



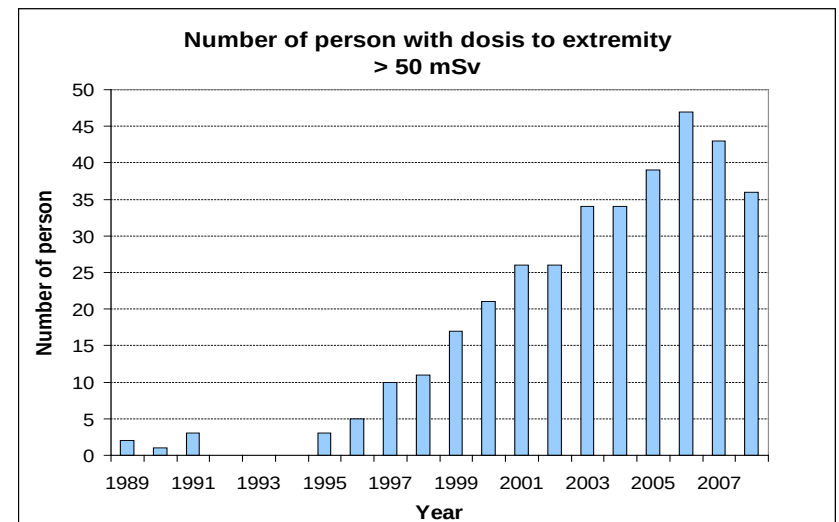
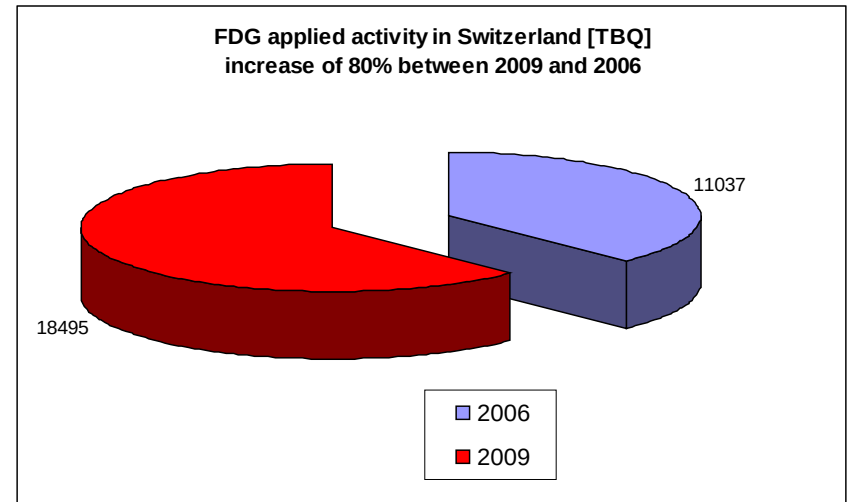
Measures taken by the authority to reduce extremity doses in nuclear medicine facilities in Switzerland

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Use of radiopharmaceuticals in Switzerland

- Development of new therapeutic applications with **beta-emitters** and other nuclides (Y-90, Lu-177, Sm-153, Re-186)
- Spread and increase of **F-18** PET/CT-examinations (5 PET in 2000, 20 PET-CT in 2010)
- Continuous increase of extremity doses of medical staff
- Start of **optimization program** by the SFOPH (70 nuclear medicine centers)



