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### The Isolated Mechanical Effect of Walking in Late Pregnancy May Contribute to The Risk for Knee Osteoarthritis Over the Lifetime

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Evidence suggests that pregnancy increases a woman's risk of knee osteoarthritis (OA). While understanding the underlying causes or association with pregnancy is complex, the mechanical load on cartilage during walking appears to be important to the initiation and progression of the disease. **PURPOSE** It is currently unknown if mechanical changes associated with pregnancy, which may be substantial in magnitude but may be limited in duration, can explain the OA risk since it is diagnosed later in life. Therefore, we aimed to model the effect of walking in late pregnancy on cartilage loading and simulate the mechanical effect of pregnancy or pregnancies, experienced at different times over the lifetime, on knee joint health. **METHODS** Static optimization, joint contact force modeling and a mechanical model of cartilage response were used to estimate cartilage loading at a self-selected "comfortable" walking speed for 10 healthy non-pregnant controls and 10 healthy pregnant women in their 3<sup>rd</sup> trimester. Probabilistic models of cartilage fatigue and failure simulated cases of 0-3 pregnancies separated by 2 years with first births at age 23 or 30 and estimated the probability of structural failure at age 55, the median age of first diagnosis of OA. Peak pregnant/non-pregnant cartilage strain in stance and estimates of cartilage failure probability were compared using paired *t*-tests. **RESULTS** Pregnant women experienced additional peak strain on knee cartilage ( $0.29 \pm 0.06$ , non-pregnant:  $0.23 \pm 0.03$   $p = 0.004$ ). The increased compressive load experienced over one or more pregnancies resulted in a greater estimates of cartilage failure probability when virtual subjects experienced 1, 2, or 3 pregnancies starting at age 23 (average increases of 7.69%, 13.43% and 15.45% from the never-pregnant condition, respectively all  $p \leq 0.01$ ) with differential effects when women experience multiple pregnancies later in their lifetime (6.9% greater risk when experiencing 2 pregnancies starting at age 30  $p \leq 0.01$ ). **CONCLUSION and SIGNIFANCE/NOVELTY** Simulated pregnancy increased the probability of cartilage failure and there was additional risk when experiencing multiple pregnancies later in life. Although understanding the underlying causes of knee OA is complex the mechanical load on cartilage during pregnancy seems to be elevated and may, in part, contribute to the increased risk off knee OA for this population. Results may have implications for pregnant physical activity and future research may aim to determine if biomechanical modifications can be used to reduce joint loading and possibly reduce knee OA risk.