BAS being untaxed. BAH is based on soldiers being stationed at Ft Hood in Texas as this is the most common location for soldiers in my data set. In 2024. an E04 soldier with 4 years of service has an RMC of $61,572. According to the Current Population Survey, the median full time worker in the United States had a usually weekly earnings of $1166 (or $60,362 annually) in Q3 of 2024 (BLS 2026). This is greater than the median earnings of workers with a high school degree who had a usual weekly earnings of $946 ($49,192 annually).

[3]There have been a series of studies showing that financial incentives can increase gym attendance; however, this effect decays quickly following the end of the intervention (Charness and Gneezy 2009, Acland and Levy 2015, and Royer, Stehr, and Sydnor 2015

with higher body mass index (BMI) or weight leads to an increase in body mass index or weight, the studies that have followed have found mixed evidence, especially when looking at adults and controlling for common environmental factors (Cohen-Cole and Fletcher 2008, Mora and Gil 2013, Trogdon, Nonemaker, and Pais 2008, Yakusheva, Kapinos, and Weiss 2011, and Yakusheva, Kapinos, and Eisenberg 2014). I also provide some evidence on the impact of peer weight status. Though somewhat noisy, I find no evidence that having peers with a higher BMI or having more obese peers impacts individual's fitness or weight status. Neither the null results nor the noise should be surprising given the crude relationship between weight/BMI and health or ideal body image, particularly amongst men (The Learning Network 2022). An increase in body mass can either increase or decrease the risk of mortality while physical fitness has a monotonic relationship with longevity (Bigaard et al. 2004, Clausen et al. 2018, Mandsager et al. 2018, and Strasser et al. 2018). In addition to having a clearer relationship with health outcomes, physical fitness is potentially a more potent area for peer effects as fitness has clear measures for competition such maximum weight lifted or fastest time on a run.

The rest of this paper is as follows: section 2 provides details on the data and the setting of the study, section 3 discusses the methodology and identifying assumptions, section 4 displays the results on soldier fitness and weight status, section 5 explores the peer effect mechanism, section 6 examines the importance of the distribution of peer fitness, section 7 discusses external validity, and section 8 concludes.

2 Data and Background

Data for this project has been collected by United States Army Human Resources Command (HRC) and Military Entrance Processing Command (MEPCOM). The data contains the universe of soldiers who enlisted in the active duty Army from 2005-2018. All data has been de-identified prior to being accessed by researchers, and is stored on Department of Defense servers to ensure data security.[4]

All data pertaining to the soldier's time in the Army comes from Army personnel records maintained by HRC. This includes characteristics of soldiers at the time they enlisted in the Army including height, weight, and Armed Forces Qualification Test (AFQT) scores. The data covering soldiers' time in the Army exists at a monthly level. The rel-

[4]Data for this project has been provided by the Office of Economic and Manpower Analysis (OEMA) at the United States Military Academy

evant data include soldier occupation, unit/location assigned, weight, height, physical fitness scores, education status, and demographics. The key variables for this study are height, weight, and fitness scores.

The data does have a notable weakness. While the MEPCOM and HRC data includes a range of information from the time soldiers apply to enlist and when they first show up for basic training, the MEPCOM data does not contain fitness scores and soldiers do not have recorded APFT scores from basic training. This means that there is no base line measure of soldier's fitness.

2.1 Soldier Assignment Mechanism

Soldiers start their service with basic training followed by occupation specific training before being assigned to their first operational unit. Soldiers are assigned to brigades by personnel managers at HRC. The goal of the assignment process is to meet the Army's staffing needs. HRC projects future vacancies based on military occupation specialty (MOS), and rank (grade). Personnel managers fill projected vacancies by searching through soldiers meeting the correct occupation requirements grouped together by rank (junior enlisted, junior non-commissioned officer, or senior non-commissioned officer) available for assignment over the following 4 to 12 months (United States Army 2019b). Other considerations for first-term soldiers include initial contract length which restricts the number of assignments they are allowed to have under that contract, location preferences, and family situation such as being married to another service member or having a family member with medical needs (exceptional family member program - EFMP). After arriving at the brigade soldiers are assigned to their companies by brigade personnel managers. The goal of the brigade personnel managers is to maintain personnel strength across companies in the brigade. Importantly, assignments are done irrespective of soldier characteristics, other than those mentioned above, and soldiers generally cannot influence their final assignment (Lyle 2006). Therefore, when restricting to junior enlisted soldiers (the first four enlisted ranks), assignment to company should be random conditional on occupation, location, contract length, and a time component.[5]

[5]Joint military couples and EFMP primarily restrict the location to which soldiers can be assigned so controlling for location should address concerns over these factors. Additionally, considerations for joint military couples and EMFP affect a very small number of assignments so not explicitly controlling for them should not impact results.

2.2 Army Physical Fitness and Body Composition Tests

During the time period covered by this study, soldier physical fitness was measured using the Army Physical Fitness Test (APFT). The APFT consists of three tests, maximum push-ups in two minutes, maximum sit-ups in two minutes, and a timed two mile run. Raw scores are converted into an age and gender adjusted score that range from 0-100 based on standards set by the Army. Soldiers must pass each test with a minimum score of 60.[6] Figure A1 depicts the distribution of soldier fitness scores and BMI one year after their arrival at their first operational unit. There is no evidence of bunching that would suggest manipulation of APFT scores around the minimum passing threshold of 180. One caveat is that soldiers must pass each part of the test individually, and my data only contains the composite score. Therefore, we can only see if a soldier scores above 180 (the minimum composite score for it to be possible to pass each section), but not if soldiers were marginal to the threshold for each section. With regards to the timing of tests, Soldiers are required to record a test every six month with exceptions made for soldiers who recently deployed or have a medical waiver (United States Army 2017). Soldiers' height and weight are measured at the time of the fitness test or every six months.[7]

2.3 Sample Construction

The sample for this project consists of newly enlisted male soldiers with no prior service who arrived at their first operational unit between 2005 and 2018, and had a standard contract (3-6 year term and initial rank E01-E04). Female soldiers are dropped as they represent a small fraction of the sample and have to meet different standards. To reduce the concerns for final soldier assignments to be related to soldier or unit characteristics, soldiers assigned to headquarters companies, which are irregular units that deal with administrative and support issues for the battalion, are dropped. To further address this concern, the final soldier analysis sample is restricted to soldiers assigned to Brigade Combat Teams (BCTs). Starting in 2004, the Army restructured BCTs to enable sustained

[6] for example the slowest passing time for a male 22-26 years of age on the run is 16:36 and the time for the maximum score is 13:00.

[7] The Army body composition program officially measures body composition using body circumference and height; however, if a soldier's weight is within an allowed range for their height and gender, they do not need to have their body circumference measured (United States Army 2019a). Army regulation does allow for body composition testing to be done within 7 days of the APFT. This is to allow soldiers who are close to the weight cutoff to engage in weight cutting practices (e.g. dehydration and calorie restriction) without impairing their performance on the fitness tests.

capabilities for prolonged fighting in Afghanistan and Iraq. One of the goals of this process was to ensure that BCTs were interchangeable (Johnson et al. 2012). So, by restricting the comparisons being made to a set of soldiers with the same qualifications (first-term soldiers with the same occupation, contract length, and arrival date) who are assigned to a set of interchangeable units (BCTs excluding headquarters companies), concerns that the deviations from the conditional random assignment to units constructed by HRC are correlated with the company and soldier characteristics should be lessened. Table A1 shows how each of these restrictions impacts the sample size.

Table 1 shows the summary statistics. All soldier characteristics, with the exception of first fitness score, are determined at the time the soldier entered the Army. The company characteristics are from the soldier's first operational company and are determined in the quarter prior to the soldier's arrival. Column (1) shows the characteristics of all soldiers who enlisted between 2005-2018. Column (2) restricts to Male soldiers not in headquarters companies with no prior service. Column (3) shows the characteristics of the final sample by further restricting to soldiers in BCTs. Overall, soldiers assigned to BCTs are more likely to be white and less likely to be married, and BCTs are slightly more fit.

2.4 Obesity Measures

The most common measure of overweight, obesity, and severe obesity for adults is having a body mass index (BMI) greater than 25, 30, and 40 respectively. BMI is the weight in kilograms divided by height in meters-squared. Figure 1 panel shows the rates of overweight, obesity and severe obesity in United States between 1960 and 2018.

3 Methodology

The primary results for this paper use the natural experiment created by the assignment process of soldiers to their first operational unit. I implement the following reduced form regression model:

$$Y_{it} = \beta_t X_{c,q-1} + \zeta V_i + \omega_{lojq} + \mu_{it} \tag{1}$$

Y_{it} is a soldier characteristic such as fitness score or BMI t years after their arrival at the unit, $X_{c,q-1}$, is the median fitness score of male soldiers in the same company as solider i in quarter $q-1$, the quarter prior to the arrival of soldier i, V_i is a vector of soldier characteristics (soldier race, education, age, height, weight, and BMI measured at the time they entered the Army), and ω_{lojq} are fixed effects for the interaction of soldier i's location, occupation, contract length, and quarter of arrival at their unit. The coefficient of interest, β_t, estimates the impact of an increase median peer fitness on soldier outcomes t years after the soldier arrives at the company.

3.1 Assumptions

The primary assumption that this identification strategy relies on is zero conditional covariance between the peer measure and the individual error term. This assumption[8] requires $X_{c,q-1}$ to not vary with soldier characteristics in a way that could impact the soldier's outcomes after conditioning on the fixed effects.

$$cov(X_{c,q-1}, \mu_{it}|\omega_{lojq}) = 0 \tag{2}$$

Conditional zero covariance should be secured by conditioning on the factors used to assign soldiers to units. As discussed above, when restricting to soldiers with the same qualifications and availability being assigned to interchangeable units, it is unlikely that assignments are systematic with respect to soldier or unit characteristics including fitness and weight status. The results section provides evidence to support this claim.[9]

Another challenge in identifying peer effects is that, if one is not careful, it is possible that an individual's characteristics influence the peer measure which is then reflected in the the individual outcome. When this occurs, the results of regressing the individual outcome on the peer measure is contaminated by the influence of the individual characteristics on the both the outcome and peer effect. To avoid this, I measure company characteristics in the quarter prior to the soldier's arrival at the company. This avoids issues with reflection, as soldier's cannot influence the fitness and weight status of other individuals in their unit prior to the soldier's arrival at the unit.

[8]conditional random assignment should guarantee conditional independence; however the linear regression model only requires zero conditional covariance, a weaker assumption.

[9]Previous work has utilized the conditionally random nature of soldier assignments to examine range of topics including deaths of despair (Bruhn et al. 2024), marriage formation (Wozniak, Baker, and Carter 2024), credit and finances (Carrell and Zinman 2014; Carter and Skimmyhorn 2017; Lieber and Skimmyhorn 2018), and parental absences (Angrist and Johnson IV 2000).

3.2 Model of Peer Effects

The use of company characteristics in the quarter prior to the soldier's arrival leads to the question of how soldier's exposure to peers changes over time. Figure 2 shows how company fitness in the quarter prior to the soldier's arrival impacts the company fitness after the soldier's arrival. These estimates are the coefficients of the regression.

$$X_{c,q+t} = \pi_t X_{c,q-1} + \zeta V_i + \omega_{lojq} + \epsilon_{it} \tag{3}$$

The figure shows that the relationship between current and future company fitness fades out over time so that a 1 standard deviation increase in company median fitness in the quarter prior to arrival is associated with a 0.05-0.1 standard deviation increase in the company's median fitness 3 years later.

The results section will show the reduced form estimates of equation 1. Because the company measure $X_{c,q-1}$ has a cumulative impact on peer exposure, it is unclear what the appropriate first stage is for the impact of peer characteristics on long-run outcomes. However, for short-term effects (effects 1 year after the soldier's arrival), I will also report two-stage least squares estimates $\beta_t^{2sls} = \frac{\beta_t}{\pi_1}$[10] to compare my results to the short term effects found in previous studies.

4 Impacts on Soldier Fitness and Health

This section will begin by presenting results from equation 1 regressing soldier outcomes on company median male fitness score. I will then discuss heterogeneity and potential mechanisms.

4.1 Impact of Peer Fitness on Soldier Outcomes

Table 2 shows that peer peer physical fitness is unlikely to be correlated with solider characteristics. As has been discussed, conditional on location, occupation, contract length, and timing of arrival at the unit, company median fitness score prior to the soldier's arrival should be independent of soldier characteristics. Column (1) of table 2 provides evidence of this. Each column of the table reports the estimates from regressing soldier

[10] π_1 comes from the regression $X_{c,q+1} = \pi_1 X_{c,q-1} + \zeta V_i + \omega_{j(i)} + \epsilon_{i,1}$. The period after the soldier's arrival is used because it is the first full quarter the soldier is at the company.

characteristics at the time they entered the Army on the characteristics of male soldiers in their company in the quarter prior to their arrival. Column (1) uses the median fitness score. Each column includes fixed effects for the interaction of location, occupation, contract length, and quarter of arrival at the company as these are the factors that influence the assignment mechanism. All standard errors are clustered at the company by quarter of arrival level as this is the level at which the instrument is constructed and treatment is assigned (Abadie et al. 2023). None of the estimates are significant at the 10% level and the estimates are not jointly significant. This supports the argument that when considering first term soldiers and restricting to BCTs, soldier assignments are conditionally random. I still control for these baseline characteristics in equation 1 in order to improve precision of the estimates.

Table 3 shows that there are positive peer spillovers.[11,12] To improve interpretability, the peer measure has been standardized to have mean 0 and standard deviation 1. Additionally soldier fitness score in Panel A has also been standardized to have mean 0 and standard deviation 1. The table shows that company median fitness score has a significant positive impact on own fitness scores with a one standard deviation increase in the median peer fitness score leading to a 0.079 standard deviation increase in own fitness score one year after arrival. For comparison, the two-stage least squares estimate is 0.160.[13] This is larger than the impact of 0.13 found in Carrell, Hoekstra, and West (2011). Unlike the previous study I can also look at longer term effects. The impact of peer fitness on own fitness decreases over time. This suggests that current peers are more important for the impact on fitness. As shown in figure 2, the continuous turnover of the peer group leads to the impact of the company fitness measure on current peer fitness to largely fade out within about 3 years.

Peer fitness also appears to have a marginal effect on BMI and the probability of having a BMI greater than 30. A one standard deviation increase in company median fitness score decreases the likelihood that a soldier is obese 3-6 years after arrival by 0.33-0.60 percentage points (or about 4% of the mean).[14] This includes time after the soldier no

[11]The table shows estimates of β_t from equation 1. As in table 2, the regressions include fixed effects for duty station, occupation, contract length, and arrival quarter. The median fitness score of male soldiers in the same company the quarter prior to the arrival of the individual is used as the measure of peer fitness.

[12]The median was chosen because as it may be more accessible for a soldier to know if they are above or below the median of their company as opposed to calculating the mean fitness of their unit. Table A3 repeats table 3 using the company mean instead of the company median. The results do not differ.

