AN EVALUATION OF PROLONGED SIMULATED DRIVING COMBINED WITH IN-VEHICLE POLICE WORK
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INTRODUCTION
There is an increased prevalence of back pain associated with professional drivers [1]. It has been shown that up to 50 percent or 6 hours of an urban police officer’s shift is spent seated in a vehicle and on average 40 percent of in vehicle time involves data entry or retrieval activities with the mobile data terminal (MDT) [2]. The purpose of this investigation was to quantify postural changes in response to prolonged simulated driving, prolonged driving with an intermittent typing task and prolonged in-vehicle typing.

METHODS
Eighteen participants, nine female (age = 23.1 ± 2.4 years, height = 164.0 ± 10.6 cm, mass = 60.4 ± 9.2 kg) and nine male (24.2 ± 2.8 years, 185.7 ± 6.9 cm, 90.0 ± 11.6 kg) were recruited from a university student population. Two 120 minute simulated driving conditions were tested, prolonged driving with intermittent typing tasks and prolonged driving without a typing task. The typing condition involved a total of 30 minutes of continuous typing and 90 minutes of mixed typing and driving with 1 minute of typing for every 3 minutes of driving. Two 15g tri-axial accelerometers (S2-10-g-MF, NexGen Ergonomics, Montreal, Quebec, Canada) were used to collect time varying lumbar and pelvic angles. Lumbar spine angles were normalized to a percentage of maximal range of motion and binned into 0.5 percent increments of maximal lumbar flexion for each subject to calculate an Amplitude Probability Distribution Function of the lumbar flexion postures. A capacitive pressure mapping system (X3, XSensor Inc, Calgary, Alberta, Canada) was used to quantify the pressure interfaces on the seat pan and seat back panel. Seat back centre of pressure (COP) and seat pan peak pressure area (PPA) were calculated.

RESULTS
There were no main effects of task, gender or time point on PPA. There was a significant main effect of gender in the seat back centre of pressure in the medio-lateral direction where women were found to sit further to the right of the seat pan later in the simulation. There was no main effect of time or task on COP (Table 1). Generally, a greater degree of lumbar flexion was found during the typing task compared to the driving task (Figure 1). The postures adopted during all three tasks exhibited a high degree of non-varying postural exposure (Figure 1), with the mixed task containing a proportional mix of the two flexed postures adopted for typing and driving independently.

| Table 1: Average seat back centre of pressure, average seat pan peak pressure area |
|----------------------------------------|--------|--------|----------------|
| Seat Back COP\textsubscript{medio-lateral} (cm) | Male (1.1) | 23.4 (1.1) | Female (1.9) | 21.3 (1.9) | P-Value | 0.0022 |
| Seat Back COP\textsubscript{superior-inferior} (cm) | 23.6 (0.7) | 23.9 (1.1) | 0.5218 |
| Seat Pan Peak Pressure Area R (%) | 1.5 (1.1) | 1.2 (0.3) | 0.0944 |
| Seat Pan Peak Pressure Area L (%) | 1.3 (0.6) | 0.3 (0.3) | 0.5343 |

DISCUSSION & CONCLUSIONS
Women were found to lean to the right on the seat back to a greater degree than male participants across all tasks. This may be indicative of a gender difference in usage patterns of the backrest that has been previously documented in office sitting [3]. Differences in PPA were not found in the current investigation. Previous work in office seating has demonstrated a gender difference in this metric where there was a significantly higher PPA in males than females (2.51% and 1.51% respectively) [3]. However, this difference may be due to the compressibility of the car seat compared to an office seat. Typing resulted in greater lumbar flexion to interface with the laterally located MDT than driving alone. When the mixture of driving and typing was examined it included the same static postures present in the isolated tasks, with a distribution driven by the task ratio of typing and driving. The postures adopted in typing approach maximum lumbar spine flexion and can be sustained for periods or hours during a shift, creating potential for injury/low back pain.

REFERENCES