

Shoulder Injury Incidence Rates in NASA Astronauts

Mitzi S. Laughlin¹, Jocelyn D. Murray², Millennia Foy², Mary L. Wear², and Mary Van Baalen³

¹Department of Health and Human Performance, University of Houston, Houston, Texas;

²Wyle, Houston, Texas; and ³National Aeronautics and Space Administration, Johnson Space Center, Houston, Texas.

Background

Evaluation of the astronaut shoulder injury rates began with an operational concern at the Neutral Buoyancy Laboratory (NBL) during Extravehicular Activity (EVA) training. An astronaut suffered a shoulder injury during an NBL training run and commented that it was possibly due to a hardware issue. During the subsequent investigation, questions arose regarding the rate of shoulder injuries in recent years and over the entire history of the astronaut corps.

Purpose

The purpose of this occupational health study was to determine the incidence rate of shoulder injuries incurred by NASA astronauts during their active duty NASA career and determine if the rate of injury has changed over time.



An astronaut conducts an EVA to repair equipment. Participation in EVAs and the associated ground training is a risk factor for shoulder injuries.



Methods

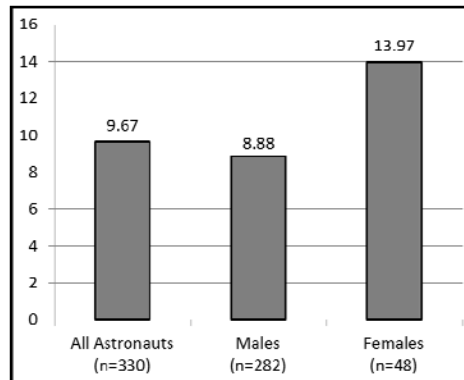
Astronaut medical records were queried from the NASA Johnson Space Center (JSC) Flight Medicine Clinic and all shoulder and upper arm orthopedic conditions were noted. An injury was considered directly attributed to EVA training if all the following conditions were met:

- The astronaut performed EVA training in the Weightless Environment Training Facility (WETF) or NBL
- The injury occurred while considered an active astronaut at NASA
- The WETF, NBL, EVA suit or EVA training was associated with the injury in the medical record.

To determine the rate of injuries over the course of NASA history, astronauts were categorized according to the decade in which they were selected as astronauts. Since the first astronaut class selected in 1959 included only seven individuals, they were grouped with the astronauts selected in the 1960's.

Shoulder injury incidence rates were calculated and reported as the number of injuries per 100 astronauts over 10 years of active duty service. Overall incidence rates were then stratified by sex and selection decade.

Shoulder Injury Incidence Rates by Sex
(per 100 astronauts over 10 years)

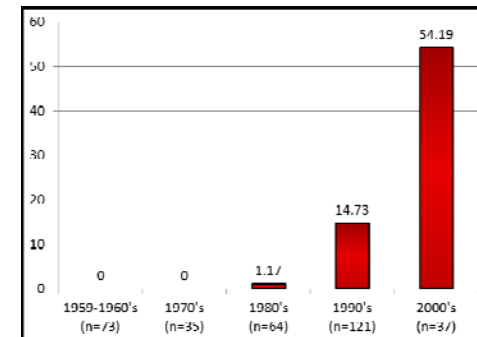


Differences in injury rates by sex were non-significant, as the 95th percentile confidence intervals are quite large with the small number of female astronauts.

Results

All astronaut medical records were queried (n=330) and a total of 40 injuries met the strict definition of shoulder injury associated with EVA training through December, 2012. The overall shoulder injury incidence rate was 9.67 injuries per 100 astronauts over 10 years. Although the differences are not statistically significant, the rate for males was slightly lower at 8.88 and females slightly higher at 13.97. The injury rates by selection decade show a dramatic increase in injuries attributed to EVA training; however, these differences are statistically non-significant likely due to the small population size.

Shoulder Injury Rates by Selection Decade
(per 100 astronauts over 10 years)



Summary and Forward Work

- Although the incidence rates of shoulder injuries appear to be increasing over the years, the requirements of the astronaut corps have also changed.
- All astronauts are now expected to be EVA certified in order to fly whereas that was not a requirement for earlier astronauts.
- Number of EVA training runs has increased:
 - 1.96 runs/year per astronaut from 1982-1996
 - 5.08 runs/year per astronaut from 2003-2009
- In order to better understand the magnitude of the astronaut shoulder injury rates, future studies will include a cohort population with similar traits.