Audit of the SFOPH

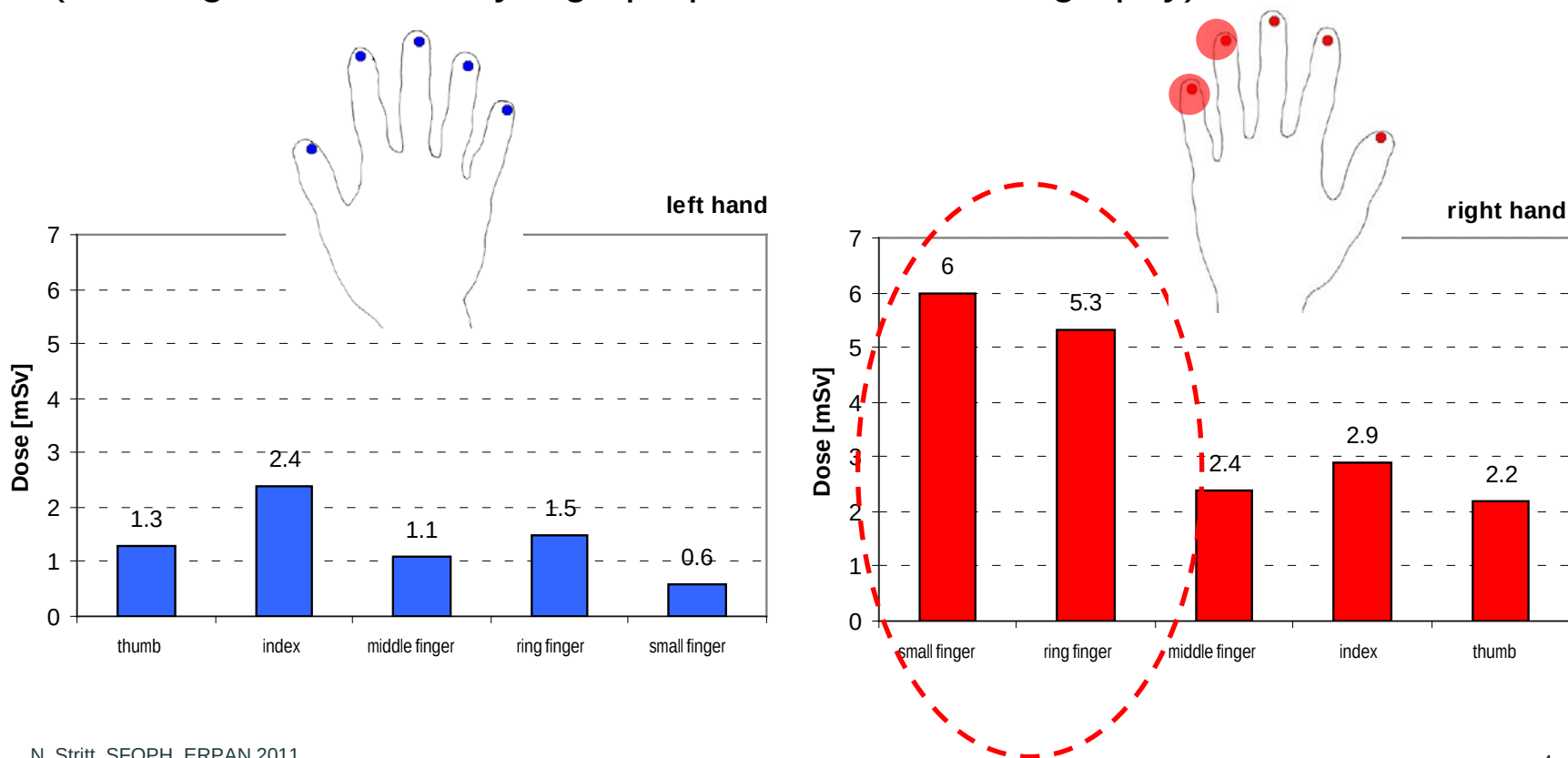
In order to clarify which manipulations lead to high hand doses, audit were performed in nuclear medicine

- Provide fingers tips dosimeter and measurements were made for Zevalin (Y-90) and FDG (F-18)
- Video of the manipulation in order to discuss with the RPO
- Training purposes for medical staff
- Optimisation purposes



