Justification of Shoulder and Back Support Exoskeletons for Minimally Invasive Surgeons and Operating Room Nurses to Reduce Musculoskeletal Symptoms

Alec J. Gonzales; Dechristian Barbieri, PhD; Alfredo M. Carbonell, II, DO FACS; Anjali Joseph, PhD, EDAC; Divya Srinivasan, PhD, and Jackie Cha, PhD

Clemson University, Clemson, SC; Prisma Health-Upstate, Greenville, SC

Introduction: Due to the physical demands of their daily duties, many surgical care team members, especially surgeons and nurses, experience musculoskeletal symptoms (MS). Subsequently, technological interventions such as exoskeletons have been evaluated to help mitigate the development of MS. In order to identify where exoskeleton support may be the most beneficial, it is important to understand the varying work demands of these surgical team members. Considering these dynamic work demands, the goal of this study was to identify where exoskeleton support may have the largest influence on reducing high work demands in surgical teams.

Methods: Seven minimally invasive bariatric surgeons and seven operating room nurses completed surveys to understand MS prevalence. The participants completed the International Physical Activity Questionnaire (IPAQ), an adapted Nordic Musculoskeletal Questionnaire, and answered questions regarding tasks that lead to pain.

Results: IPAQ metabolic equivalent (MET) results show surgeons (116.4 MET-min/week), and nurses (190.9 MET-min/week) were classified as having low levels of overall physical activity. For surgeons, the most common area of MS was reported in the neck and shoulders while nurses most commonly reported MS in the shoulders and lower back. Surgeons' self-reported that the tasks that contributed to areas of pain were leaning forward during surgical procedures and awkward postures that stem from manipulating laparoscopic tools. Nurses' self-reported pain was attributed to patient positioning, lifting, and pulling.

Conclusions: Based on self-reported pain and task results, surgeons may benefit from back- and shoulder- support exoskeletons while nurses may benefit from back-support. However, due to the different areas of pain, and dynamic work tasks, it is still unclear which exoskeleton support is most needed for surgeon populations. Future steps would be to objectively quantify which exoskeleton would be most helpful to justify the implementation of exoskeleton use for minimally invasive surgeons and operating room nurses.