[13]Estimates for β_1^{2sls} are shown in table A2.

[14]There may be some concern that results are impacted by the Covid 19 pandemic. The fixed effects include quarter of arrival to the company which means that there are no comparisons being made between pre-

longer interacts with the same peer group. Soldiers move every two to three years, so the soldier's peers are turning over every month with total or near total replacement within three years. This is in contrast to other obesity interventions that have found that even when a intervention induces weight loss, the effects are short lived. As mentioned in the introduction, most participants in both dietary and drug interventions regain the lost weight after the end of the intervention (Ayyad and Andersen 2001, Rubino et al. 2021 and Aronne, Sattar, and Horn 2024).

It is important to note that each regression is restricted to soldiers that are observed in the data for the length of time being considered. This introduces concerns that the results may be impacted by changes in the sample composition.[15] I propose two pieces of evidence to assuage these concerns. First, figure A2 shows that the results are similar when restricting to a balanced panel of soldiers who remain in the Army for at least 6 years after arriving company and who are not missing a fitness score. Second, peer fitness does not appear to have an impact on soldiers separating from the Army. Table A4 shows that company fitness does not impact the likelihood that the soldiers stays in the Army more than 3 months past their initial contract expiration, more than 6 months past their initial contract expiration, or leaves the Army within 6 months of their initial contract expiration confirming that company fitness does not impact selection out of the sample. This provides evidence that there is not differential attrition out of the sample.

4.2 Heterogeneity by Weight and Fitness

While the result that adult fitness and weight status can respond to workplace environment is interesting, the repercussion for individual health and associated health care costs as well as the importance for the military in terms of getting current and potential soldiers to meet and maintain minimum fitness and body composition standards depends on whether the impact of company fitness effects high risk individuals. For the purpose of this study high risk is defined as being in the top quartile of initial BMI (BMI > 27.5).

covid and post-covid observations. Additionally, restricting the data to prior to march 2020, does not meaningfully change the results.

[15]Panel A only includes soldiers with a recorded fitness test. While soldiers are required to take a fitness test every 6 months, soldiers can be exempted from a fitness test if they are injured or deployed, and the Army did not require fitness test records to be recorded electronically during this time period. This leads to a notable portion of the sample not having a recorded fitness test until 2 to 3 years after arrival at the company. Restricting to soldiers that have a recorded fitness test prior to arrival at the first operational company (less than 10% of the sample) leads to larger but not statistically different estimates of the impact on soldier fitness.

Figure 3 repeats the results from table 3 looking at heterogeneity across soldier BMI at the time they entered the Army. The figure plots the results for soldiers in the bottom quartile, inner quartiles, and top quartile of initial BMI. The impact of company median fitness score on soldier fitness score is similar across each group. The impact on BMI and likelihood of being obese is concentrated in individuals in top quartile of BMI. The point estimates in panel (b) suggests that the impact on the top quartile is larger in magnitude than the impact on the inner quartiles; however, do to noise of the estimates I cannot reject that the two are the same. Additionally, a standard deviation increase in company median fitness score only decreases the likelihood of being obese for soldier's in the top quartile (approx. 2 percentage points at years 4-6 relative to a mean of 40-45%). This makes sense as soldiers with an initial BMI < 27.5 have a lower likelihood of becoming obese in the following six years. These results have a couple important implications. The decrease in BMI and likelihood of having a BMI > 30 are greatest in those with a higher risk of health conditions related to excess weight. Relatedly, for individuals in the bottom quartile of initial BMI for whom losing weight might have negative health consequences, the effect of peer fitness on BMI is indistinguishable from 0.

5 How does Peer Fitness Influence Individuals?

This section explores how peer fitness impacts soldier outcomes. I start by separating out the impact of peers from common shocks to the peer group. I then provide evidence on the ability of peers' time varying behaviors to influence individuals and discuss what this means to the potential of social policy to create spillovers. The section concludes by examining the role of correlated peer characteristics, especially peer weight status, to influence the impact of peer fitness.

5.1 Peer Effects versus Common Environment

The interpretation of these results depends in large part on the mechanism through which these effects on fitness scores and weight status take place. Up to this point I have shown results for the impact of individuals being assigned to company's with more physically fit soldiers. One explanation for these results is that they describe the effect of having more physically fit peers. However, it is also possible that the variation in company fitness scores is being driven by environmental factors that are also impacting the soldier outcomes. An example of this would be if some companies have access to better exercise space/equipment that leads to an increase in peer fitness as well as the soldier's fitness. The fixed effects control for both location and time of year, so environmental concerns such as exercise space, proximity of fast food establishments, and the weather should not be an issue. Additionally, I can replace location with brigade in the fixed effects to reduce concerns that differences in Army experiences such as deployments are driving the results. Table A5 shows that reduced form estimates of equation 1 do not change when including brigade instead of location in the fixed effects (in comparison to table 3). There are, however, some concerns that are particular to this setting that are not addressed by controlling for brigade. The primary concern is the potential influence of company commanders. The commander may effect company fitness scores and soldier outcomes in multiple ways. There is a potential direct effect of the commander requiring the company to engage in more physical training. This would likely directly increase the measures of company fitness score and individual soldier fitness score. More generally, this concern can be modeled by assuming that company fitness, $X_{c,q-1}$, is function of the characteristics of the soldiers in the company ,$X^s_{c,q-1}$, and the characteristics of the company itself, $X^c_{c,q-1}$.

$$X_{c,q-1} = f(X^s_{c,q-1}, X^c_{c,q-1}) \tag{4}$$

The reduced form equation, including a company effect, is:

$$Y_{it} = \beta_t X_{c,q-1} + \zeta V_i + \gamma_{ct} + \omega_{lojq} + \mu_{it} \tag{5}$$

Where γ_{ct} is a fixed effect for company c in time period t and $X_{c,q-1}$ is correlated with γ_{ct} through $X^c_{c,q-1}$. Because the peer measure is determined at the company by quarter level, I cannot directly control the time specific characteristics of the company[16]. Instead I will instrument for peer fitness to isolate the variation in peer fitness that is uncorrelated with the current companies characteristics. As will be discussed, this test is not perfect, but the results support the claim that environmental factors are not the primary cause of the results.

[16]One potential test would be to include a time invariant company fixed effect γ_c. This is not possible as the company fixed effect would be an endogenous regressor. To see this, consider a soldier that is assigned to company A from January 2012 to December 2014. The peer measure of every soldier that is assigned to company A between April 2012 to March 2014, would be influenced by the fitness score of the original soldier which is an outcome measure. Since soldiers' outcomes are used as to construct the peer measures, I cannot include a time invariant company fixed effect.

5.1.1 Instrumenting with peer fitness from the prior company

One method of testing for the difference between peer effects and common environment effects would be to have an instrument that is correlated with $X^s_{c,q-1}$ but uncorrelated with $X^c_{c,q-1}$. To do this, I propose a new peer measure. This instrument is constructed in the same manner as original company measure, male soldiers in the individual's company the quarter before the individual arrives at the company. Instead of using the peers most recent fitness scores, the new instrument will use the peers most recent fitness score at their prior unit. I denote this new instrument $X^{s,c-1}_{c,q-1}$ since it is the median fitness score of soldiers, s, in company c in quarter $q-1$, using the fitness scores from the soldiers' prior companies, $c-1$. The instrumental variables model is:

$$ReducedForm : Y_{i,t} = \beta^{c-1}_t X^{s,c-1}_{c,q-1} + \psi V_i + \omega_{lojq} + \nu_{i,t} \tag{6}$$

$$1stStage : X_{i,t} = \gamma^{c-1}_t X^{s,c-1}_{c,q-1} + \phi V_i + \omega_{lojq} + \eta_{i,t} \tag{7}$$

The coefficient of interest is $\beta^{2sls}_t = \frac{\beta^{c-1}_t}{\gamma^{c-1}_t}$. Under conditional random assignment, soldier's current fitness test scores are uncorrelated with the characteristics of their next company, $cov(X^{s,c-1}_{c,q-1}, \gamma_{ct}) = 0$ and the fitness of a soldier's previous and current companies are uncorrelated, $cov(X^{c-1}_{c-1,q-1}, X^c_{c,q-1}) = 0$. Thus the proposed instrument $X^{s,c-1}_{c,q-1}$ and the independent variable, $X_{c,q-1}$ are only correlated through $X^s_{c,q-1}$.

Before going into the results it should be confirmed that this is a valid instrument - that peers' fitness scores from their prior unit are uncorrelated with the characteristics of the current company. Table 2 column (3) confirms that $X^{s,c-1}_{c,q-1}$ is uncorrelated with baseline soldier characteristics. It also should be confirmed that $X^{s,c-1}_{c,q-1}$ is uncorrelated with $X^c_{c,q-1}$. So far I have only shown that soldier's initial assignments are not correlated with company fitness scores. The concern is that soldiers who are currently assigned to higher fitness companies are more likely to be assigned to companies with higher fitness scores in their next assignment. This can be tested by regressing the median fitness scores of soldiers prior company in the quarter prior to their departure on the median fitness score of the soldiers current company in the quarter prior to their arrival. A one standard deviation increase in the median fitness score of the current company is associated with a 0.024 standard deviation increase in the median fitness score of the prior company (standard error 0.005). While this result is statistically significant, suggesting that soldiers in high fitness unit are more likely to move to other high fitness units, the size of the coefficient is quite small.[17,18] Even though the coefficient is not 0, this still suggests that using the peers fitness scores from their previous company greatly reduces the potential for environmental factors to be driving the results. Thus, the estimates being the same when instrumenting with $X^{s,c-1}_{c,q-1}$ would be evidence in support of peer effects as the primary driver of the results.

Table 4 shows the two-stage least squared estimates, β^{2sls}_t from using this new instrument. Columns (1)-(3) report the original reduced form estimates from table 3. Columns (4)-(6) show the estimates of β^{2sls}_t when using $X^{s,c-1}_{c,q-1}$ to instrument for $X_{c,q-1}$. Columns (7)-(9) show the p-value from tests to see if the impact of company fitness on soldier outcomes is the same when instrumenting.[19] Soldier outcomes have been pooled into short-term and long-term periods. Panel A shows the results in years 1-3 after arrival at the company. This reflects outcomes measured when most soldiers are still at their initial company. Panel B shows the results in years 4-6 after arrival at the company. This reflects outcomes measured when most soldiers are no longer in the their initial company. As can be seen in the table there are mixed results. Instrumenting causes the estimated magnitude of the impact of peer fitness on soldier fitness to be smaller in the short run and larger, but not statistically different in the long run. Instrumenting also increases the impact of peer fitness on the likelihood of being obese. Overall this suggests that, though there may some impact of common environmental factors, the results, particularly the impact on soldier weight status, are primarily being driven by characteristics of the soldiers that comprise the peer group and not other characteristics of the company.

[17] This coefficient comes from a sample of soldier moves dropping all moves prior to and including moving to the soldier's first operational company. Only moves to non-headquarters companies in brigade combat teams are included as these are the soldiers that will comprise the peer group used to calculate $X^{s,c-1}_{c,q-1}$. Similar to the main results, the regression includes fixed effects for the combination of location, occupation, soldier rank, soldier initial contract length, and quarter of assignment as these are the factors that impact the assignment process.

[18] For comparison, the first stage coefficient (equation 3) from regressing $X_{c,q-1}$ on $X^{s,c-1}_{c,q-1}$ is 0.363 with a stand error of 0.027.

[19] The group of soldiers used for the instrument is a subset of the soldiers in the peer group. Many of the soldiers in a company are serving in their first operational unit. Since the data does not contain fitness scores from training, these soldiers do not have fitness scores from a prior unit. This means that the peer group does not include many other junior enlisted soldiers. Table A6 repeats table 4 in which I calculate the peer measure, $X_{c,q-1}$ only using the subset of the peer group with fitness scores from a prior unit. This leads to smaller OLS estimates in columns (1)-(3) as well as a larger first stage for the 2SLS estimates in columns (4)-(6). The OLS estimates are similar to the 2SLS estimates. The fact that the OLS estimates are smaller is consistent with there being larger spillovers from other junior enlisted soldiers than older non-commissioned officers as well as attenuation from only using a subset of the peer group.

5.2 Ability vs Behaviors

While the prior section provides evidence in support of the importance of peers, it does not determine how peer fitness impacts individual outcomes. It is possible that the peer effect is being driven by having peers with more athletic ability regardless of their fitness related behaviors. In this case, individuals assigned to a more fit company would be incentivized to improve their own fitness in order to keep up with their peers. This would be a model of competition or inspiration driving the peer effect. An alternative is that, independent of athletic ability, some peers have high fitness scores because they engage in more behaviors that promote fitness. In this case the peer effect could operate through individuals mirroring the behaviors of their peers. I explore this in the following decomposition.

Assume that individual fitness has two components. A_i represents an individual's athletic ability which does not vary over time. $B_{i,t}$ represents an individual's time varying behaviors which impact their fitness. The peer fitness measure is a function of the peers' ability and behaviors.

$$X_{c,q-1} = f(A_{c,q-1}, B_{c,q-1}) \tag{8}$$

Where $A_{c,q-1}$ and $B_{c,q-1}$ are the ability and fitness related behaviors of soldiers in company c, in quarter $q-1$.

The distinction between time invariant and time varying characteristics is important for determining how group formation can be used to create positive peer effects. Consider the extreme case where peer effect is driven entirely by peer athletic ability. Here, changes in individual fitness behaviors do not lead to spillovers as the individuals ability is unchanged. The only way to create a positive peer spillover would be to recruit more high ability peers or to try to manipulate group composition. This would be a problem for the Army as recruiting challenges have led the Army to create programs to enlist individuals who cannot currently meet the minimum fitness and body composition requirements to serve (Affairs 2022). This would also limit the possibility of fitness peer effects to lead to societal changes as adding high ability people to one peer group would mean reducing the number of high ability people from another group.[20] Importantly, social changes or policies that impacted fitness related behaviors would not generate spillovers. To see if government or workplace policy can generate positive spillovers we need to isolate the impact of peer behaviors.

[20] I will explore the importance of group composition in section 6.

To identify the impact of fitness behaviors separate from athletic ability, I am going to focus on peers' prior peers. Figure A3 Panel C depicts these relationships. Imagine a soldier arrives at a high fitness unit. All of the results show that this will lead to a short term increase in the soldier's fitness. As ability is fixed, this means that the improvement in the soldier's fitness must be caused by a change in their behaviors. After two to three years this soldier moves to new unit where they will have a new set of peers. If this new unit contains a large percentage of soldiers who were originally assigned to high fitness units, the new unit will be high fitness. Thus, when new soldiers are assigned to this unit, they will experience a positive peer effect. However, the increase in peer fitness will be due only to an improvement in the peer behaviors and not peer ability.

