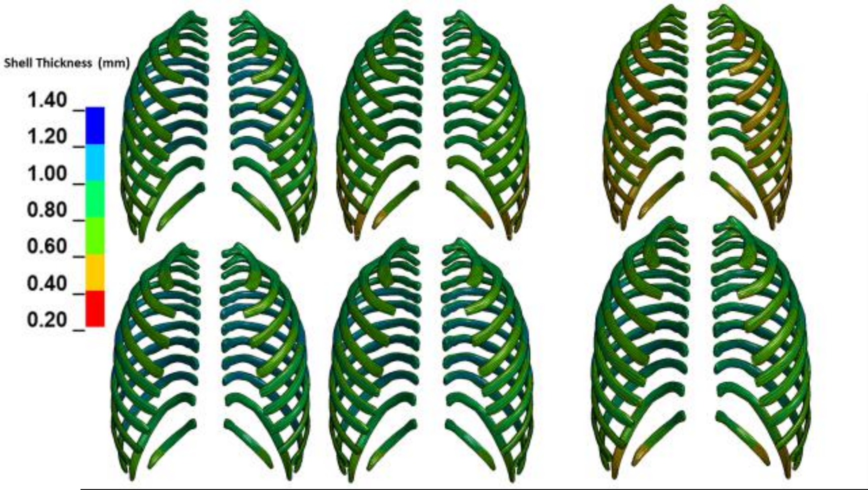

Rib Cortical Thickness Variation with Age and Sex

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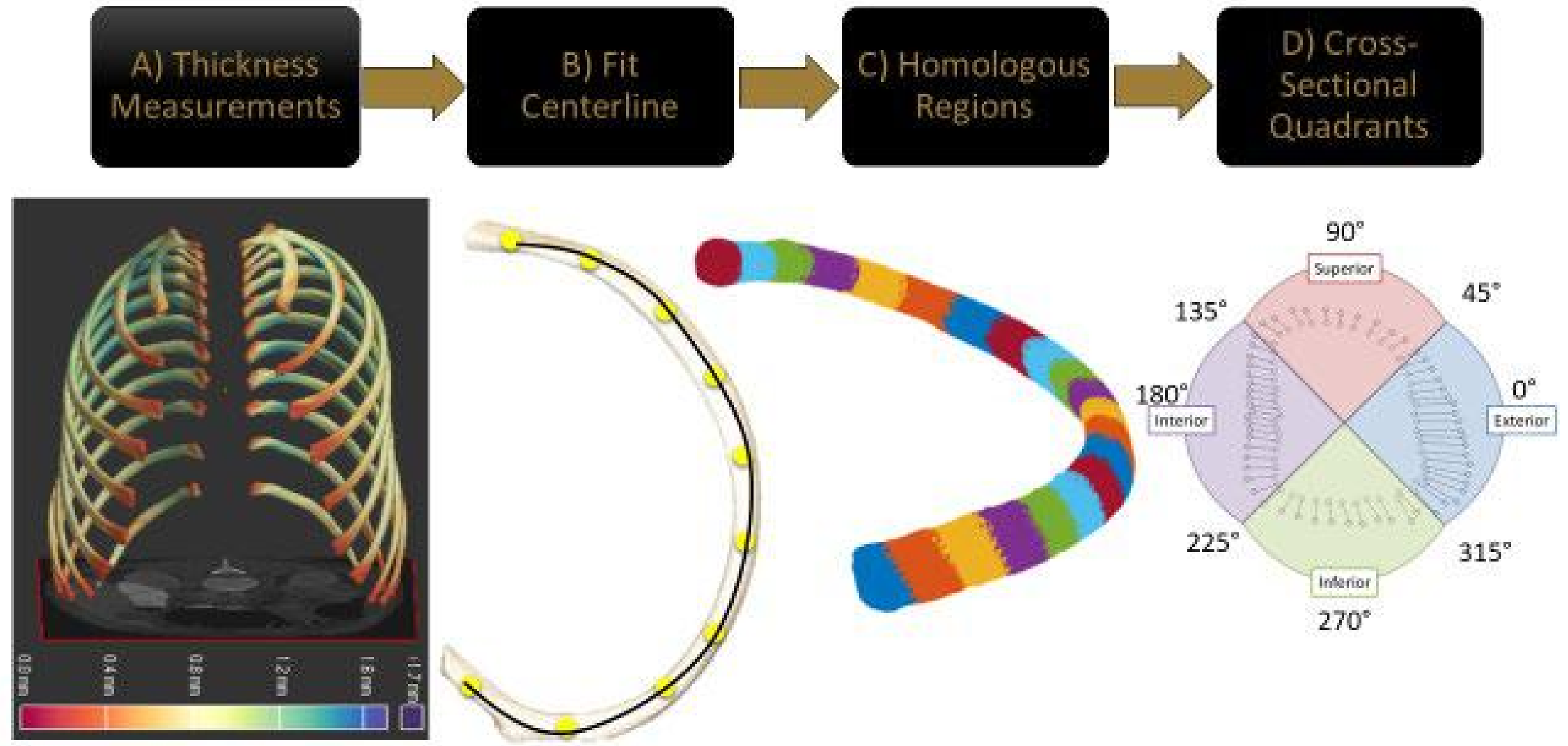
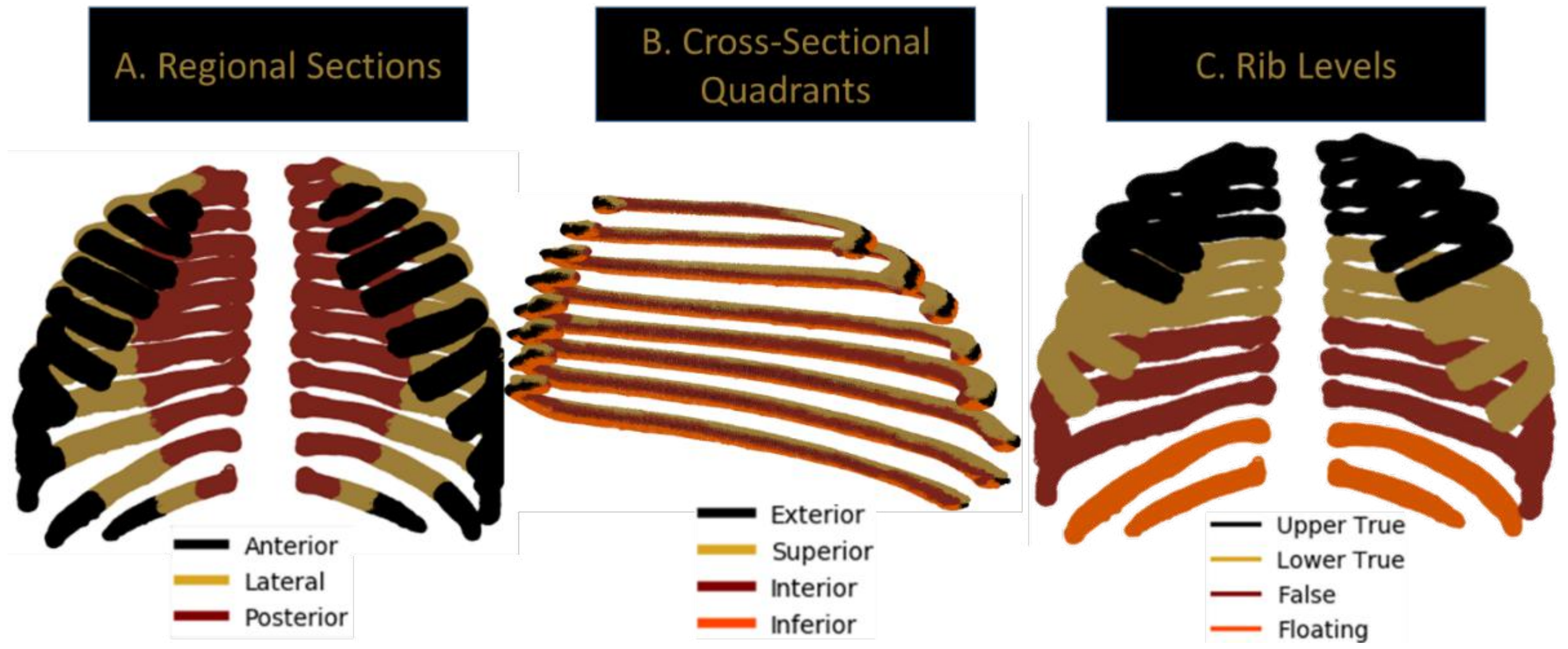
Introduction:

Rib fractures are common, and aging increases the risk of sustaining rib fractures and developing associated pulmonary complications. Rib cortical thickness declines with aging affect injury risk and are likely sex-specific. The objective of this study was to create sex-specific continuous age-based regressions describing rib cortical thickness variation.