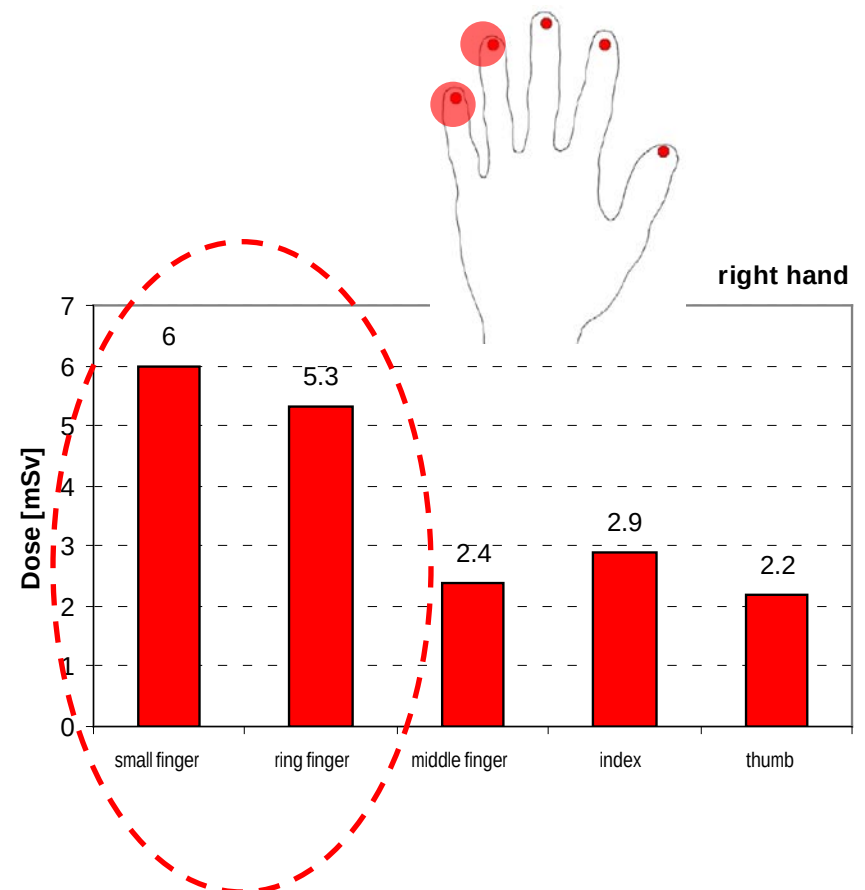
Measurements of finger tips doses with Zevalin, labelling

- Zevalin beta emitters used for therapy: Y-90
- Preparation of an activity: 300 MBq from a vial containing 2 GBq
- Duration: 45 minutes
(labelling, calibration, syringe preparation, chromatography)



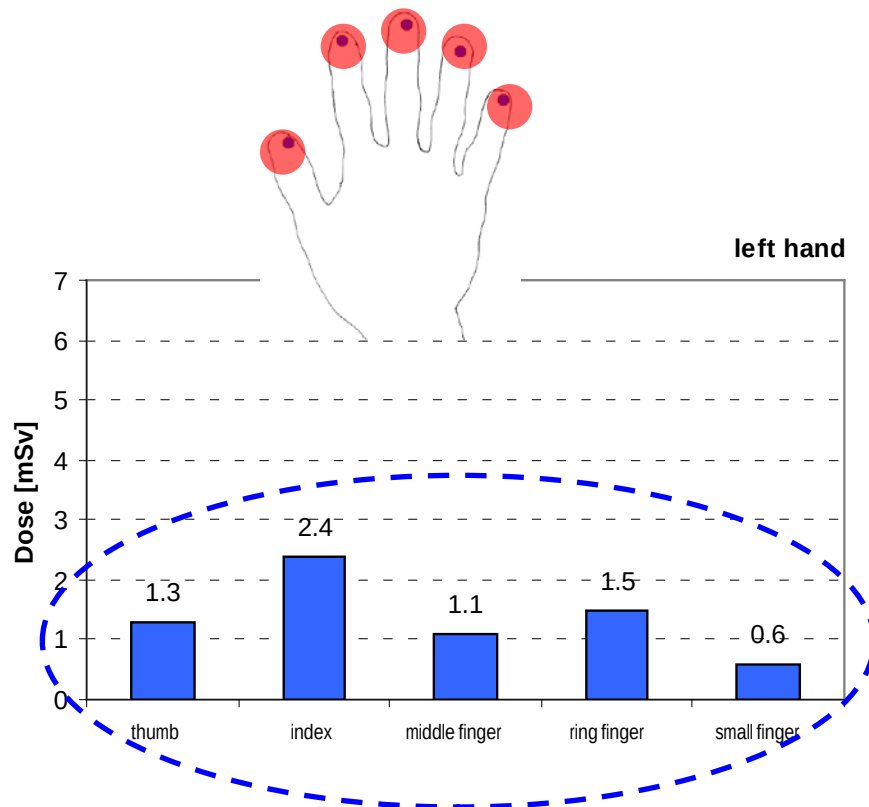
Measurements of finger tips doses with Zevalin, labelling