Explicitly, I propose an instrumental variables approach in which I use the percent of an individual's peers with high fitness prior peers to instrument for current peer fitness. This instrument is constructed in the same manner as the primary peer measure $X_{c,q-1}$. I find each peer's previous company and calculate the median fitness score of male soldiers in that company the quarter before the peer arrived at that company. This is the median fitness score of each peer's prior peers. To aggregate this measure across each individual's peers, I first create dummy variables for whether the prior peers are high fitness (median fitness score in the top quartile of peer groups - >267) or low fitness (median fitness score in the bottom quartile of peer groups - <240). I then take an average of this to get the percent of peers that were previously in a high or low fitness company. Following the notation in section 5.1, I denote these measures $X_{s(c),q-1}^{c-1,high}$ and $X_{s(c),q-1}^{c-1,low}$ - The percent of soldiers, s, in company c in quarter $q-1$ whose prior company, $c-1$ was high or low fitness. The instrumental variables model is:

$$ReducedForm : Y_{i,t} = \beta_t^{high} X_{s(c),q-1}^{c-1,high} + \beta_t^{low} X_{s(c),q-1}^{c-1,low} + \varsigma V_i + \omega_{lojq} + \varepsilon_{i,t} \tag{9}$$

$$1stStage : X_{c,q-1} = \gamma_t^{high} X_{s(c),q-1}^{c-1,high} + \gamma_t^{low} X_{s(c),q-1}^{c-1,low} + \varrho V_i + \omega_{lojq} + \vartheta_{i,t} \tag{10}$$

The 2SLS estimate $\frac{\beta_t^{high}}{\gamma_t^{high}}$ equals the impact of peer fitness for compliers, $\beta_t^{compliers}$. The compliers can be thought of as soldiers whose peers are high fitness if and only if the peers' prior peers were high fitness. Under random assignment, the only way in which prior peer fitness is correlated with soldier outcomes is through the fitness behaviors of the current peers.

Table A7 compares the OLS estimates from equation 1 to the two-stage least squares estimate of $\beta_t^{complier}$. The 2SLS estimates are larger though mostly not statistically different from the OLS estimates of β_t. This means that workplace policies such as, employeer provided gym memberships or insurance wellness plans, that aim to change fitness behaviors can potentially generate a positive peer effect without having to recruit higher ability individuals or manipulate peer group composition.

Having provided evidence in the prior two sections that the reduced form results are primarily driven by peer spillovers, not common shocks, and that peer spillovers can be created through changes in peer behaviors, the rest of the paper will focus on reduced form results from equation 1.

5.3 Confounding Peer Characteristics

While I have provided evidence of peer spillovers related to peer fitness behaviors it is worth checking that the impact of peer fitness is not being driven by other peer characteristics. It is possible that peer fitness is correlated with other peer characteristics or behaviors so that the results in table 3 are not caused by an increase in peer fitness but a change in a correlated characteristic. The most obvious characteristic that could be influence peer fitness is peer weight status.[21] Before checking to see if peer weight status influences the impact of peer fitness, it is worth seeing if peer weight status has any impact by itself on individual fitness or weight status. Table A9 shows that peer BMI does not appear to have an effect on either fitness or BMI. While this may be surprising based on previous studies (including Christakis and Fowler 2007, Lim and Meer 2018, and Yakusheva, Kapinos, and Weiss 2011), Yakusheva, Kapinos, and Eisenberg (2014) found that, when looking at randomly assigned college roommates, female students exhibit positive peer effects of weight while male students do not. One possible explanation for this results is that BMI is a non-linear measure. Having either a high BMI (being obese) or having a low BMI (being underweight) can be harmful for health. Additionally, for men, media and social media frequently promote both body types with high BMI and low BMI (The Learning Network 2022). In contrast to fitness, if men are comparing themselves to their peers or competing with peers along a dimension of body weight or composition, it is unclear what direction the effect would take. An alternative measure of peer body composition is the percent

[21] A one standard deviation increase in company median fitness scores is correlated with a 0.065 standard deviated decrease in company median BMI.

of peers that are obese[22,23]. Table A10 shows the impact of a standard deviation increase in the percent of peers with a BMI $>$ 30 on soldier outcomes. Unlike when using BMI as a continuous measure, an increase in peer obesity does potentially impact soldier fitness; however, the increase in fitness is smaller and less consistent than the impact of peer fitness on soldier fitness.[24] Interestingly peer obesity has no impact on soldier BMI or likelihood of being obese.

To test whether the impact of peer fitness is impacted by peer weight status, I can run versions of equation 1 with both company median fitness score and company percent obese. Table A12 shows the results of doing this. The results are almost identical to the results from table 3 and table A10. A different version of this test is to see if the impact of an increase in the percent of high fitness peers differs by those peers' weight status. I categorize each peer as high, middle, or low fitness based on whether the peer is in the top, middle, or bottom quartile of fitness. I can do the same for each peer's BMI. Table A13 shows the impact of a 10 pp. increase in the percent of peers in each fitness-BMI group (e.g. high fitness, high BMI) relative to having middle fitness middle BMI peers. As can be seen in columns (3), (5), and (8) the impact of an increase in the percent of high fitness peers on soldier fitness is similar whether those peers have a low, middle, or high BMI. Similarly, the impact of an increase in the percent of low fitness peers on soldier fitness is similar whether those peers have a low, middle, or high BMI. Both of these tests suggest that the impact of peer fitness is independent of peer weight status.

Another characteristic that is correlated with fitness is education.[25] I can also control for company education in the quarter prior to the soldier's arrival.[26] Table A14 shows the results of repeating equation 1 with both company median fitness score and percent of

[22]Table 2 column (6) shows the correlation between the percent of the company that is obese in the quarter prior to the soldier's arrival and soldier baseline characteristics. Companies with more obese soldiers are less likely to be assigned Hispanic soldiers. Race is part of the controls included in equation 1

[23]Soldiers must meet body composition requirements to remain in the Army. If a soldier has a BMI$>$30 they either passed the body circumference test or are currently enrolled in a weight loss program to come back into compliance with the body composition requirements.

[24]Table A11 looks at the impact of an increase in the percent of peers who's weight is above the Army maximum which requires them to pass the body circumference test. This may be a more available signal of weight status than having a BMI $>$ 30. An increase in the percentage of peers with above the maximum allowed weight does not impact soldier fitness, BMI, having a BMI $>$ 30, or being above the Army's maximum allowed weight.

[25]A one standard deviation increase in median company fitness is associated with a 0.016 standard deviation increase in the percent of the company with some college experience and a 0.015 standard deviation increase in the percent of the company with at least a 4 year college degree

[26]Table 2 confirms that the percent of the company with at least a 4 year college degree in the quarter prior to the soldier's arrival is uncorrelated with soldier baseline characteristics.

the company with at least a 4 year college degree. The results are almost identical to the results from table 3. This is evidence that the impact of peer fitness is not being driven by the correlation between peer fitness and peer education.[27]

6 Optimal Composition of Peer Groups

In section 5.2, I explored the potential for social policy to create spillovers through the change of peers' behaviors. An alternative method for increasing spillovers is to manipulate the composition of groups. In this section I explore how the assignment of soldiers to companies can be done to maximize positive fitness spillovers. Under a linear-in-means peer effect model reassigning individuals cannot increase spillovers as adding a higher fitness individual to one group increases the mean fitness of that group by the same amount that it decreases the mean fitness of the group the individual was removed from. Figure A4 panels (a) and (b) show the results of a local linear regression of soldier fitness on mean peer fitness (similar to equation 1). The response of individual fitness to average peer fitness is linear with respect to mean peer fitness. This, however, only rules out using peer group composition to increase spillovers, if individuals only respond to the mean of the peer group.

6.1 Most important peers

So far I have used company median fitness score to examine the impact of peer fitness under the assumption that that individuals may have an easier time comparing themselves to the median of the peer group than the mean.[28] There is, however, no ex-ante reason to believe that the median peer is the most influential for physical fitness and weight status. Figure 4 shows the estimates, β_t, from equation 1 using different parts of the distribution of company fitness scores. Panel (a) shows the impact on soldier fitness. Soldier fitness is less responsive to changes in the 10^{th} and 25^{th} percentiles of company fitness compared

[27]More generally, I can simultaneously control for a range of company characteristics including, percent with some college experience, percent with at least a 4-year college degree, median AFQT score, median BMI, percent obese, percent above the Army maximum allowed weight for their height, percent white, black, Hispanic, or other race, percent married, percent divorced and percent with at least one child. Adding these controls does not change the estimates of the impact of company median fitness score on soldier fitness score, BMI, or having a BMI > 30.

[28]Table A3 shows that the main results do not change when using mean peer fitness instead of median peer fitness.

to the company median fitness. The impact of the 75^{th} and 90^{th} percentiles of company fitness score is similar to the impact of the company median fitness score. The effects on soldier BMI and having a BMI > 30 follow a similar, but less stark pattern. This suggests that the positive impact of peer fitness on fitness scores is being driven by higher performing peers influencing others to "keep up" rather than individuals feeling pressure to improve to not be among the worse performing members of their company.

What does this mean for the optimal composition of peer groups? If an increase to median peer fitness creates a larger spillover than an increase to the bottom of the distribution of peer fitness, the average spillover across peer groups could be increased by spreading high and low fitness soldiers across companies. Figure A5 provides an example of how this could work. Consider two companies, company A and company B, that each have 5 soldiers. Suppose company A is more fit than company B. Since the spillover of marginally increasing the median peer fitness is greater than the spillover of marginally increasing the fitness of a peer in the bottom half of the distribution we can increase the average spillover by swapping each company A's fourth most fit soldier with company B's median soldier. This will increase the median fitness in company B while decreasing the fitness of the fourth soldier in company A. This will increase the spillover in company B more than it will decrease the spillover in company A.

6.2 Percent of high fitness peers

An alternative way of looking at this question of the relative importance of high performing versus low performing peers is to look at the impact of changes in the percent of peers who are high or low fitness. Carrell, Hoekstra, and West (2011) found that having a higher percentage of lower preforming peers had a negative impact on own fitness while having a higher percentage of high performing peers did not have any impact. Table A8 replicates the analysis of Carrell, Hoekstra, and West (2011), by using the percent of soldiers in the individual's company that have low fitness scores (bottom quartile, APFT < 223) and high fitness scores (top quartile, APFT > 272). The coefficients in columns (1)-(3) show the impact of a 10 percentage point increase in the percent of low fitness peers while the coefficients in columns (4)-(6) show the impact of a 10 percentage point increase in the percent of high fitness peers. Columns (7)-(9) show the p-value of a test to see if the impact of an decrease in low fitness peers is the same as an increase in high fitness peers. An increase in high performing peers and a decrease in low performing peers have similar sized impacts on soldier fitness scores. However, an increase in high fitness peers does not appear to impact the likelihood that a soldier is obese.

In combination with the result from section 6.1, this suggests that the impact of high performing peers on soldier weight status operates along an intensive margin. That is, an increase in the fitness of a soldier's more fit peers, the peers in the 75^{th} and 90^{th} percentiles, decreases the likelihood that the soldier is obese; however an increase in the percent of the soldier's peers who are highly fit does not impact the likelihood that they are obese. Meanwhile the impact of low performing peers falls along the extensive margin. A decrease in the percent of low performing peers improves soldier fitness and weight status, but an increase in the fitness of low performing peers has little impact. This could have important implications for the military initiatives that recruit low fitness individuals. If these programs increase the percent of the soldiers with low fitness, this could create negative spillovers; however, if these programs lead to a decrease in the fitness of low fitness soldiers without increasing the percentage of soldiers that are low fitness, they would not create a negative spillover.

7 External Validity

There are two potential concerns over the external validity of this study. One potential critique is that the Army is a fairly unique institution and findings from the military may not be meaningful for most other settings. When thinking about the ability for coworkers to influence worker fitness or weight status, the Army is both an ideal and non-ideal setting to find effects. If peer fitness influences individual behavior, then an environment where coworkers routinely work out together and compete against each other in fitness tests would be an ideal environment to find effects. The Army setting, however, only allows for intensive margin effects. All soldiers in this study already meet basic fitness and body composition requirements and engage in organized physical activity. Fellow soldiers can only incentivize individuals to work out more or with more intensity. In a more typical setting, a workplace incentive could move an individual from engaging in no exercise to some exercise. In fact, Charness and Gneezy (2009) found that financial incentives for gym attendance had the largest impact on individuals who were not regular gym goers prior to the intervention. So while the Army setting is ideal for finding intensive margin effects, the effect could be larger in groups with lower baseline physical activity.

A related concern is that individuals who select into Army service likely differ from the general population in ways related to fitness. If selection into the Army is related to fitness in a way that impacts the influence of peer fitness, one would expect that selection to be greater among occupations that require higher levels of fitness (e.g. infantry). To test for this I split the sample into combat and noncombat occupations. The Army has increased fitness requirements for combat occupations. This includes infantrymen as well as combat engineers, combat medics, and some armor soldiers.

Table A15 repeats the results from table 3 estimating separate peer effects for combat versus noncombat occupations. There is no difference in the impact of peer fitness on soldier fitness in either the short or long run. However, there is marginally significant evidence that an increase in peer fitness has a larger impact on the likelihood of being obese among noncombat occupations than combat occupations. The fact that the peer spillovers are similar or larger among noncombat occupations suggests that the results may still be valid in populations that are less selected on fitness as soldiers in noncombat occupations likely more closely resemble the general population in terms of fitness characteristics than the average soldier.[29]

8 Conclusion

This paper has shown evidence of the potential for workplace environment to impact fitness and weight status. Utilizing the conditional random assignment of first-term Army soldiers to companies, I find that being assigned to a unit with higher fitness test scores leads to a short term increase in soldier fitness test scores as well as a longer term decrease in soldier BMI and likelihood of being obese. This finding is in contrast to results from dietary and drug treatments for obesity that reveal a high rate of individuals regaining lost weight following the end of an intervention. Further analysis indicates that the effects on fitness are similar across soldiers with different initial BMI, and the impact on BMI and weight status is concentrated among soldiers in the top quartile of initial BMI. Importantly, I show that the results are caused by spillovers from peer fitness not common environmental factors and that the impact of peer fitness is independent of other peer characteristics including weight status. Using a unique instrumental variables approach I also provide evidence that changes to peer time varying behaviors can create spillovers

[29] The most common noncombat occupations in my sample are the 91, 92, and 88 occupation codes which include quartermasters and food service workers, maintenance workers and mechanics, and motor transportation operators. These occupations make up over half of the soldiers in noncombat occupations in the sample.

separate from peer ability.

With regards to the ideal composition of peers groups to create spillovers, I find that the fitness score of the bottom end of the company distribution has a smaller impact on soldier fitness and weight status than the fitness score from the top end of the company distribution showing that having high performing peers is important. This suggests that the Army could increase the average spillover across companies by spreading high performing soldiers across different units.

