ANALYSIS OF THE EFFECT OF PROTECTIVE LEG RESTRAINTS ON LOWER EXTREMITY INJURIES IN U.S. NAVY AND MARINE CORPS EJECTIONS FROM 1980 TO 2010.

Lcdr Robert J. Krause, MC, USN; Cdr John E. Moore, MC, USN; Cdr Christopher A. Orsello, MC, USN
Residency in Aerospace Medicine, Naval Aerospace Medical Institute (Nami)

INTRODUCTION
Protective leg restraint garters on ejection seats aim to maximize lower extremity (LE) injury prevention. A literature search found no published studies that evaluated efficacy of leg restraints in reducing lower extremity injuries.

Assumptions:
Restraints put the body in a better ejection position.
Restraints minimize flail injuries.

OBJECTIVES
The objective of the study was to determine if the number of LE injuries differed between ejections occurring in seats with and without leg restraints. The study hypothesis was that ejections with leg restraints would result in statistically fewer LE injuries compared to those without.

METHODS
A retrospective cohort study was conducted with chi-square analysis to compare the number of lower extremity injuries occurring between ejections with and without leg restraints. U.S. Naval Safety Center Aviation data from Navy and Marine Corps ejections between 1980 and 2010 was analyzed. Exclusion criteria were unknown seat type (could not determine the presence or absence of restraints) and cases in which it was unknown whether the ejection occurred in versus out of the ejection envelope. SAS® v9.2 Software was used.

RESULTS
A total of 983 ejections were analyzed that resulted in 2232 individual injuries. 710 (72%) ejections occurred in seats with leg restraints and 273 (28%) occurred in seats without restraints. 320 (32.6%) ejections resulted in one or more lower extremity injuries. There was no statistical difference in the occurrence of lower extremity injuries between seats with and those without leg restraints.

CONCLUSIONS
Data analysis suggests that leg restraints do not significantly decrease the number of lower extremity injuries during ejection.

Limitations:
- Data is from Naval Safety Center and subject to recall bias.
- No correlation to severity of LE injuries.
- No differentiation between ejection envelopes of different seats and aircraft.
- Injuries due to Parachute Landing Fall (PLF) not corrected for.

Future Analysis:
- Impact of restraints on other body regions (arm restraints, etc.)
- Sub-analysis of injury severity and overall disability from LE injuries with and without leg restraints and impact of landing injuries.
- This points out the need for careful analysis of new passive restraint systems.

REFERENCES
1. Data from the Naval Safety Center Aviation Database

DISCLOSURE
Views of the authors do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U.S. Government.
- I have no financial relationships to disclose.
- I will not discuss off-label use and/or investigational use in my presentation.