



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Injury Risk Assessment and Criteria Development

Using Novel Statistical Modeling Techniques to Develop Age-specific Neck Injury Risk Curves for Women

Injury tolerances and specifications for injury assessments are based on data from human cadavers and are targeted to the male population. Anatomical differences exist between men's and women's spines, and the intrinsic load-paths or load-sharing among their components are also different. With the increasing role of women in military operational environments, female-specific Injury Risk Curves (IRC) are needed to improve and assess safety of female Service members.

Researchers at the Medical College of Wisconsin (Milwaukee, WI) developed IRCs to support this goal (Yoganandan *et al.*, 2018). Head impact tests using upright and inverted head-spine preparations from female cadavers ($n = 20$, age range 29–95) were conducted with data gathered on injury and non-injury producing forces. IRCs were derived for females of 35, 45, and 63 years of age. These IRCs indicate increasing injury probability with age at a given force. A comparison of the female-specific IRCs for 63 years of age (the mean in this study) with male-specific IRCs for that age from a previous cadaver-based study demonstrates that female-based IRCs are left-shifted; that is, female spine tolerance to injury from head impact loading is lower than male spine tolerance at all impact forces.

These female-specific IRCs will assist in the development of Injury Assessment Reference Curves or Injury Assessment Reference Values at pre-chosen risk levels as design and evaluation tools for injury prevention. They will be also useful in the validation and application of finite element models of female necks for injury prediction.

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REFERENCES:

Yoganandan, N., Chirvi, S., Pintar, F. A., Baisden, J. L., & Banerjee, A. (2018). Preliminary female cervical spine injury risk curves from PMHS tests. *J Mech Behav Biomed Mater*, 83, 143-147. doi:10.1016/j.jmbbm.2018.04.020

