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# REDUCTION OF OCCUPATIONAL RADIATION EXPOSURE IN PET FACILITIES THROUGH THE IMPLEMENTATION OF AUTOMATIC AND SEMI - AUTOMATIC RADIOPHARMACEUTICAL INJECTION SYSTEMS

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## Background and aims

Assess the **difference in personal dose**, both superficial $H_P(0.07)$ and deep $H_P(10)$, among workers exposed in PET due to the use of **Posijet and a semi-automatic injection system**, in comparison with the manual preparation and administration of $^{18}F$.

## Materials and Methods

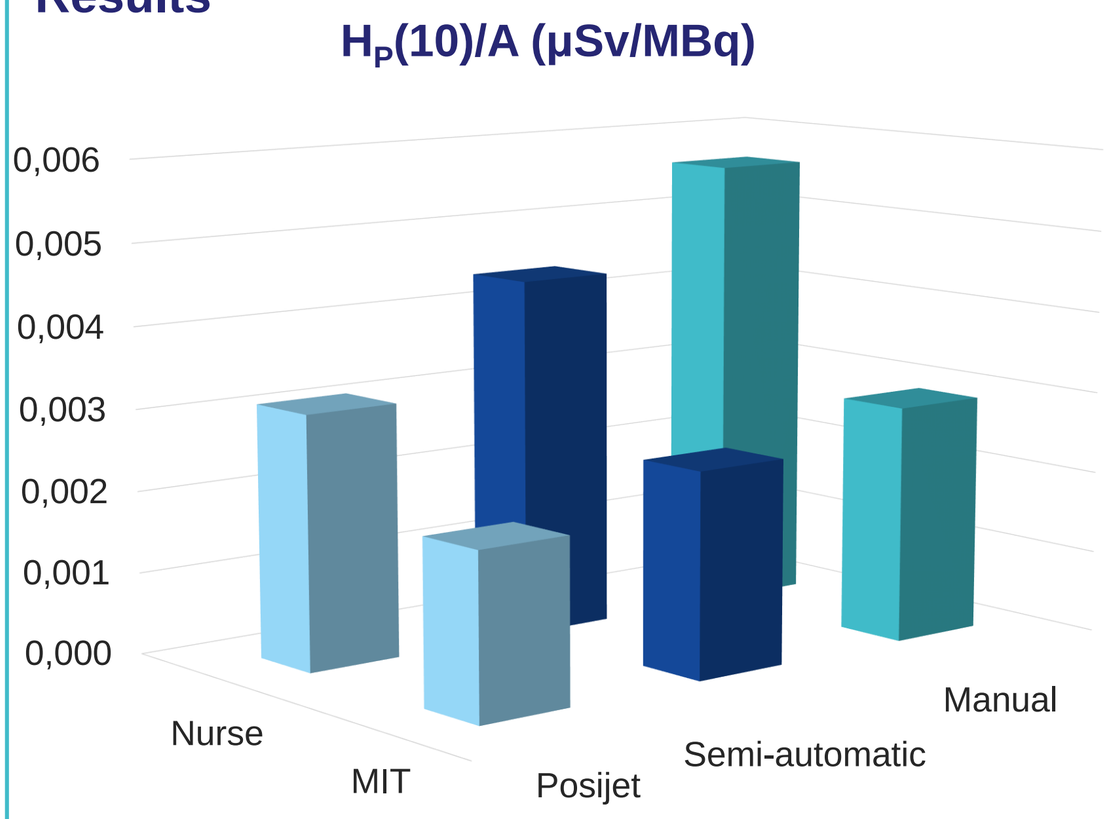
The study was conducted on **253 patients**, of whom 170 corresponded to the use of the automatic injector and 83 to a semi-automatic system. **Direct-reading dosimeters** ($H_P(10)$) and **ring dosimeters** ($H_P(0.07)$) were employed for both injection systems, with their readings normalized to the injected activity. These results were compared with values for manual preparation and administration reported in the literature [1, 2].

