Designing a Low Back Pain Reduction Pilot Seat

Low back pain (LBP) is one of the leading causes of high health care costs in developed countries. In western societies, LBP affects up to 80% of people at some time during their lives. Almost all anatomic structures of the lumbar spine (vertebrae, ligaments, tendons, facet joints, intervertebral discs, muscles) are suspected to play a role in LBP. While the biomechanical etiology of LBP remains unknown, heavy lifting as well as long term and repetitive exposures to mechanical stresses are believed to be associated with numerous LBP cases observed in truck drivers, assembly line workers, nurses, etc.

Pilots of the U.S. Navy aircraft are frequently exposed to several types of loading that have been associated with LBP while they are restrained in their seats. For example, the exposures can be due to high onset of rear-end acceleration during takeoff from an aircraft carrier, high rate of inertial loading during landing, and long periods of quasi-static vibration loading during missions. Because chronic pain could lead to reduced operational readiness and long-term medical treatment, the Navy issued a new funding opportunity that seeks to encourage advancement in the design of aircraft seat to minimize LBP for $1 million over a three-year period. You see this as a wonderful opportunity to utilize your talents. Knowing the fact that it is impossible to examine all potential sources of LBP with the limited budget, you decide to write a limited proposal in response to this funding opportunity that includes the following sections:

A. **Abstract**: In no more than 300 words, briefly describe the scope of the entire project.

B. **Table of Contents**: List headings and associated page numbers

C. **Introduction and Background**: Provide a general overview of the current state-of-the-art understanding of LBP and its etiologies. Compare and contrast different schools of thought related to LBP and decide which one you agree with the most. Describe or estimate loading conditions in Navy aircraft seats. Express outcome variables to be used for designing and assessing a LBP reduction seat.

D. **Specific Aims**: Please list the specific aims to accomplish the design of a LBP reduction seat.

E. **Research Plan**
   a. **Materials and Methods**: Describe approaches you will use for each aim to design the new LBP reduction seat which can reduce the incidence of LBP for both the short-duration high-load loading and long-duration low-load loading conditions. If experimental studies are needed, explain the materials, methods, instrumentation, etc. needed. Express the relationships among the proposed design method(s) and experimental results.
   b. **Expected Outcomes**: What are the anticipated outcomes of your proposed research designs.
   c. **Potential Problems and Alternative Strategies**: What problems do you anticipate and how would you overcome those problems?

F. **References**

Make sure that you follow the attached guidelines for submission of your response to this exam question. Please note page limitations and proper citation method. Responses that do not follow these guidelines will not be accepted.