A. SPECIFIC AIMS. Osteoarthritis (OA) is a debilitating disease that leads to pain and disability. OA currently affects 30 million Americans and results in $90 billion in total costs annually. Agricultural workers are an estimated 2-10 times more likely to develop OA than non-farmers. There is a critical need address this rural health disparity and lessen the burden of OA on the 3.2 million agricultural workers in the United States.

Scientific Premise: Agricultural workers are at an increased risk for developing OA relative to rural non-agricultural controls. This elevated risk is pronounced at the hip and in those who have greater contact with animals as opposed to those who manage large crops. Physical activity can protect against OA; however, excessive joint stress, prior joint trauma, and increased inflammation can substantially increase the risk of OA. Agricultural work is associated with heavy physical workload; however, much remains unknown regarding differences in activity patterns and joint loading between those who raise crops (i.e., farmers) and those who manage livestock (i.e., ranchers). Time is often used to quantify workload, but this approach does not account for the variability in physical demands that exist. Our preliminary data from focus groups of farmers and ranchers in Montana support this study by suggesting arthritis is a major health concern in these communities and these workers often experience joint pain.

Impact on the Field: The long-term goal of this research is to minimize the health and financial burden of OA in farmers and ranchers. The objectives of this risk factor pilot project move toward this goal by 1) understanding differentiating factors related to physical activity and biomechanics in farmers and ranchers and 2) enabling future analyses into joint contact stress in rural populations. Our central hypothesis is that ranchers will demonstrate more intense physical activity demands and higher-risk movements compared to farmers.

Aim 1. Elucidate differences in physical activity patterns between Montana farmers and ranchers. We hypothesize that physical activity patterns and intensity will differ between farmers and ranchers. Using accelerometers worn on the lower back and activity journals for continuous 3-day periods during 1) low and 2) high workload seasons, we expect to provide new quantitative evidence into the physical demands of various farming and ranching tasks that are not captured with time-based workload exposure estimates. Ranching is expected to be associated with greater physical activity intensity compared to farming.

Aim 2. Validate a reliable approach to obtain joint loading data between agricultural workers. Logistical barriers limit the ability for rural populations to participate in and benefit from biomechanical research studies that typically require testing in human movement laboratories at large institutions. To obtain joint loading information that can advance our understanding of OA risk factors and guide future preventative strategies, an approach to obtain reliable joint loading data that is accessible to rural agricultural workers is critically needed. We hypothesize that augmenting an existing mobile laboratory with portable force platforms and motion capture cameras will yield a valid and reliable means to measure forces and motion in remote Montana areas when compared to our gold-standard biomechanics laboratory.

Aim 3. Identify movement patterns that characterize farming and ranching occupational demands. Guided by prior OA-rate discrepancies across agricultural operation types and our preliminary data from focus groups with individuals from these populations, we will observe common farming and ranching tasks during high workload seasons to characterize movement patterns. These movements will be the focus of future biomechanical analyses into joint contact stress during relevant occupational tasks. This Aim will identify movements in need of novel means to lessen physical demand (e.g., equipment, neuromuscular training).

Expected Outcomes: This research will advance the fundamental knowledge of physical demands and biomechanical loads in agricultural workers. The unique contributions of this rural health equity pilot project include 1) development of physiologically-relevant measures of workload exposure in the agricultural workers, 2) identification of occupational movements that warrant detailed biomechanical analysis, and 3) establishing a reliable approach to conduct detailed biomechanical analyses across rural Montana. These data will advance the understanding of factors that contribute toward the increased risk of cartilage degeneration in agricultural workers and enable future research to develop creative solutions to mitigate exposure to these risk factors. At the conclusion of this study, we will be positioned to continue this multidisciplinary collaboration by submitting an R21 proposal for biomechanical modelling to obtain detailed joint contact stresses in agricultural workers. Detailed joint contact stress modelling will serve as a powerful outcome that will complement inflammatory biomarkers to comprehensively assess the efficacy of preventative interventions with regard to decreasing agricultural workers' exposure to established OA risk factors.