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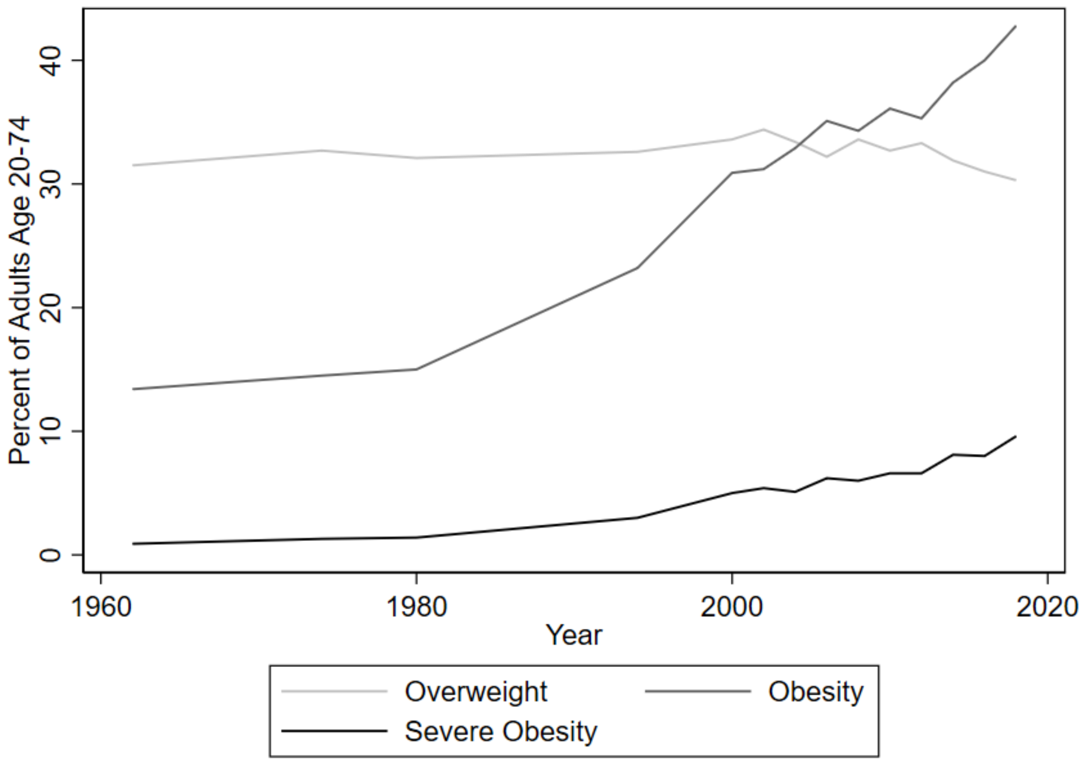
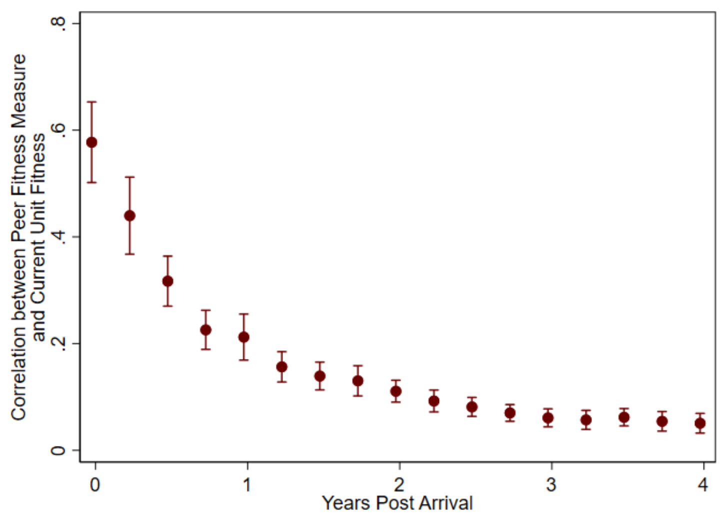
Figures and Tables

Figure 1: United States Obesity Rates 1960-2018



Notes: Data for the figure comes from the National Center for Health Statistics, National Health Examination Survey 1960-1962 and National Health and Nutrition Examination Surveys, 1971–1974, 1976–1980, 1988–1994, and 1999–2018. Overweight is defined as having a BMI between 25 and 29.9, obesity is having a BMI equal to or greater than 30, and severe obesity is having a BMI greater than or equal to 40.

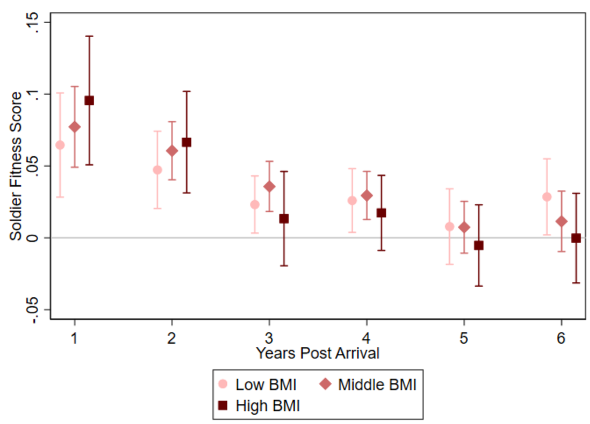
Figure 2: Correlation of Company Median Fitness Over Time



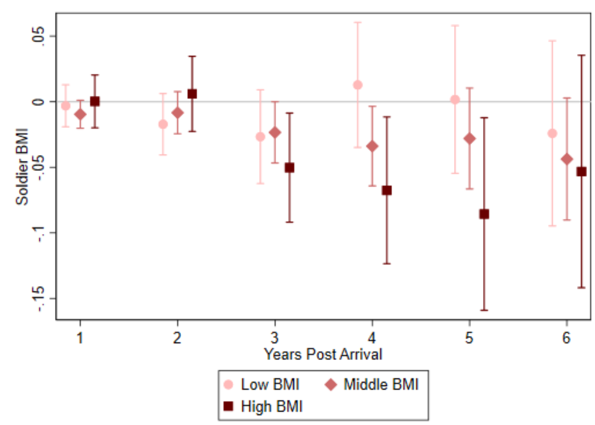
Notes: This figure shows the results of regressing the median company fitness score 0-16 quarters after the soldier's arrival on the median company fitness score in the quarter prior to the soldier's arrival including fixed effects for the interaction of location, soldier occupation, soldier contract length, and quarter of the soldier's arrival at the company and controls for soldier baseline characteristics (V_i from equation 3). The coefficient after 1 quarter is π_1 from the first stage equation 3. Standard errors are clustered at the company by quarter of arrival level. This figure shows how the peer measure impacts the soldier's exposure to peer fitness over time.

Figure 3: Heterogeneity of Impacts of Company Fitness by Soldier Initial BMI

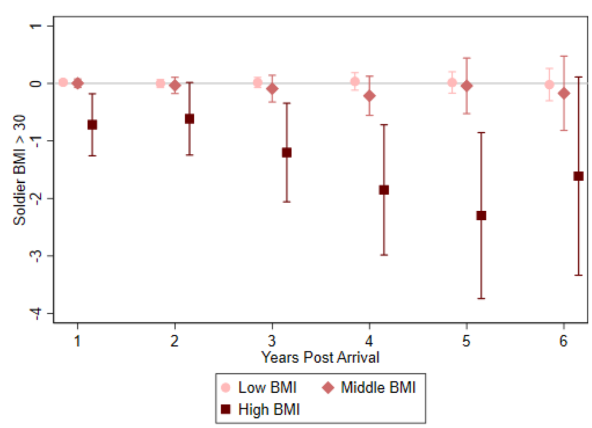
(a): Fitness Score



(b): BMI

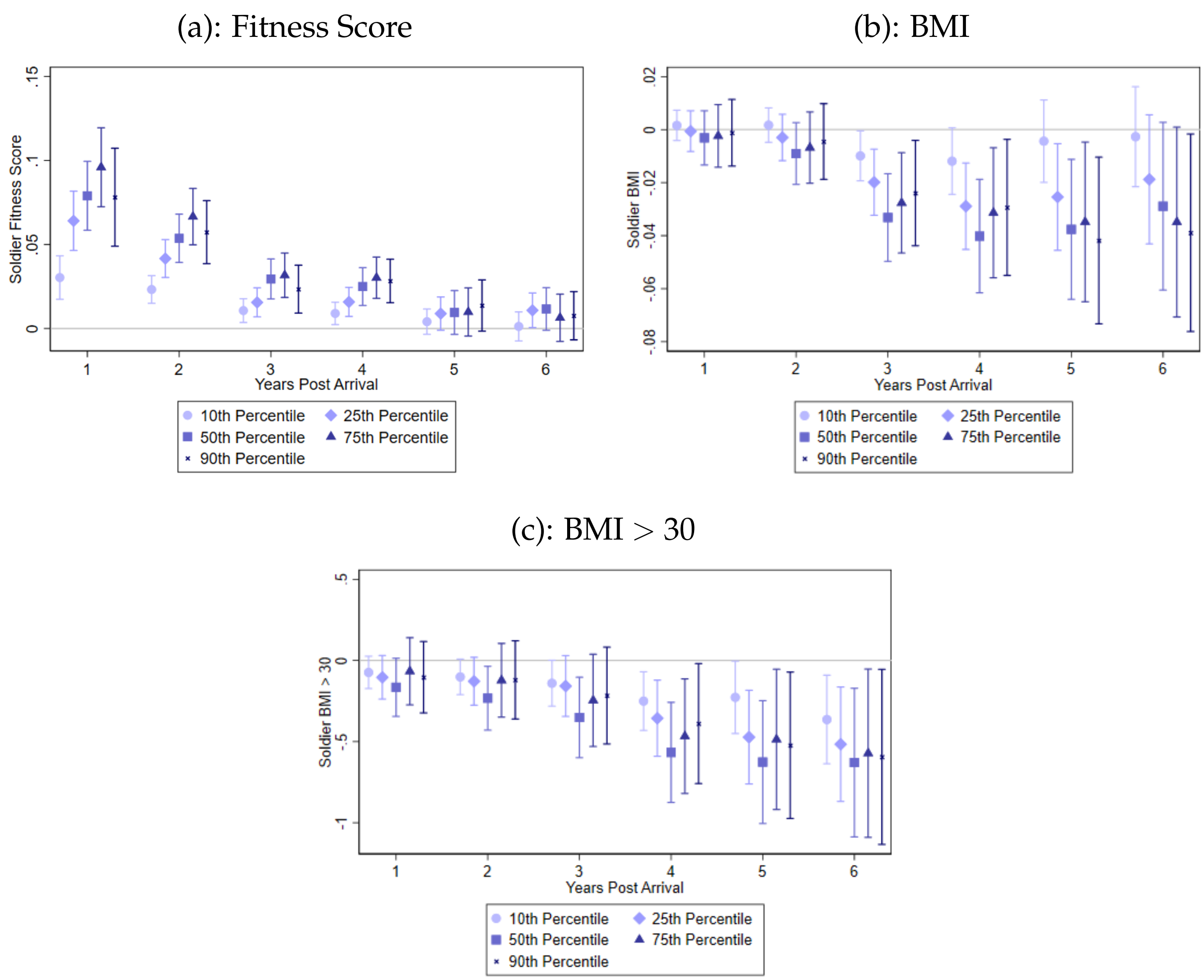


(c): BMI $>$ 30



Notes: This figure shows how the estimates from Table 3 (equation 1) differ depending on the initial weight status of the soldier. Each color restricts to a subsample of soldiers based on their initial BMI. Low BMI includes soldiers with initial BMI $<$ 22.1 (the bottom quartile). High BMI includes soldiers with initial BMI $>$ 27.5 (The top quartile]). The vertical lines represent the 95% confidence intervals. As in table 3 all regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level.

Figure 4: Heterogeneity of Impacts Across Distribution of Peer Fitness Scores



Notes: This figure shows how the estimates from Table 3 (equation 1) differ depending on the part of the distribution of peer fitness score used. Results are plotted for the 10^{th}, 25^{th} 50^{th} ,75^{th}, and 90^{th} percentiles of company fitness scores. The vertical lines represent the 95% confidence intervals. As in table 3 all regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level.

Table 1: Summary Statistics

	All Soldiers (1)	Male Soldiers (2)	Analysis Sample (3)
% Black	19.485	16.841	13.710
	[39.609]	[37.423]	[34.395]
% Hispanic	14.617	14.300	14.507
	[35.328]	[35.007]	[35.217]
% Other Race	5.993	5.682	5.412
	[23.735]	[23.150]	[22.625]
% Married	14.685	14.200	12.233
	[35.395]	[34.905]	[32.766]
Soldier Age	21.863	21.809	21.517
	[3.885]	[3.750]	[3.766]
% HS Grad+	89.533	88.724	87.687
	[30.612]	[31.630]	[32.859]
AFQT Score	57.857	57.933	56.463
	[19.172]	[19.229]	[18.880]
Soldier First APFT Score	241.870	242.809	245.143
	[37.762]	[37.122]	[36.204]
Soldier Initial BMI	24.865	25.079	25.022
	[6.404]	[4.622]	[4.631]
Company Median APFT	254.305	254.845	259.564
	[20.903]	[20.680]	[21.054]
Company Median BMI	25.204	25.403	25.256
	[1.091]	[0.917]	[0.853]
Company Number of Male Soldier	75.033	80.733	83.294
	[49.754]	[44.327]	[37.979]
Company Number of Female Soldiers	6.465	4.449	2.024
	[11.399]	[9.888]	[6.713]
Observations	688,949	480,299	231,977

Notes: This table presents the average soldier and company characteristics. Standard deviations are presented in brackets. Column (1) uses all soldiers enlisted between 2005 and 2018. Column (2) restricts male soldiers not in headquarters companies with no prior service. Column (3) restricts to the analysis sample by dropping soldiers not in BCTs. All soldier characteristics are measured at the time the soldier entered the army with the exception of fitness score. Soldier fitness score is the soldier's first recorded fitness score. Company number of male soldiers represents the size of the peer group. Each column drops soldiers who are singletons within location, occupation, contract length and quarter of arrival as the interaction of these variables is necessary for identification and these soldiers are dropped from the sample in all of the results.