Methods:

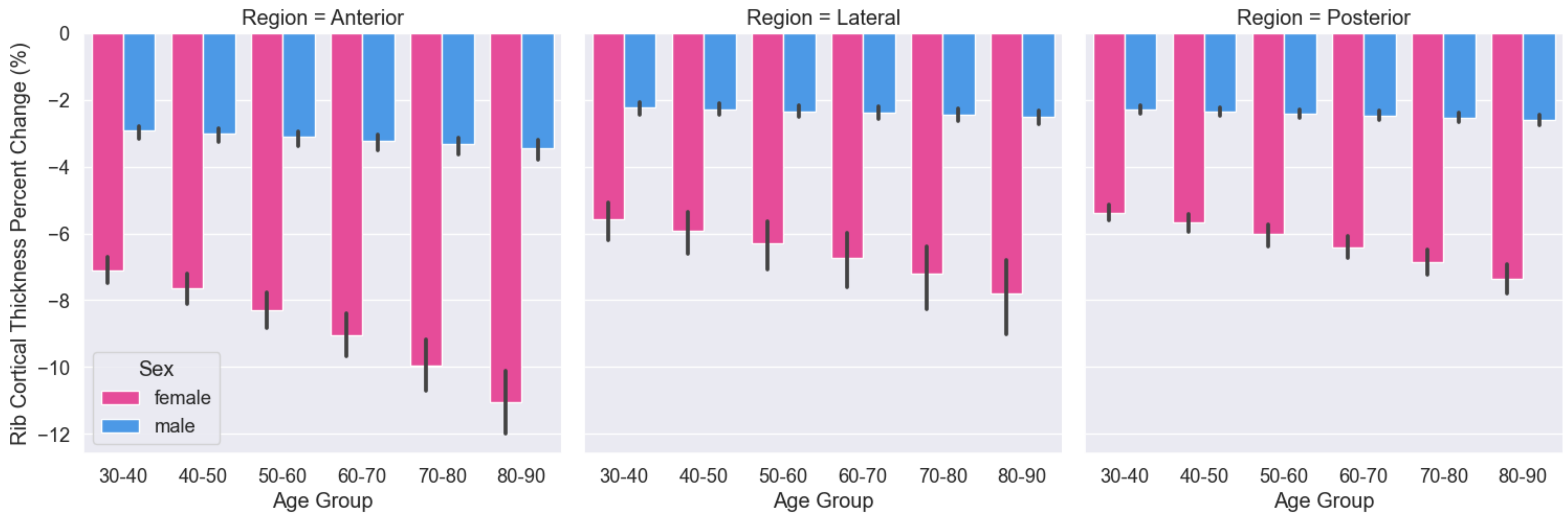
A validated cortical thickness algorithm was applied to 124 in-vivo clinical computed tomography (CT) scans of men and women (ages 30-97). Cortical thickness measurements were obtained for the entire rib cage. Sex-specific age-based regressions were fitted, and cortical thinning was evaluated between the different anatomical regions, cross-sectional quadrants, and rib levels. The percent change in thickness was evaluated cumulatively across ages 30-97 and per age decade.