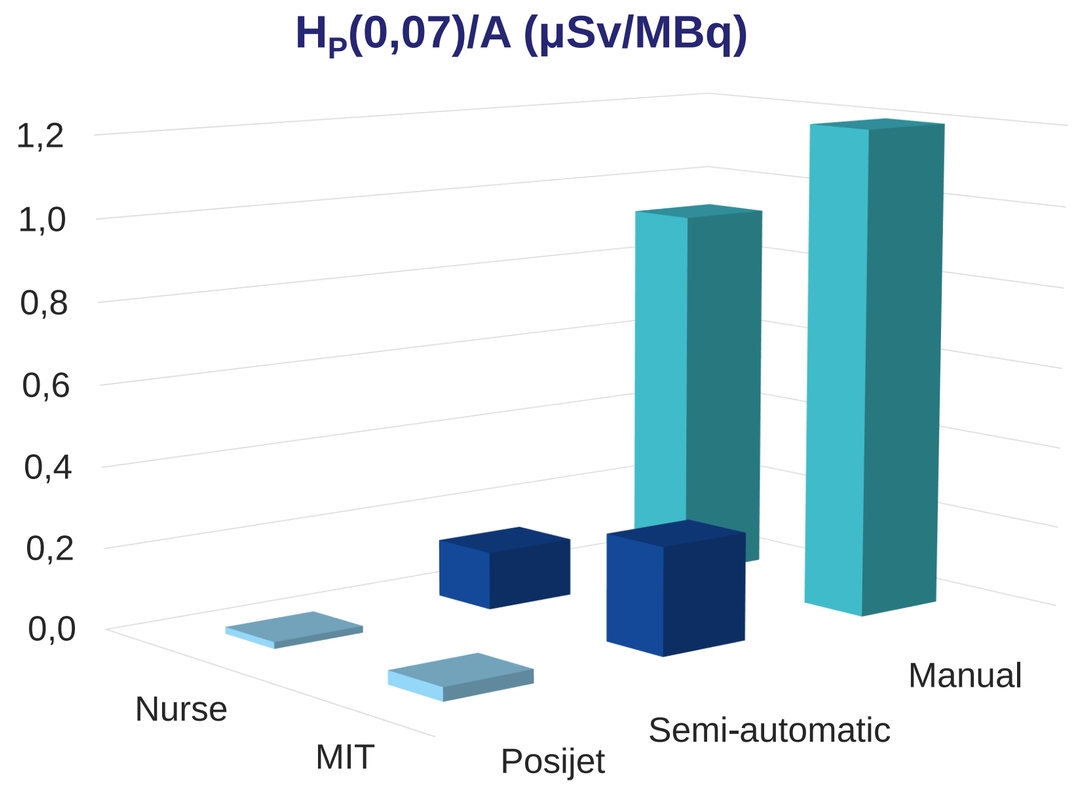


The **automatic** system used was **Posijet** (Lemer Pax, France), an autonomous device designed to measure and administer any radionuclide under very high radiological protection conditions. The medical imaging technologist (MIT) loads the vial of $^{18}F$ into the system and prepares the activity to be injected, while the nursing staff is responsible for the administration process.

The **semi-automatic** system consists of two main components: a preparation module located within a shielded hot cell with 50 mm of lead, in which, from the outside, the MIT prepares the desired activity and volume of $^{18}F$ through a manual control interface and a camera, in conjunction with a dual-channel syringe pump and 6 mm lead glass shielding.

## Results




Regarding the manual technique, Posijet lowers $H_P(10)/A$ by 44.4% for nursing staff and 31.2% for MIT, while $H_P(0.07)/A$ decreases by 98.2% and 97.2%, respectively. With the semi-automatic system, $H_P(10)/A$ is reduced by 21.3% in nursing staff and 15.6% in MIT, and $H_P(0.07)/A$ by 84.6% and 78.1%.

## Conclusions

**Posijet** significantly **reduces the radiation doses** received by exposed professionals, achieving a **reduction of over 95%** in **superficial dose** and approximately **50%** in **deep dose**, thereby optimizing radiological protection in PET facilities. Semi-automatic injection systems also decrease radiation exposure, although to a lesser extent. These systems reduce the risk of long-term adverse effects and are effective for different professional groups across various stages of the diagnostic procedure.

## References

[1] Peet DJ et al. Radiation protection in fixed PET/CT facilities: design and operation. Br J Radiol. 2012
[2] Carnicer A et al. Hand exposure in diagnostic nuclear medicine with $^{18}F$ and $^{99m}Tc$ - labelled radiopharmaceuticals: Results of the ORAMED project. Radiat Meas. 2011.