Table 2: Instrument Balance Table

	Fitness			BMI	BMI>30	College Deg
	Median	Mean	Prior Company	Median	Percent	Percent
	(1)	(2)	(3)	(4)	(5)	(6)
Height	0.010	0.000	0.006	0.010	-0.010	0.005
	(0.010)	(0.001)	(0.010)	(0.009)	(0.008)	(0.009)
Weight	-0.055	-0.003	0.086	0.106	-0.143*	-0.035
	(0.106)	(0.006)	(0.102)	(0.096)	(0.086)	(0.095)
BMI	-0.015	-0.001	0.005	0.010	-0.001	-0.001
	(0.017)	(0.001)	(0.016)	(0.015)	(0.013)	(0.015)
Black	0.084	0.006	0.029	-0.158	0.104	-0.184*
	(0.118)	(0.006)	(0.115)	(0.105)	(0.094)	(0.104)
Hispanic	-0.090	-0.002	-0.039	-0.152	-0.235**	0.110
	(0.128)	(0.007)	(0.125)	(0.115)	(0.103)	(0.114)
Other Race	0.036	-0.000	0.069	0.029	0.020	-0.047
	(0.081)	(0.004)	(0.079)	(0.073)	(0.065)	(0.073)
HS graduate +	-0.015	-0.003	-0.142	-0.082	-0.078	0.028
	(0.105)	(0.006)	(0.097)	(0.098)	(0.087)	(0.097)
Age	-0.005	-0.001	0.017	0.008	0.005	0.004
	(0.013)	(0.001)	(0.013)	(0.012)	(0.011)	(0.012)
AFQT	-0.045	-0.001	-0.036	0.058	-0.014	0.120**
	(0.059)	(0.003)	(0.056)	(0.053)	(0.047)	(0.053)
Observations	202,322	202,322	190,048	217,118	217,118	217,164
P-value on Joint Test	0.918	0.908	0.801	0.512	0.127	0.191

Notes: This balance table reports the results of regressing each soldier characteristic at the time they first entered the Army on different peer measures ($V_i = \gamma Z_i + \omega_{j(i)} + \mu_i$ with the variables defined as in equation 1). The sample is restricted to male, first term junior enlisted soldiers who are assigned to non-headquarters companies in brigade combat teams. All columns use fixed effects interacting duty station, occupation, contract length, and quarter of arrival at the unit. Columns (1)-(3) use Peer fitness. Column (1) uses the primary peer measure, median company fitness, while column (2) uses mean company fitness. Columns (3) uses the median of peers most recent fitness score from the prior unit. Column (4) uses company median BMI while column (5) uses percent of the company that is obese. Column (6) uses percent of the company with at least a 4 year college degree. All measures are constructed from individuals in the company in the quarter prior to the soldier's arrival and have been standardized to have mean 0 and standard deviation 1. Binary variables (race and HS graduate plus are multiplied by 100). AFQT, the Armed Forces Qualification Test, is a test individuals take to join the military that measures arithmetic and verbal reasoning skills. Standard errors are clustered at the level of company by arrival quarter which is the level of treatment assignment. $* \, p < 0.1$, $^{**} \, p < 0.05$, $^{***} \, p < 0.01$

Table 3: Impact of a 1 Standard Deviation increase in Median Company Fitness on Soldier Outcomes

	1 Yr (1)	2 Yr (2)	3 Yr (3)	4 Yr (4)	5 Yr (5)	6 Yr (6)
	Panel A: Soldier Fitness Score (Standardized)					
Peer Fitness	0.079***	0.054***	0.030***	0.025***	0.010	0.012*
	(0.010)	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)
Observations	77,537	107,287	80,086	61,299	46,418	34,039
Dep Var Mean (Raw)	242.2	246.9	252.9	254.8	255.3	255.8
Dep Var Std Dev	[34.5]	[35.1]	[33.9]	[32.7]	[33.7]	[34.1]
R^2	0.270	0.282	0.316	0.298	0.293	0.285
	Panel B: Soldier BMI					
Peer Fitness	-0.003	-0.009*	-0.033***	-0.040***	-0.038***	-0.029
	(0.004)	(0.005)	(0.007)	(0.010)	(0.014)	(0.018)
Observations	191,579	172,886	101,452	68,164	48,819	34,894
Dep Var Mean	25.1	25.4	25.7	26.0	26.3	26.6
R^2	0.882	0.846	0.787	0.731	0.696	0.665
	Panel C: Soldier Obese (BMI > 30)					
Peer Fitness	-0.165*	-0.233***	-0.351***	-0.566***	-0.626***	-0.629***
	(0.086)	(0.087)	(0.112)	(0.130)	(0.159)	(0.219)
Observations	191,579	172,886	101,452	68,164	48,819	34,894
Dep Var Mean	10.2	10.7	11.1	12.1	13.4	14.8
R^2	0.429	0.405	0.410	0.401	0.402	0.404

Notes: This table shows the results of the reduced form regression (equation 1) regressing soldier outcomes on the median fitness score of soldiers in the individual's company in the quarter prior to the individual arriving at the company. The peer measure has been standardized to have mean 0 and standard deviation 1. Each panel shows the impact of a one standard deviation increase peer fitness on individual outcomes over the following six years. All regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. The sample is restricted to soldiers for whom it would be possible to observe in the data at that point (e.g. if a soldier arrives at their unit in 2017 and the data ends in 2022, they are only observable for 5 years). All columns restrict to soldiers still in the Army as I cannot observe the outcomes after individuals separate. All regressions include controls for soldier initial height, weight, BMI, race, age, AFQT, and education. Soldier fitness score in Panel A has been standardized to have mean 0 and standard deviation 1. I report the mean and standard deviation of soldier fitness score. Since soldiers exit the sample as they leave the Army the population changes between columns. Additionally, in panel A, soldiers do not enter the sample until their first recorded fitness test. See section 4.1 for more details. $* \, p < 0.1$, $^{**} \, p < 0.05$, $^{***} \, p < 0.01$

Table 4: Common Environment vs Peers: Instrumenting with Prior Unit Fitness Scores

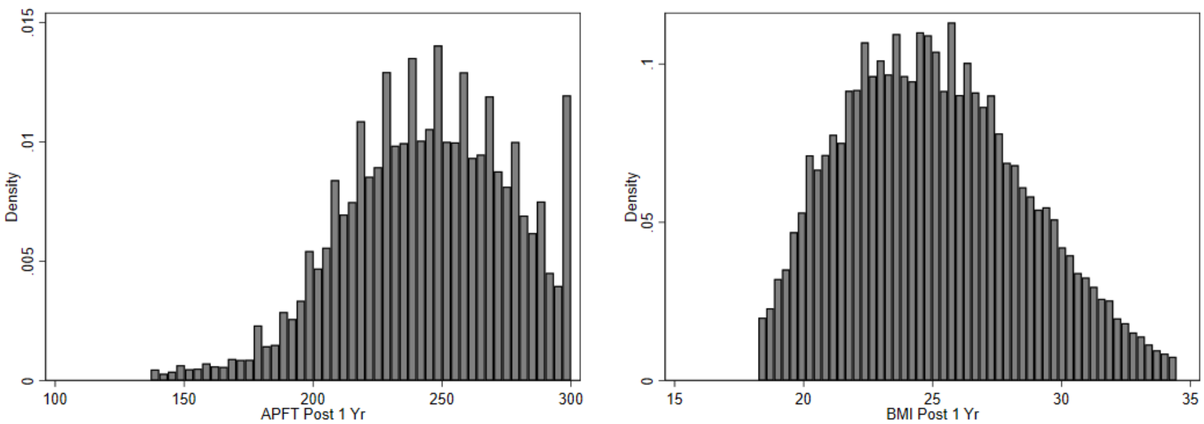
	Reduced Form			2SlS: Fitness from Prior Company			P-value		
	Fitness	BMI	BMI > 30	Fitness	BMI	BMI > 30	(1)=(4)	(2)=(5)	(3)=(6)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Short Term, 1-3 years post arrival								
Peer Fitness	0.048***	-0.013***	-0.227***	0.018*	-0.018*	-0.606***	0.000	0.993	0.008
	(0.004)	(0.004)	(0.057)	(0.010)	(0.010)	(0.153)			
Observations	299,230	513,047	513,047	291,929	480,961	480,961			
Dep Var Mean	247.32	25.37	10.79	246.94	25.40	10.75			
	Panel B: Long Term, 4-6 years post arrival								
Peer Fitness	0.016***	-0.037***	-0.608***	0.026***	-0.018	-0.992***	0.245	0.191	0.112
	(0.004)	(0.007)	(0.101)	(0.009)	(0.018)	(0.260)			
Observations	169,669	180,197	180,197	157,286	165,028	165,028			
Dep Var Mean	254.37	26.28	13.35	253.75	26.33	13.60			

Notes: This table shows reduced form and two-stage least squares estimates. Columns (1)-(3) report the reduced form estimates from table 3. Columns (4)-(6) report two-stage least squares estimates that use $X^{s,c-1}_{c,q-1}$, the soldiers in the company's most recent fitness score at their prior unit to instrument for $X_{c,q-1}$ (equation 6 Each column shows the impact of a one standard deviation increase peer fitness on individual outcomes. As in table 3 all regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. Individual fitness score has been standardized to have mean 0 and standard deviation 1. Columns (7)-(9) shows the p-value of the test that the coefficient of the two independent variables are equal. Panel A pools soldier outcomes from 1-3 years post arrival at the company. This reflects the period of time when the soldier is likely at the same company. Panel B, pools soldier outcomes from 4-6 years post arrival at the company. This reflects outcomes measured after the soldier has left the initial company. $*\, p < 0.1$, $^{**}\, p < 0.05$, $^{***}\, p < 0.01$

A Appendix Figures and Tables

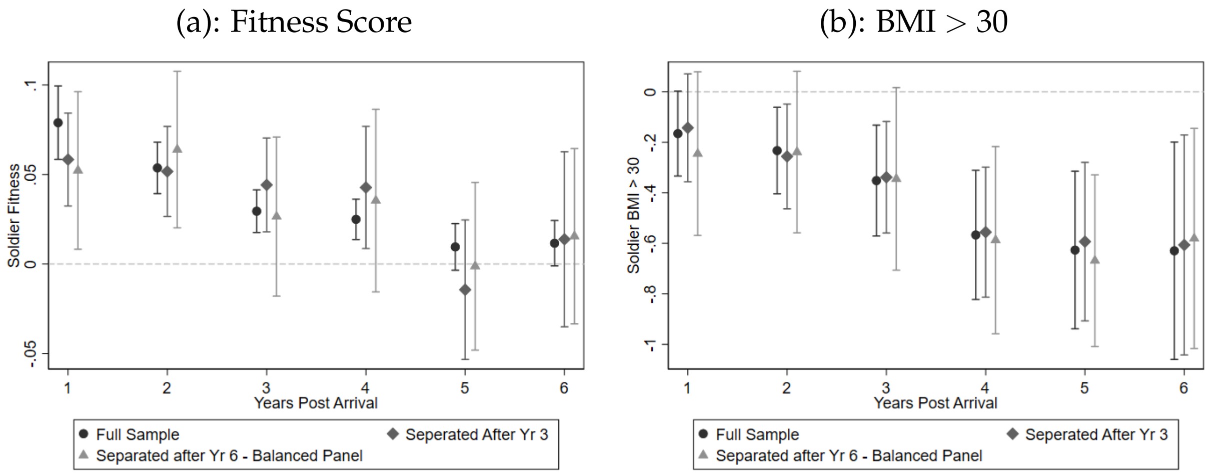
Figure A1: Distribution of Fitness Scores and BMI

(a): Fitness Score (b): BMI



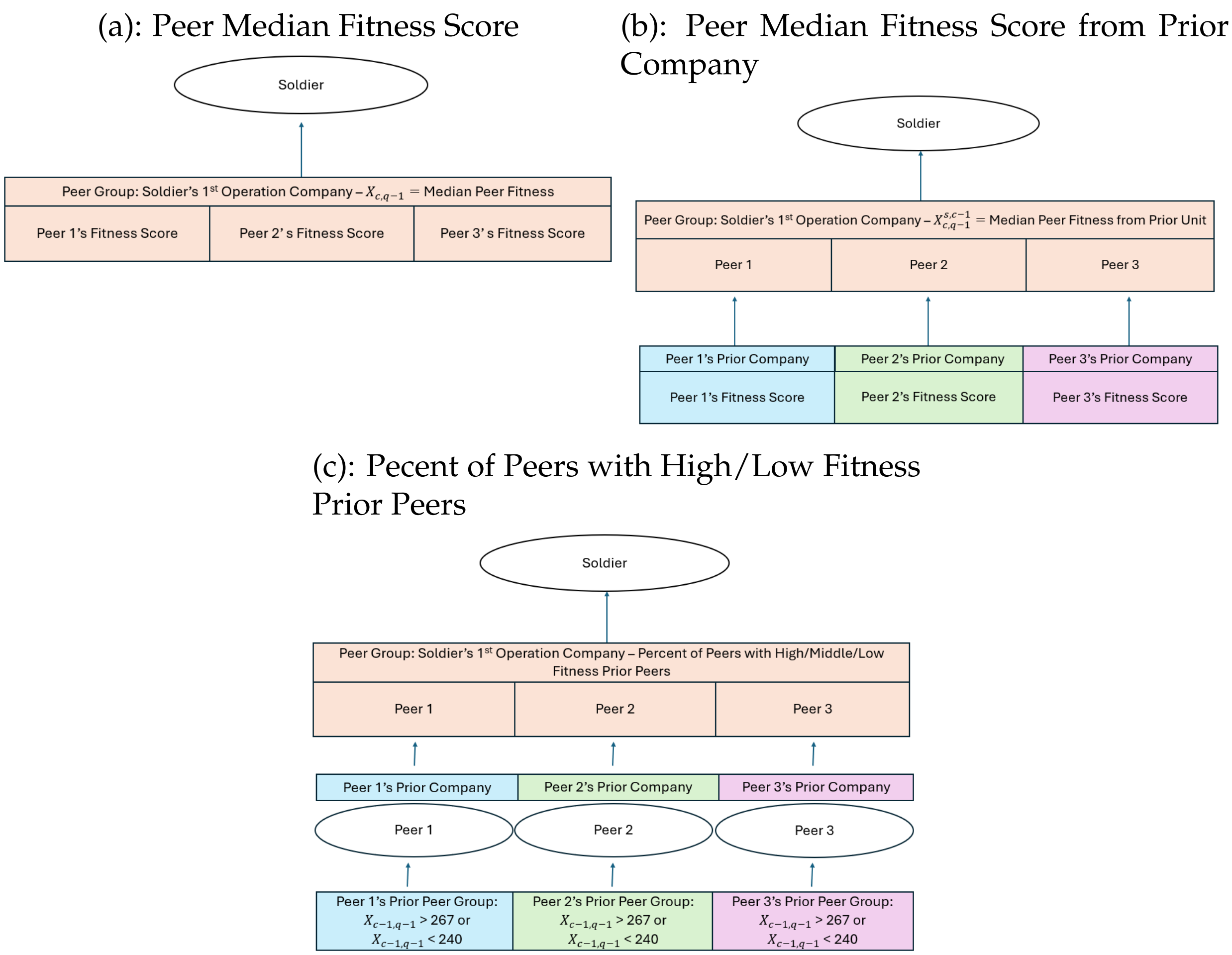
Notes: This figure shows the distribution of fitness test scores and BMI 1 year after a soldier arrives at their first operational company. The sample is restricted to soldiers in the primary analysis sample (restricted to men in brigade combat teams not assigned to a headquarters company). The top and bottom 1% of observations have been dropped. There does not appear to be any bunching in either distribution.

