

**Title of Abstract Name: What You Wear Matters: How lead gown design affects radiation exposure to the Orthopaedic Surgeon.**

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**Specific Aims and Objectives:** Orthopaedic surgery increasingly relies on the use of intraoperative fluoroscopy to guide fracture reduction and implant placement. The inherent risk of fluoroscopy is radiation exposure and the damaging effects it has on biologic tissues. The latency between exposure and effect, and limited epidemiologic data make it difficult to determine a safe level of radiation exposure. Protection is primarily afforded by lead gowns worn by members of the theatre team. Within our department there exists a variety of lead gowns designs which led us to theorise that the protection afforded may also vary. There were three gown designs; a traditional 'skirt and vest', an over the shoulders 'tunic' style and a backless option with partial splits so a flap is created between the legs named the 'spartan'. We sought to quantify radiation exposure to the surgeon whilst wearing each of these styles during standing and seated procedures.

**Methods:** An electronic dosimeter was utilised to record radiation levels at five areas on the surgeon; eye, axilla, waist, groin and knee for each gown design in a simulated seated distal radius volar plating and standing antegrade femoral intramedullary nailing. Image intensifier was operated by radiographers utilising the standard trauma protocols for our centre. All recordings were performed in an operating theatre in a standard configuration, using anthropomorphic phantom limbs and real implants. Data was then analysed using single factor ANOVA and post hoc analysis using Bonferroni correction and two sample student t tests with an alpha value set at 0.05.

**Results:** There exists significant variation between gown designs in both seated and standing positions when measuring at the waist and groin. During seated procedures, the skirt and vest design led to significantly higher doses to the waist and groin when compared to designs that allowed lead to fall between the legs such as the tunic or spartan. Conversely, when standing there were significantly higher doses to the groin when wearing the spartan design compared to the other gown styles. The skirt and waist design allowed significantly higher doses at the waist than other gown styles when standing. There was no difference in exposure to the surgeon's eyes and knees between gown designs as these remain unprotected by all three styles.

**Conclusion:** Seated procedures should prioritise gown designs that allow lead to fall between the legs and protect the surgeon's groin. Standing procedures must balance surgeon mobility with protection, as any gaps between lead will cause higher doses of radiation exposure. Although it is recommended that lead covers below the knee, no gown design did so in our centre. Despite significant differences between gown designs the overall doses recorded fell within currently accepted levels. However, the cumulative effect of these small variations would create significant differences over the working life of a surgeon. Where possible gown designs should be standardised, tailored to the individual and the position/procedure. Radiation safety training should be evolved to include these considerations for those working with fluoroscopy in theatre.

You must add details of your involvement in the research: Research idea, design, data collection, statistics and write up (Dr Nicholas Jones).

Assistance from Ms Andrea Gray (radiographer), Ms Shivani Parbhu (radiographer) and Mr Brett Cunningham (Physicist) with data collection and equipment.