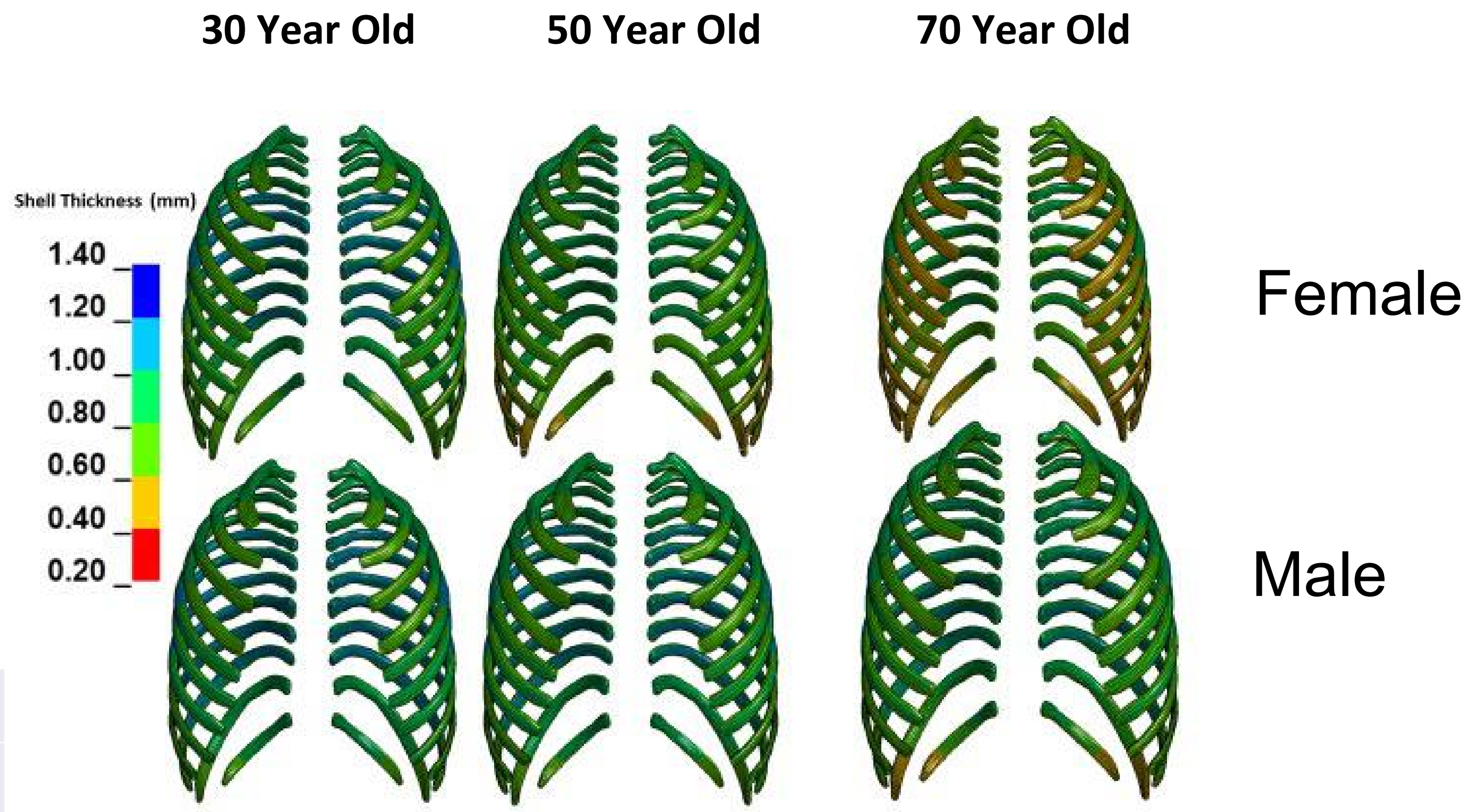
Results:

In women, the cumulative percent loss of rib cortical thickness over the lifespan was over twice as high, and thinning occurred at a more rapid rate with each decade of aging. From age 30-97, the anterior rib regions thinned 19% in men and 53% in women, while the lateral-posterior regions thinned 14% in men and 39% in women. Female cortical thinning accelerated with age (-7% anterior and -5% lateral-posterior losses from age 30-40, increasing to -11% anterior and -7% lateral-posterior losses from age 80-90). Male cortical thinning was relatively constant across ages 30-90 (-3% anterior and -2% lateral-posterior losses per decade). Thinning was similar across different rib levels and quadrants.



Discussion:

The aim of this study was to develop continuous age-based regression models of cortical thickness for males and females for the entire rib cage. Expanding upon previous studies, the regression analysis controlled for the different anatomical regions, cross-sectional quadrants, rib level, age, and sex of the subject. To capture the overall variability between subjects, all the raw data were included in the regression analysis. These sex-specific age-based rib cortical thickness regressions can be mapped to finite element thorax models to create biofidelic representations of men and women across the lifespan.



Acknowledgments:

This study was funded by the National Highway Traffic Safety Administration (NHTSA) under Cooperative Agreement Number DTN22-09-H-00242. Additional support was provided by the National Institute on Aging (K25AG058804). Dr. Stitzel is a co-founder and Dr. Weaver is a consultant of Elemance LLC, which provides academic and commercial licenses of the Global Human Body Models Consortium (GHBMC)-owned human body computer models. Views expressed are those of the authors and do not represent the views of NHTSA, NIA/NIH, or the GHBMC.