Figure A2: Heterogeneity of Impacts of Company Fitness by Initial BMI



Notes: This figure shows how the main results from table 3 are impact by selection into and out of the sample. As described in section 4.1. Some soldiers do not have their first recorded fitness score until years after their arrival at the company. Therefore, the results in table 3 include the potential impact of this selection into the sample. Additionally, individuals may leave the Army during this period. Once a soldier separates from the Army, they drop out of the sample. So the results are also impacted by selection out of the sample. This figure shows the estimates of equation 1 using 3 different samples. The first series uses the full sample (the same as the main results). The second series restricts to soldiers who had a recorded outcome (fitness score or BMI) within 1 year of arriving at the company and stayed in the Army for at least 3 years after arriving. The final series restricts to soldiers who had a recorded outcome (fitness score or BMI) within 1 year of arriving at the company and stayed in the Army for at least 6 years after arriving - this forces the sample to remain unchanged across estimates. All three series give similar estimates. This suggests that the results are not driven by changes in the sample composition.

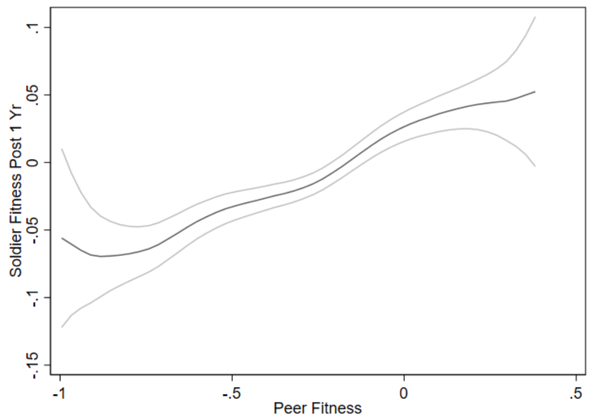
Figure A3: Visualization of Peer Groups and Instruments



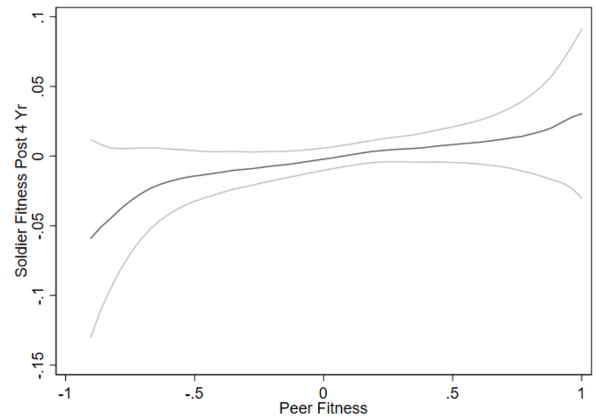
Notes: This figure illustrates how the different independent variables are constructed. Panel A depicts the main peer measure, $X_{c,q-1}$. For each soldier, I identify their first operational company and take the median fitness score of the other soldiers in the company the quarter before the original soldier arrives at the unit. Panel B depicts the instrument in section 5.1, $X^{s,c-1}_{c,q-1}$. This uses the same peer group, but instead of taking the median of the peers' current fitness scores, it takes the median of the peers' most recent fitness scores from their previous company. Panel (c) depicts the construction of the prior peer measure. Similar to panel (b) I identify each peer's prior company. I then construct $X_{c-1,q-1}$, the median fitness score of the prior peer group for each peer's peer group at the prior company. Each peer is determined to have a high (low) fitness prior peer group if the prior peer group has a median fitness score above 267 (below 240). I then take an average the original soldier's peer group to determine what percent of the soldier's peers have high (low) fitness prior peers.

Figure A4: Local Linear Regression - Relationship between Soldier Fitness and Mean Peer Fitness

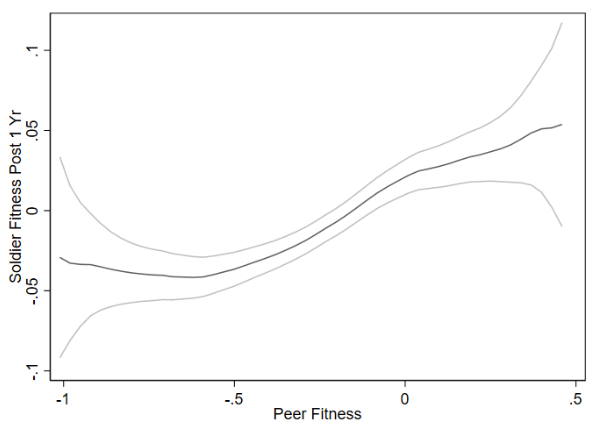
(a): Soldier Fitness Post 1 Year - Peer Mean



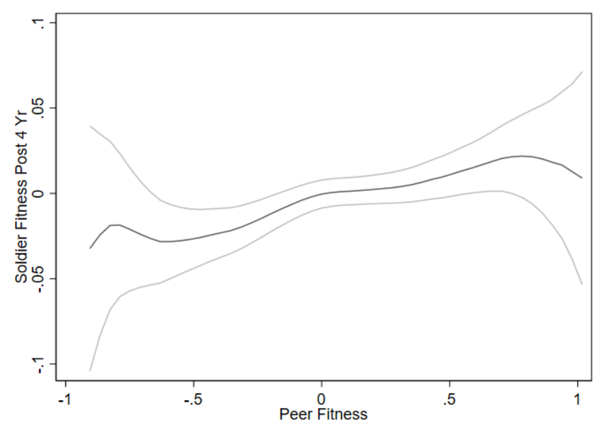
(b): Soldier Fitness Post 4 Years - Peer Mean



(c): Soldier Fitness Post 1 Year - Peer Median

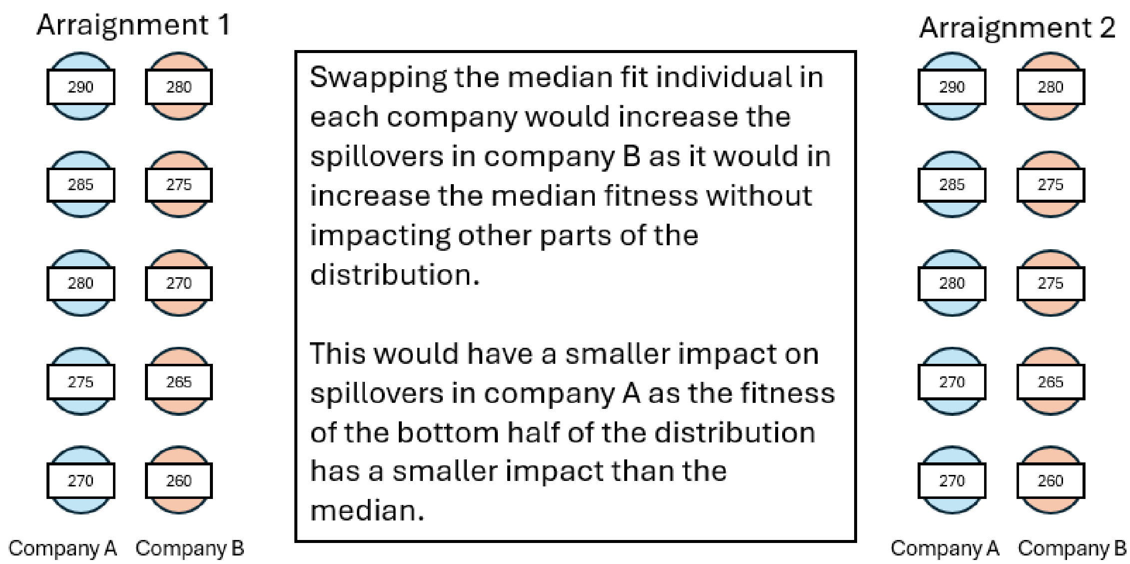


(d): Soldier Fitness Post 4 Years - Peer Median



Notes: This figure shows the results of a local linear regression of soldier fitness on mean peer fitness. I have trimmed to sample to exclude the top and bottom 2.5% of peer fitness. Panels (a) and (b) use the peer mean fitness while panels (c) and (d) use the peer median fitness. Panels (a) and (c) use soldier fitness 1 year after arrival at the company. Panels (b) and (d) use soldier fitness 4 years after arrival at the company. As in table 3, I include controls for soldier demographics and fixed effects for the interaction of soldier post, occupation, contract length, and quarter of arrival to the company. Standard errors are cluster at the company by arrival quarter level. This figure supports the claim that peer spillovers are linear with respect to the mean and median peer fitness.

Figure A5: Example of Rearranging Copmanies to Increase Average Peer Effects



Notes: This figure illustrates a way to recompose companies to increase peer spillovers. Based on the results in figure 4, increases to the top of end of the distribution of peer fitness create larger spillovers than a decrease to the bottom of the distribution peer fitness. This suggests that spreading high and low performers across companies would lead to an increase in peer effects.

Table A1: Sample Restrictions

Full Sample	756,679
Soldiers assigned to BCTs	355,926
Exclude:	
Head Quarters Companies	78,284
Non-Commissioned Officers	41
Abnromal Contract Lengths	3,071
Women	23,234
Singleton Fixed Effects	19,319
Analysis Sample	231,977
Other Considerations:	
Missing Peer Fitness	29,655
Effective Sample	202,322

Notes: The sample includes 756,679 soldiers who enlisted in the Army between 2005 and 2018. I then restrict the sample to soldier in Brigade Combat Teams to restrict the sample to interchangeable units. I further exclude non-headquarters companies, soldier who enlisted as noncommissioned officers, and soldiers with contracts less than 3 years or greater than 6 years. I exclude women from the sample as I only have aggregate sex-adjusted scores which makes comparisons across gender difficult. Finally, soldiers the are singletons within the primary fixed effect, location, occupation, contract length, and quarter of arrival, are dropped. This gives an analysis sample of 231,977. The primary regressor in this study is peer fitness. Not all companies electronically recorded fitness scores during this time period. Removing these soldiers gives an effect sample of 202,322 soldiers.

Table A2: Impact of a 1 Standard Deviation Increase in Median Company Fitness on Soldier Outcomes - 2SLS Early Peers

	Fitness	BMI	BMI $>$ 30
	(1)	(2)	(3)
	Panel A: Company Fitness Score		
Post 1 Yr	0.160***	-0.007	-0.363*
	(0.020)	(0.010)	(0.202)
Observations	77,495	191,045	191,045
Dep Var Mean	242.2	25.1	10.2
R^2	0.080	0.864	0.353

Notes: This table shows the results of the two-stage least squared regression (first stage equation 3 and reduced form equation 1). The median fitness score of soldiers in the individual's company in the quarter prior to the individual arriving at the company is used as an instrument for the median fitness score of the soldiers in the individual's company the quarter after the individual's arrival. Each column shows the impact of a one standard deviation increase peer fitness on individual outcomes over the following six years. All regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. All regressions include controls for soldier initial height, weight, BMI, race, age, AFQT, and education. Soldier fitness score in column (1) has been standardized to have mean 0 and standard deviation 1. $* \, p < 0.1$, $^{**} \, p < 0.05$, $^{***} \, p < 0.01$

Table A3: Impact of a 1 Standard Deviation increase in Mean Company Fitness on Soldier Outcomes

	1 Yr	2 Yr	3 Yr	4 Yr	5 Yr	6 Yr
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Soldier Fitness Score			
Peer Fitness	0.090***	0.059***	0.026***	0.024***	0.010	0.011*
	(0.011)	(0.008)	(0.006)	(0.006)	(0.007)	(0.006)
Observations	77,537	107,287	80,086	61,299	46,418	34,039
Dep Var Mean (Raw)	242.2	246.9	252.9	254.8	255.3	255.8
Dep Var Std Dev	[34.5]	[35.1]	[33.9]	[32.7]	[33.7]	[34.1]
R^2	0.270	0.282	0.316	0.298	0.293	0.285
			Panel B: Soldier BMI			
Peer Fitness	0.001	-0.003	-0.027***	-0.037***	-0.033**	-0.028
	(0.005)	(0.005)	(0.007)	(0.010)	(0.014)	(0.019)
Observations	191,579	172,886	101,452	68,164	48,819	34,894
Dep Var Mean	25.1	25.4	25.7	26.0	26.3	26.6
R^2	0.882	0.846	0.787	0.731	0.696	0.665
			Panel C: Soldier Obese (BMI > 30)			
Peer Fitness	-0.129	-0.178**	-0.292***	-0.520***	-0.582***	-0.709***
	(0.087)	(0.088)	(0.112)	(0.131)	(0.160)	(0.221)
Observations	191,579	172,886	101,452	68,164	48,819	34,894
Dep Var Mean	10.2	10.7	11.1	12.1	13.4	14.8
R^2	0.429	0.405	0.410	0.401	0.402	0.404

Notes: This table shows the results of the reduced form regression (equation 1) regressing soldier outcomes on the mean fitness score of soldiers in the individual's company in the quarter prior to the individual arriving at the company instead of the median as in table 3. The peer measure has been standardized to have mean 0 and standard deviation 1. Each panel shows the impact of a one standard deviation increase peer fitness on individual outcomes over the following six years. All regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. The sample is restricted to soldiers for whom it would be possible to observe in the data at that point (e.g. if a soldier arrives at their unit in 2017 and the data ends in 2022, they are only observable for 5 years). All columns restrict to soldiers still in the Army as I cannot observe the outcomes after individuals separate. All regressions include controls for soldier initial height, weight, BMI, race, age, AFQT, and education. Individual fitness score in Panel A has been standardized to have mean 0 and standard deviation 1. I report the mean and standard deviation of soldier fitness score. Since soldiers exit the sample as they leave the Army the population changes between columns. Additionally, in panel A, soldiers do not enter the sample until their first recorded fitness test. $* \, p < 0.1$, $^{**} \, p < 0.05$, $^{***} \, p < 0.01$

Table A4: Impact of A 1 Std Dev Increase in Company Fitness on Soldier Separations Relative to Contract Expiration

	Separated 3+ Mths After Initial Contract (1)	Separated 6+ Mths After Initial Contract (2)	Separated W/in 6 Months of End of Initial Contract (3)
Peer Fitness	-0.176	-0.046	0.032
	(0.183)	(0.177)	(0.194)
Observations	146,330	146,330	146,330
Dep Var Mean	42.5	31.2	48.0

Notes: This table shows the impact of a 1 standard deviation increase in company median fitness score on the timing of soldier separation from the Army. Column (1) shows the impact on whether a soldier stays in the Army more than 3 months past the expiration of their initial contract. Column (2) shows the impact on whether a soldier stays in the Army more than 6 months past the expiration of their initial contract. Column (3) shows the impact on whether a soldier separates from the Army within 6 months of the expiration of their initial contract. Note that I drop all soldiers from this table if I cannot observe them for at least 6 months past their expiration of their initial contract. As in equation 1 I include fixed effects for the interaction of soldier location, occupation, contract length, and quarter of arrival and cluster standard errors at the company by quarter of arrival level. $* p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

Table A5: Impact of a 1 Standard Deviation increase in Median Company Fitness on Soldier Outcomes - Brigade FE

