

Body Mass Index Trajectories and the Relationship between Stressful Life Changes and Nutrition-Related Health Outcomes among United States Army Soldiers

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Abstract

Military service can be characterized as an ever-changing, demanding profession that requires dedication to a highly stressful lifestyle. U.S. Army Soldiers must balance stressors that normally occurs over an individual's lifecourse with unique stressors associated with Army service, such as deployment and routine relocations. Soldiers must also meet physical fitness requirements, adhere to body mass index (BMI)-based body composition standards, and remain free of major physical limitations to remain in service. Despite these requirements, Soldiers are not free of many of the chronic health conditions present in the general population such as obesity and hyperlipidemia.

BMI has risen among members of the military, though to a lesser degree than in civilian populations. BMI as an anthropometric tool has been essential for population surveillance and documenting the obesity epidemic and its health consequences. One use for BMI in population surveillance is to model the BMI trajectories of a population over time. Many studies are available on the BMI trajectories and determinants of BMI in civilians, but few studies of this nature in military populations exist. Establishing the shape and determinants of BMI trajectories among Soldiers is critical given the importance of weight management to military service requirements.

Stress has been implicated as a contributor to health conditions such as obesity, hypertension, and hyperlipidemia. Soldiers have the same stressful life changes as civilians,

including marriage, divorce, childbirth, and job change in addition to unique stressors related to frequent relocations, being deployed to a combat zone, and reintegrating from deployment. Stressful experiences may change behavior and alter an individual's physiology leading to undesirable health outcomes. Considering that health consequences of chronic stress may impact the ability of Soldiers to meet Army standards or perform their duties, there is a salient need to investigate the impact of stress on Soldier health.

Two specific aims were proposed in this dissertation. Both aims used longitudinal data from the Stanford Military Data Repository representing all active-duty U.S. Army Soldiers who were age 17-62 between 2011 and 2014 (n=827,126). Specific aim 1 was to model the overall BMI trajectory of Soldiers, find the most common trajectory groups among Soldiers, investigate the relationship between BMI trajectories and sociodemographic and military-specific characteristics, and determine if there were Soldiers with large fluctuations in BMI. Group-based trajectory modeling was used to identify the BMI trajectories of Soldiers and multinomial logistic regression was used to estimate associations between Soldier characteristics and trajectory membership. In a smaller sample, person-specific growth curves were used to identify Soldiers with large intra-individual variability, such as BMI fluctuations caused by weight cycling.

Specific aim 2 was to determine if experiencing stressful life changes was associated with blood pressure changes, an earlier onset of hyperlipidemia diagnosis, substantial weight gain, or being separated from the Army for failure to meet body composition standards. A sub-aim was to determine which stressful life changes were most associated with these outcomes and if there were gender differences in the effects. Stressful life changes were marital transitions, deployment to a combat zone, return from deployment, rank change, relocation, change in

occupation, and developing a physical limitation to duty. Event history analysis was used to model the association of stressful life changes with study outcomes.

For specific aim 1, four distinct BMI trajectory groups were found: increasing, decreasing, constant, and inconstant. The constant, increasing, and decreasing trajectories were similar in shape and percentage between men and women. The constant trajectory had the fewest Soldiers who exceeded weight standards or had duty limitations. The increasing trajectory was associated with marriage and fewer service years. The decreasing trajectory was associated with more service years and higher educational attainment. The inconstant trajectory differed in shape between men and women. Over 6% of men and 12% of women had fluctuations in BMI indicative of weight cycling. Characteristics of Soldiers, such as service years, age, and limitations to duty were associated with BMI trends.

For specific aim 2, results showed marriage increased odds of substantial weight gain 3 months later by 1.23 times for men and 1.68 times for women with women having a higher cumulative probability of weight gain in the 12 months following marriage. Relocation was associated with lower blood pressure in men and women, but higher odds of substantial weight gain in women. Developing a physical duty limitation increased odds of hyperlipidemia 2 months later by 1.42 times for men and 1.83 times for women and the odds of substantial weight gain 2 months later by 3.16 times in men and 1.68 times in women. Stressful life changes were found to have an effect on nutrition-related health outcomes among Soldiers with differing effects between men and women.

Soldiers in the U.S. Army have unique challenges related to service requirements and life experiences resulting from military service. Even though Soldiers are often young and active, they are not free of nutrition-related health concerns such as obesity and hyperlipidemia.

Understanding and utilizing Soldier characteristics associated with BMI may assist the Army in targeting resources aimed to improve Soldier health and combat readiness. Identifying times in a Soldiers lifecourse when the risk of developing an undesirable health outcome is highest could help the Army employ existing resources to help mitigate the stress response and the effects of stress on health.