

DO ASTRONAUTS HAVE A HIGHER RATE OF ORTHOPEDIC SHOULDER CONDITIONS THAN A COHORT OF WORKING PROFESSIONALS?

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INTRODUCTION

Occupational surveillance of astronaut shoulder injuries began with operational concerns at the Neutral Buoyancy Laboratory (NBL) during Extra Vehicular Activity (EVA) training. Orthopedic shoulder injury and surgery rates were calculated [1], but classifying the rates as normal, high or low was highly dependent on the comparison group. Thus, the purpose of this study was to identify a population of working professionals and compare orthopedic shoulder consultation and surgery rates.

METHODS

The normal population cohort consisted of individuals (n=347,540; 166,412 males and 181,128 females) enrolled in a global services health maintenance organization (HMO) insurance plan that was in effect from September 1996 to June 2006. A private, independent physician association of 62 orthopedic surgeons was the exclusive provider of all orthopaedic services for the HMO. Plan members and their dependents were enrolled in this HMO through their employers, which included public school districts, petrochemical companies, shipping companies, manufacturing and distribution companies, and engineering companies in the greater Houston area. Orthopedic care was delivered through the emergency room for serious conditions and injuries and after primary-care physician referral for less emergent conditions and injuries. No individuals in this cohort used Medicare, Medicaid, or Workers' Compensation as a source of health insurance.

NASA astronauts from the first class selected in April 1959 to the study cut-off date of December 31, 2014 were included in the analysis (n=338; 286 males and 52 females). To match the two populations by patient age, both populations were limited to patients between the ages of 25 and 65 years. Age was further categorized into 10 year increments to evaluate the role of age in shoulder orthopedic consults and surgeries.

All data were prospectively collected through the NASA Flight Medicine Clinic or the independent physician association as orthopedic care was provided. Medical records were queried for patients with musculoskeletal injuries or conditions involving the shoulder, upper arm or trapezius. Treatment was classified as surgical if it required anesthesia, open treatment or percutaneous fixation at any time during the patient's course of treatment. All non-surgical treatment provided by an orthopedist was classified as an orthopedic consultation and was defined as a first visit to an orthopedist for a shoulder condition or injury. Survival analysis was used to model the time to orthopedic shoulder consult or surgery while adjusting for age. Separate models were calculated for males and females due to the low number of females in the NASA population.

RESULTS

Age was a significant ($p < 0.001$) predictor of orthopedic shoulder consult for females and increased the hazard by 5.3% per year. Differences between rates of orthopedic shoulder consults were not observed in females between the NASA and cohort population, but this could be due to the low numbers in the female NASA population. In the male comparison, age ($p < 0.001$) and cohort group ($p < 0.001$) were significant predictors of orthopedic shoulder consults. Males in the NASA cohort had a 94% increased hazard of an orthopedic shoulder consult, and age increased the hazard by 3.2% per year for males. Shoulder surgery rates were only calculated in the males as the NASA female population only had 2 cases during the study time period. In males, for each additional year of age the hazard of shoulder surgery increased by 4% ($p < 0.001$). Males in the Fondren and NASA cohorts did not have significantly different hazards of shoulder surgery ($p = 0.938$).

CONCLUSIONS

A variety of occupational health initiatives have been implemented to manage shoulder injuries over the past 20 years at NASA. Although it is impossible to distinguish changes in the rates over the years due to these initiatives, the rates of orthopedic shoulder surgery in males are similar to a population of working professionals indicating the initiatives are effectively preventing or lessening the severity of shoulder injuries resulting in fewer injuries progressing to surgical outcomes.

REFERENCE

[1] Laughlin M.S. et al. (2015) *HRP Investigators' Workshop*.