	1 Yr	2 Yr	3 Yr	4 Yr	5 Yr	6 Yr
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Soldier Fitness Score			
Peer Fitness	0.078***	0.050***	0.033***	0.026***	0.009	0.013
	(0.012)	(0.008)	(0.007)	(0.007)	(0.007)	(0.008)
Observations	73,272	101,350	74,301	56,603	42,687	31,156
Dep Var Mean (Raw)	242.3	247.1	253.3	255.2	255.7	256.1
Dep Var Std Dev	[34.3]	[34.9]	[33.6]	[32.4]	[33.4]	[33.8]
R^2	0.310	0.317	0.351	0.332	0.324	0.318
			Panel B: Soldier BMI			
Peer Fitness	-0.006	-0.010*	-0.026***	-0.034***	-0.028*	-0.022
	(0.004)	(0.006)	(0.008)	(0.012)	(0.015)	(0.022)
Observations	183,801	165,379	95,110	63,255	45,004	31,980
Dep Var Mean	25.1	25.4	25.7	26.0	26.3	26.6
R^2	0.921	0.852	0.798	0.744	0.710	0.682
			Panel C: Soldier Obese (BMI > 30)			
Peer Fitness	-0.127	-0.258**	-0.392***	-0.489***	-0.497**	-0.562**
	(0.096)	(0.101)	(0.136)	(0.178)	(0.215)	(0.279)
Observations	183,801	165,379	95,110	63,255	45,004	31,980
Dep Var Mean	10.1	10.6	11.0	12.0	13.3	14.8
R^2	0.448	0.425	0.436	0.427	0.429	0.431

Notes: This table repeats table 3 including brigade in the fixed effects instead of location. Each panel shows the impact of a one standard deviation increase peer fitness on individual outcomes over the following six years. All regressions include fixed effects for the interaction of brigade, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. The sample is restricted to soldiers for whom it would be possible to observe in the data at that point (e.g. if a soldier arrives at their unit in 2017 and the data ends in 2022, they are only observable for 5 years). All columns restrict to soldiers still in the Army as I cannot observe the outcomes after individuals separate. All regressions include controls for soldier initial height, weight, BMI, race, age, AFQT, and education. Individual fitness score in Panel A has been standardized to have mean 0 and standard deviation 1. I report the mean and standard deviation of soldier fitness score. Since soldiers exit the sample as they leave the Army the population changes between columns. Additionally, in panel A, soldiers do not enter the sample until their first recorded fitness test. $* p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

Table A6: Common Environment vs Peers: Instrumenting with Prior Unit Fitness Scores - restricting to peers with prior fitness scores

	Most Recent Fitness Score			Fitness from Prior Company				P-value	
	Fitness	BMI	BMI > 30	Fitness	BMI	BMI > 30	(1)=(4)	(2)=(5)	(3)=(6)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Short Term, 1-3 years post arrival								
Peer Fitness	0.028***	-0.008**	-0.220***	0.009*	-0.008*	-0.272***	0.000	0.856	0.180
	(0.004)	(0.004)	(0.058)	(0.005)	(0.004)	(0.069)			
Observations	291,929	480,961	480,961	291,929	480,961	480,961			
Dep Var Mean	246.94	25.40	10.75	246.94	25.40	10.75			
	Panel B: Long Term, 4-6 years post arrival								
Peer Fitness	0.013***	-0.007	-0.383***	0.013***	-0.009	-0.488***	0.772	0.708	0.100
	(0.004)	(0.007)	(0.109)	(0.004)	(0.009)	(0.128)			
Observations	157,286	165,028	165,028	157,286	165,028	165,028			
Dep Var Mean	253.75	26.33	13.60	253.75	26.33	13.60			

Notes: This table repeats table 4 restricting to peers that have a fitness score from a prior unit. Columns (1)-(3) report the reduced form estimates of regression soldier outcomes on the median fitness score of these peers (equation 1). Columns (4)-(6) report two-stage least squares estimates that use $X^{s,c-1}_{c,q-1}$, the soldiers in the company's most recent fitness score at their prior unit to instrument for the median fitness score of the same group of soldiers using their most recent fitness score (equations 6, 7). Each column shows the impact of a one standard deviation increase peer fitness on individual outcomes. As in table 3 all regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. Individual fitness score has been standardized to have mean 0 and standard deviation 1. Columns (7)-(9) shows the p-value of the test that the coefficient of the two independent variables are equal. Panel A, pools soldier outcomes from 1-3 years post arrival at the company. This reflects the period of time when the soldier is likely at the same company. Panel B, pools soldier outcomes from 4-6 years post arrival at the company. This reflects outcomes measured after the soldier has left the initial company.

Table A7: Importance of Fitness Behaviors: Instrumenting with Prior Peers

	Reduced Form			2SLS: Prior Peers			P-value		
	Fitness	BMI	BMI > 30	Fitness	BMI	BMI > 30	(1)=(4)	(2)=(5)	(3)=(6)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Short Term, 1-3 years post arrival								
	0.048***	-0.013***	-0.227***	0.081	-0.128**	-0.181	0.519	0.017	0.962
	(0.006)	(0.004)	(0.079)	(0.054)	(0.053)	(0.965)			
Observations	299,230	513,047	513,047	298,940	511,717	511,717			
Dep Var Mean	247.32	25.37	10.79	247.31	25.37	10.79			
	Panel B: Long Term, 4-6 years post arrival								
	0.016***	-0.037***	-0.608***	0.085	-0.115	-1.316	0.235	0.544	0.691
	(0.005)	(0.011)	(0.126)	(0.061)	(0.135)	(1.872)			
Observations	169,669	180,197	180,197	169,135	179,546	179,546			
Dep Var Mean	254.37	26.28	13.35	254.36	26.29	13.37			

Notes: This table shows reduced form and two-stage least squares estimates. Columns (1)-(3) report the reduced form estimates from table 3 (equation 1). Columns (4)-(6) report two-stage least squares estimates that use $X^{c-1,high}_{s(c),q-1}$, the percent of soldier i's peers, s, that had high fitness peers in their previous company, $c-1$ to instrument for median peer fitness, $X_{c,q-1}$ (equations 9, 10). Each column shows the impact of a one standard deviation increase peer fitness on individual outcomes. As in table 3 all regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. Individual fitness score has been standardized to have mean 0 and standard deviation 1. Columns (7)-(9) shows the p-value of the test that the reduced form and IV estimates are equal. Panel A, pools soldier outcomes from 1-3 years post arrival at the company. This reflects the period of time when the soldier is likely at the same company. Panel B, pools soldier outcomes from 4-6 years post arrival at the company. This reflects outcomes measured after the soldier has left the initial company. $* \; p < 0.1$, $^{**} \; p < 0.05$, $^{***} \; p < 0.01$

Table A8: Impact of Having Low Versus High Performing Peers

	% Low Fitness Peers			% High Fitness Peers			P-value		
	Fitness	BMI	BMI > 30	Fitness	BMI	BMI > 30	-(1)=(4)	-(2)=(5)	-(3)=(6)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Short Term, 1-3 years post arrival								
Peer Fitness	-0.018***	-0.001	0.127***	0.019***	-0.004**	0.020	0.750	0.182	0.019
	(0.003)	(0.003)	(0.044)	(0.002)	(0.002)	(0.030)			
Observations	299,230	513,047	513,047						
Dep Var Mean	247.32	25.37	10.79						
	Panel B: Long Term, 4-6 years post arrival								
Peer Fitness	-0.005	0.010*	0.343***	0.007***	-0.010***	-0.036	0.521	0.972	0.007
	(0.003)	(0.006)	(0.081)	(0.002)	(0.004)	(0.054)			
Observations	169,669	180,197	180,197						
Dep Var Mean	254.37	26.28	13.35						

Notes: This table shows the impact of the having more peers with high fitness scores and more peers with low fitness scores relative to having peers with neither high nor low scores. Low fitness score is defined as having an fitness score below 223 (the bottom quartile of first fitness score). High fitness score is defined as having an fitness score above 272 (the top quartile of first fitness score). Each column shows the impact of a 10 percentage point increase in the portion of peers with low/high fitness scores on individual outcomes over the following six years. As in table 3 all regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. Individual fitness score has been standardized to have mean 0 and standard deviation 1. Columns (7)-(9) shows the p-value of the test that the magnitude of the coefficients of low and high fitness score are equal. Panel A, pools soldier outcomes from 1-3 years post arrival at the company. This reflects the period of time when the soldier is likely at the same company. Panel B, pools soldier outcomes from 4-6 years post arrival at the company. This reflects outcomes measured after the soldier has left the initial company. I report the mean and standard deviation of soldier fitness score. $* \, p < 0.1$, $^{**} \, p < 0.05$, $^{***} \, p < 0.01$

Table A9: Impact of a 1 Standard Deviation increase in Median Company BMI on Soldier Outcomes

	1 Yr (1)	2 Yr (2)	3 Yr (3)	4 Yr (4)	5 Yr (5)	6 Yr (6)
			Panel A: Soldier Fitness Score			
Peer BMI	-0.004	0.006	0.003	-0.001	-0.005	0.001
	(0.007)	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)
Observations	77,744	109,138	84,991	66,367	50,940	38,062
Dep Var Mean (Raw)	242.2	247.2	253.6	255.6	256.0	256.6
R^2	0.270	0.287	0.322	0.303	0.295	0.284
			Panel B: Soldier BMI			
Peer BMI	-0.001	0.006	-0.001	-0.003	0.015	0.016
	(0.005)	(0.005)	(0.007)	(0.010)	(0.012)	(0.015)
Observations	205,343	185,563	111,599	75,356	54,263	39,356
Dep Var Mean	25.1	25.3	25.6	26.0	26.3	26.5
R^2	0.889	0.853	0.794	0.737	0.699	0.666
			Panel C: Soldier Obese (BMI $>$ 30)			
Peer BMI	0.006	0.112	0.040	0.015	0.207	0.309
	(0.078)	(0.085)	(0.107)	(0.136)	(0.169)	(0.209)
Observations	205,343	185,563	111,599	75,356	54,263	39,356
Dep Var Mean	10.3	10.7	11.0	11.9	13.1	14.5
R^2	0.431	0.407	0.409	0.399	0.400	0.400

Notes: This table shows the results of the reduced form regression (equation 1) regressing soldier outcomes on the median BMI of soldiers in the individual's company in the quarter prior to the individual arriving at the company. The peer measure has been standardized to have mean 0 and standard deviation 1. Each panel shows the impact of a one standard deviation increase peer fitness on individual outcomes over the following six years. All regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. The sample is restricted to soldiers for whom it would be possible to observe in the data at that point (e.g. if a soldier arrives at their unit in 2017 and the data ends in 2022, they are only observable for 5 years). All columns restrict to soldiers still in the Army as I cannot observe the outcomes after individuals separate. All regressions include controls for soldier initial height, weight, BMI, race, age, AFQT, and education. Individual fitness score in Panel A has been standardized to have mean 0 and standard deviation 1. I report the mean and standard deviation of soldier fitness score. Since soldiers exit the sample as they leave the Army the population changes between columns. Additionally, in panel A, soldiers do not enter the sample until their first recorded fitness test. $* \, p < 0.1$, $^{**} \, p < 0.05$, $^{***} \, p < 0.01$

Table A10: Impact of a 1 Standard Deviation Increase in the Percent of the Company with a BMI > 30 on Soldier Outcomes

	1 Yr (1)	2 Yr (2)	3 Yr (3)	4 Yr (4)	5 Yr (5)	6 Yr (6)
	Panel A: Soldier Fitness Score					
Peer Obsesity Rate	-0.006	0.003	0.013***	0.011**	0.013**	0.007
	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)
Observations	77,744	109,138	84,991	66,367	50,940	38,062
Dep Var Mean	242.2	247.2	253.6	255.6	256.0	256.6
R^2	0.270	0.287	0.322	0.303	0.295	0.284
	Panel B: Soldier BMI					
Peer Obsesity Rate	-0.005	0.004	0.001	0.009	-0.011	-0.005
	(0.004)	(0.005)	(0.007)	(0.009)	(0.011)	(0.014)
Observations	205,343	185,563	111,599	75,356	54,263	39,356
Dep Var Mean	25.1	25.3	25.6	26.0	26.3	26.5
R^2	0.889	0.853	0.794	0.737	0.699	0.666
	Panel C: Soldier Obese (BMI > 30)					
Peer Obsesity Rate	-0.045	0.095	0.012	0.117	0.015	-0.028
	(0.071)	(0.080)	(0.102)	(0.129)	(0.160)	(0.199)
Observations	205,343	185,563	111,599	75,356	54,263	39,356
Dep Var Mean	10.3	10.7	11.0	11.9	13.1	14.5
R^2	0.431	0.407	0.409	0.399	0.400	0.400

Notes: This table shows the results of the reduced form regression (equation 1) regressing soldier outcomes on the percent of soldiers with a BMI > 30 in the individual's company in the quarter prior to the individual arriving at the company. The peer measure has been standardized to have mean 0 and standard deviation 1. Each panel shows the impact of a one standard deviation increase peer fitness on individual outcomes over the following six years. All regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. The sample is restricted to soldiers for whom it would be possible to observe in the data at that point (e.g. if a soldier arrives at their unit in 2017 and the data ends in 2022, they are only observable for 5 years). All columns restrict to soldiers still in the Army as I cannot observe the outcomes after individuals separate. All regressions include controls for soldier initial height, weight, BMI, race, age, AFQT, and education. Individual fitness score in Panel A has been standardized to have mean 0 and standard deviation 1. I report the mean and standard deviation of soldier fitness score. Since soldiers exit the sample as they leave the Army the population changes between columns. Additionally, in panel A, soldiers do not enter the sample until their first recorded fitness test. $* p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

Table A11: Impact of a 1 Standard Deviation increase in the Percent of Peers Above Maximum Allowed Weight on Soldier Outcomes

	1 Yr (1)	2 Yr (2)	3 Yr (3)	4 Yr (4)	5 Yr (5)	6 Yr (6)
	Panel A: Soldier Fitness Score					
Peer Weight Above Max	-0.005	0.002	0.005	0.003	-0.003	0.005
	(0.006)	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)
Observations	77,744	109,138	84,991	66,367	50,940	38,062
Dep Var Mean	242.2	247.2	253.6	255.6	256.0	256.6
R^2	0.270	0.287	0.322	0.303	0.295	0.284
	Panel B: Soldier BMI					
Peer Weight Above Max	-0.005	0.003	-0.001	0.005	0.012	0.005
	(0.006)	(0.005)	(0.006)	(0.009)	(0.011)	(0.013)
Observations	205,343	185,563	111,599	75,356	54,263	39,356
Dep Var Mean	25.1	25.3	25.6	26.0	26.3	26.5
R^2	0.889	0.853	0.794	0.737	0.699	0.666
	Panel C: Soldier Obese (BMI > 30)					
Peer Weight Above Max	0.014	0.083	0.007	-0.067	0.170	0.213
	(0.069)	(0.076)	(0.096)	(0.124)	(0.152)	(0.188)
Observations	205,343	185,563	111,599	75,356	54,263	39,356
Dep Var Mean	10.3	10.7	11.0	11.9	13.1	14.5
R^2	0.431	0.407	0.409	0.399	0.400	0.400

Notes: This table shows the results of the reduced form regression (equation 1) regressing soldier outcomes on the percent of soldiers in the individual's company in the quarter prior to the individual arriving at the company whose weight is above the Army maximum for their age, height, and sex. The peer measure has been standardized to have mean 0 and standard deviation 1. Each panel shows the impact of a one standard deviation increase peer fitness on individual outcomes over the following six years. All regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. The sample is restricted to soldiers for whom it would be possible to observe in the data at that point (e.g. if a soldier arrives at their unit in 2017 and the data ends in 2022, they are only observable for 5 years). All columns restrict to soldiers still in the Army as I cannot observe the outcomes after individuals separate. All regressions include controls for soldier initial height, weight, BMI, race, age, AFQT, and education. Individual fitness score in Panel A has been standardized to have mean 0 and standard deviation 1. I report the mean and standard deviation of soldier fitness score. Since soldiers exit the sample as they leave the Army the population changes between columns. Additionally, in panel A, soldiers do not enter the sample until their first recorded fitness test. $* p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

Table A12: Peer Fitness Versus Obesity Rate

	1 Yr	2 Yr	3 Yr	4 Yr	5 Yr	6 Yr
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Soldier Fitness Score					
Peer Fitness	0.080***	0.055***	0.031***	0.026***	0.011	0.012*
	(0.011)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)
Peer Obesity Rate	0.002	0.008	0.013**	0.015***	0.016**	0.011
	(0.006)	(0.005)	(0.005)	(0.006)	(0.007)	(0.008)
Observations	77,537	107,287	80,086	61,299	46,418	34,039
Dep Var Mean (Raw)	242.2	246.9	252.9	254.8	255.3	255.8
Dep Var Std Dev	[34.5]	[35.1]	[33.9]	[32.7]	[33.7]	[34.1]
R^2	0.270	0.282	0.316	0.298	0.293	0.285
	Panel B: Soldier BMI					
Peer Fitness	-0.003	-0.008	-0.033***	-0.039***	-0.038***	-0.028
	(0.004)	(0.005)	(0.007)	(0.010)	(0.014)	(0.018)
Peer Obesity Rate	-0.004	0.008	0.001	0.010	-0.003	0.013
	(0.005)	(0.006)	(0.008)	(0.011)	(0.014)	(0.018)
Observations	191,579	172,886	101,452	68,164	48,819	34,894
Dep Var Mean	25.1	25.4	25.7	26.0	26.3	26.6
R^2	0.882	0.846	0.787	0.731	0.696	0.665
	Panel C: Soldier Obese (BMI > 30)					
Peer Fitness	-0.171**	-0.219	-0.354***	-0.559***	-0.628***	-0.629***
	(0.086)	(0.087)	(0.112)	(0.131)	(0.159)	(0.220)
Peer Obesity Rate	-0.057	0.139	-0.030	0.093	-0.020	0.001
	(0.082)	(0.093)	(0.124)	(0.163)	(0.199)	(0.260)
Observations	191,579	172,886	101,452	68,164	48,819	34,894
Dep Var Mean	10.2	10.7	11.1	12.1	13.4	14.8
R^2	0.429	0.405	0.410	0.401	0.402	0.404

Notes: This table shows the results of the reduced form regression 1 in which I include measures for both peer fitness and peer obesity. The median fitness score of soldiers in the individual's company in the quarter prior to the individual arriving at the company and the percent of soldiers in the individual's company with a BMI $>$ 30 in the quarter prior to the individual arriving at the company are both included in the regressions. Both peer measures have been standardized to have mean 0 and standard deviation 1. Each panel shows the impact of a one standard deviation increase peer fitness on individual outcomes over the following six years. All regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. The sample is restricted to soldiers for whom it would be possible to observe in the data at that point (e.g. if a soldier arrives at their unit in 2017 and the data ends in 2022, they are only observable for 5 years). All columns restrict to soldiers still in the Army as I cannot observe the outcomes after individuals separate. All regressions include controls for soldier initial height, weight, BMI, race, age, AFQT, and education. Individual fitness score in Panel A has been standardized to have mean 0 and standard deviation 1. I report the mean and standard deviation of soldier fitness score. Since soldiers exit the sample as they leave the Army the population changes between columns. Additionally, in panel A, soldiers do not enter the sample until their first recorded fitness test. $* \, p < 0.1$, $^{**} \, p < 0.05$, $^{***} \, p < 0.01$

Table A13: Impact of Interaction of Peer Fitness and BMI

	Low BMI			Middle BMI		High BMI		
	Low Fitness	Mid Fitness	High Fitness	Low Fitness	High Fitness	Low Fitness	Mid Fitness	High Fitness
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Short Run, 1-3 years post arrival							
Peer Fitness	-0.015	0.007	0.015**	-0.018***	0.022***	-0.010	0.009*	0.025***
	(0.012)	(0.006)	(0.006)	(0.006)	(0.003)	(0.006)	(0.005)	(0.006)
Observations	299,230							
	Panel B: Long Run, 4-6 years post arrival							
Peer Fitness	-0.013	0.011**	0.011*	-0.003	0.010***	0.008	0.009*	0.018***
	(0.012)	(0.006)	(0.006)	(0.006)	(0.004)	(0.007)	(0.005)	(0.005)
Observations	169,669							

Notes: This table shows the impact of a 10 percentage point increase in the percent of the company that is high or low fitness and BMI relative to the percent of peers that have a BMI and fitness score in the inner quartiles (BMI between 22.1 and 27.5 and fitness between 223 and 272) on soldier fitness score. Low fitness score is defined as having an fitness score below 223 (the bottom quartile of first fitness score), and high fitness score is defined as having an fitness score above 272 (the top quartile of first fitness score). Low BMI is having a BMI below 22.1, and high BMI is having a BMI above 27.5. As in table 3 all regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. Individual fitness score has been standardized to have mean 0 and standard deviation 1. Panel A, pools soldier outcomes from 1-3 years post arrival at the company. This reflects the period of time when the soldier is likely at the same company. Panel B, pools soldier outcomes from 4-6 years post arrival at the company. This reflects outcomes measured after the soldier has left the initial company. $* p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

Table A14: Peer Fitness Versus Education

	1 Yr	2 Yr	3 Yr	4 Yr	5 Yr	6 Yr
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Soldier Fitness Score			
Peer Fitness	0.079***	0.054	0.029***	0.025***	0.009	0.012*
	(0.010)	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)
Peer College Deg	0.004	0.002	0.006	0.017***	0.005	0.003
	(0.006)	(0.005)	(0.006)	(0.006)	(0.007)	(0.009)
Observations	77,537	107,287	80,086	61,299	46,418	34,039
Dep Var Mean (Raw)	242.2	246.9	252.9	254.8	255.3	255.8
Dep Var Std Dev	[34.5]	[35.1]	[33.9]	[32.7]	[33.7]	[34.1]
R^2	0.270	0.282	0.316	0.298	0.293	0.285
			Panel B: Soldier BMI			
Peer Fitness	-0.003	-0.009	-0.033***	-0.040***	-0.037***	-0.029
	(0.004)	(0.005)	(0.007)	(0.010)	(0.014)	(0.018)
Peer College Deg	0.022	0.013	0.007	-0.002	-0.025	0.003
	(0.015)	(0.006)	(0.009)	(0.012)	(0.016)	(0.020)
Observations	191,579	172,886	101,452	68,164	48,819	34,894
Dep Var Mean	25.1	25.4	25.7	26.0	26.3	26.6
R^2	0.882	0.846	0.787	0.731	0.696	0.665
			Panel C: Soldier Obese (BMI > 30)			
Peer Fitness	-0.166*	-0.233	-0.352***	-0.567***	-0.622***	-0.634***
	(0.086)	(0.087)	(0.112)	(0.131)	(0.159)	(0.219)
Peer College Deg	0.043	0.015	0.040	0.040	-0.181	0.254
	(0.089)	(0.099)	(0.131)	(0.176)	(0.223)	(0.295)
Observations	191,579	172,886	101,452	68,164	48,819	34,894
Dep Var Mean	10.2	10.7	11.1	12.1	13.4	14.8
R^2	0.429	0.405	0.410	0.401	0.402	0.404

Notes: This table shows the results of the reduced form regression in which I include measures for both peer fitness and peer education. The median fitness score of soldiers in the individual's company in the quarter prior to the individual arriving at the company and the percent of soldiers in the individual's company with at least a 4 year degree in the quarter prior to the individual arriving at the company are both included in the regressions. Both peer measures have been standardized to have mean 0 and standard deviation 1. Each panel shows the impact of a one standard deviation increase peer fitness on individual outcomes over the following six years. All regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. The sample is restricted to soldiers for whom it would be possible to observe in the data at that point (e.g. if a soldier arrives at their unit in 2017 and the data ends in 2022, they are only observable for 5 years). All columns restrict to soldiers still in the Army as I cannot observe the outcomes after individuals separate. All regressions include controls for soldier initial height, weight, BMI, race, age, AFQT, and education. Individual fitness score in Panel A has been standardized to have mean 0 and standard deviation 1. I report the mean and standard deviation of soldier fitness score. Since soldiers exit the sample as they leave the Army the population changes between columns. Additionally, in panel A, soldiers do not enter the sample until their first recorded fitness test. $* \, p < 0.1$, $^{**} \, p < 0.05$, $^{***} \, p < 0.01$

Table A15: Combat versus Noncombat Occupations

	Combat Occupations			Noncombat Occupations			P-value		
	Fitness	BMI	BMI > 30	Fitness	BMI	BMI > 30	(1)=(4)	(2)=(5)	(3)=(6)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Short Term, 1-3 years post arrival								
	0.048***	-0.013***	-0.137	0.050***	-0.012*	-0.477**	0.873	0.948	0.099
	(0.006)	(0.004)	(0.088)	(0.013)	(0.007)	(0.198)			
Observations	194,781	345,114	345,114	104,449	167,933	167,933			
Dep Var Mean	250.43	25.28	10.04	241.53	25.56	12.34			

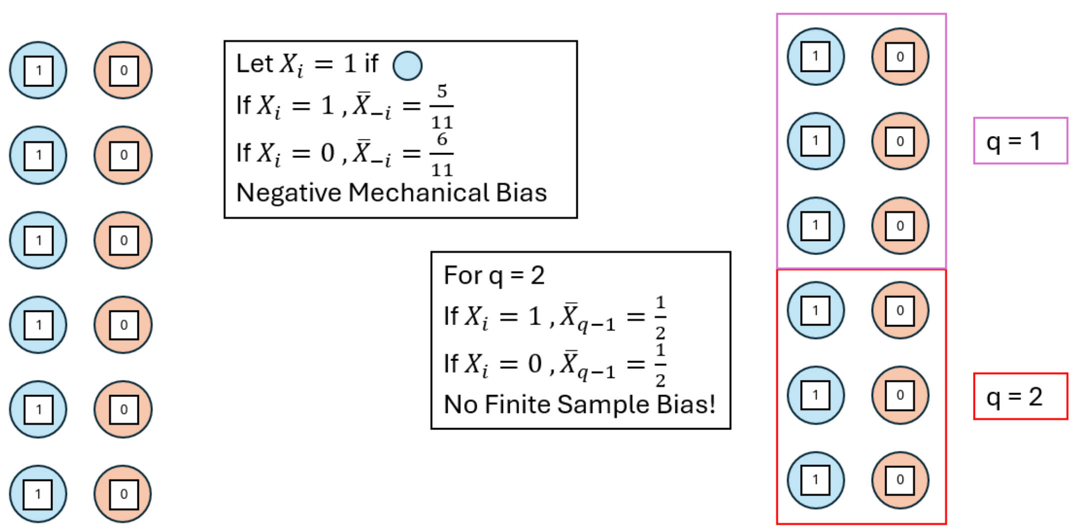
	Panel B: Long Term, 4-6 years post arrival								
	0.014***	-0.043***	-0.495***	0.022*	-0.018	-0.933***	0.513	0.224	0.149
	(0.005)	(0.013)	(0.145)	(0.013)	(0.019)	(0.288)			
Observations	108,697	115,674	115,674	60,972	64,523	64,523			
Dep Var Mean	258.30	26.19	12.36	247.37	26.46	15.14			

Notes: This shows the impact of peer fitness on soldiers outcomes (1) splitting the sample by soldier occupation. Columns (1)-(3) report the reduced form estimates restricting to soldiers in combat occupations. Columns (4)-(6) report the reduced form estimates restricting to soldiers in noncombat occupations. Each column shows the impact of a one standard deviation increase peer fitness on individual outcomes. As in table 3 all regressions include fixed effects for the interaction of duty station, occupation, contract length, and quarter of arrival with standard errors clustered at the company by quarter of arrival level. Individual fitness score has been standardized to have mean 0 and standard deviation 1. Columns (7)-(9) shows the p-value of the test that the coefficient of the two independent variables are equal. Panel A, pools soldier outcomes from 1-3 years post arrival at the company. This reflects the period of time when the soldier is likely at the same company. Panel B, pools soldier outcomes from 4-6 years post arrival at the company. This reflects outcomes measured after the soldier has left the initial company. $* p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

B Concerns with Identifying Peer Spillovers off of Group Means

Angrist (2014) provides a detailed argument against using group average characteristics to study peer spillovers. I will not copy the full argument from that paper here, but provide a description of the pertinent concern. Researchers attempting to estimate peer effects may be tempted to regress individual outcomes the average characteristics within a group. Denote the group mean $\bar{X}_g$. There is a clear vacuous relationship between the X_i and $\bar{X}_g$ as X_i is a component of $\bar{X}_g$. A common method for avoiding this relationship is the leave-out mean $\bar{X}_{g,-i} = \frac{N_g \bar{X}_g - X_i}{X_i - 1}$. This is useful as the leave-out mean converges to the group mean and (as long as $cov(X_i, X_j) = 0$, $\forall i \neq j$ and $i, j \in g$) the leave-out mean is uncorrelated with X_i. A problem with this arises in finite samples, as in finite samples $cov(X_i, X_j) < 0$, $\forall i \neq j$ and $i, j \in g$. Figure B1 provides an illustration of this. Individuals with higher values of X_i have mechanically lower values of $\bar{X}_{g,-i}$ compared to other individuals in the same group.

Figure B1: Illustration of Finite Sample Bias of Leave-out Mean



One solution to this is to split each group into subgroups then use individuals in a different subgroup as peers. I do this in the paper by splitting soldiers in the same company by their quarter of arrival in the company. I use all soldiers who were in the company in the prior quarter as peers for the soldiers who arrived in the current quarter. Then, by including quarter of arrival in the set of fixed effects, I eliminate all within company across arrival quarter comparisons from my regressions. Figure B1 provides a simple illustration of this. Suppose a company has twelve individuals. Six individuals arrived at the company in quarter 1, six arrived in quarter 2. For individuals who arrived in quarter 2, there is no relationship between X_i and the average X of individuals who arrived at the same company in quarter 1, $\bar{X}_{g,q-1}$. More generally, this works to avoid the finite sample bias as all individuals in the same peer group (company) and same strata of fixed effects have the same value of the peer measure.