- Right hand holding the vial
- Holding of the vial, small finger and ring finger in close contact with the activity



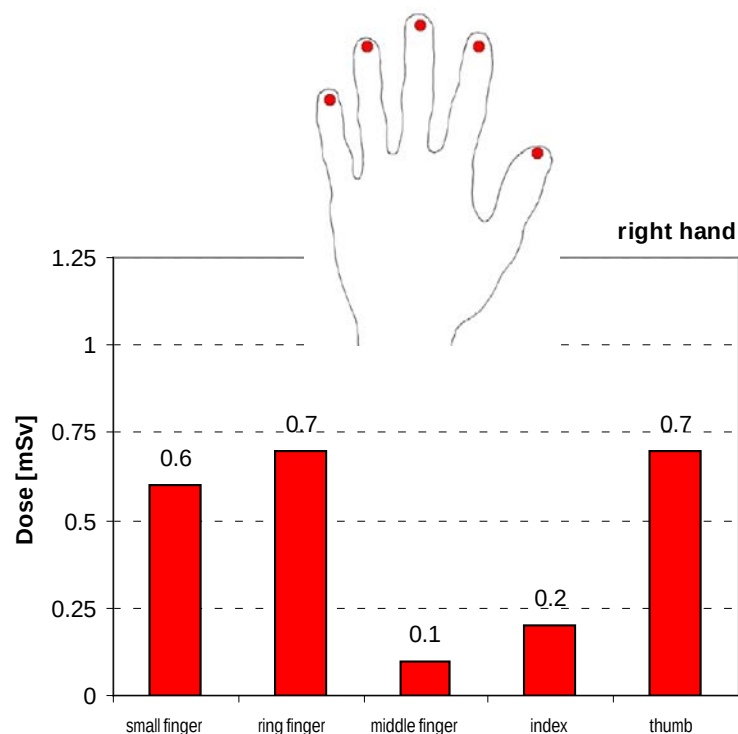
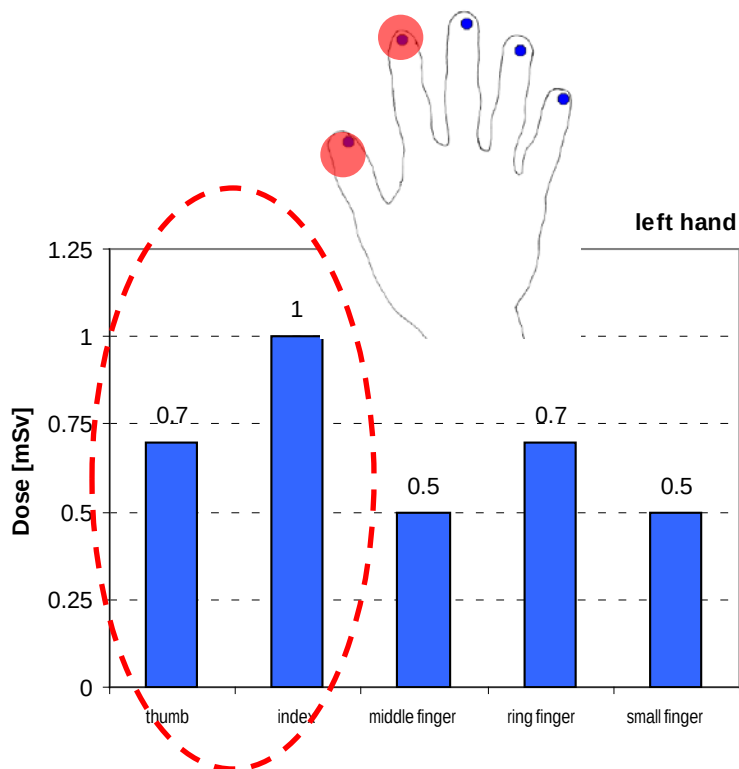
Measurements of finger tips doses with Zevalin, labelling

- Left hand holding the syringe
- No Plexiglas shielding on the syringe



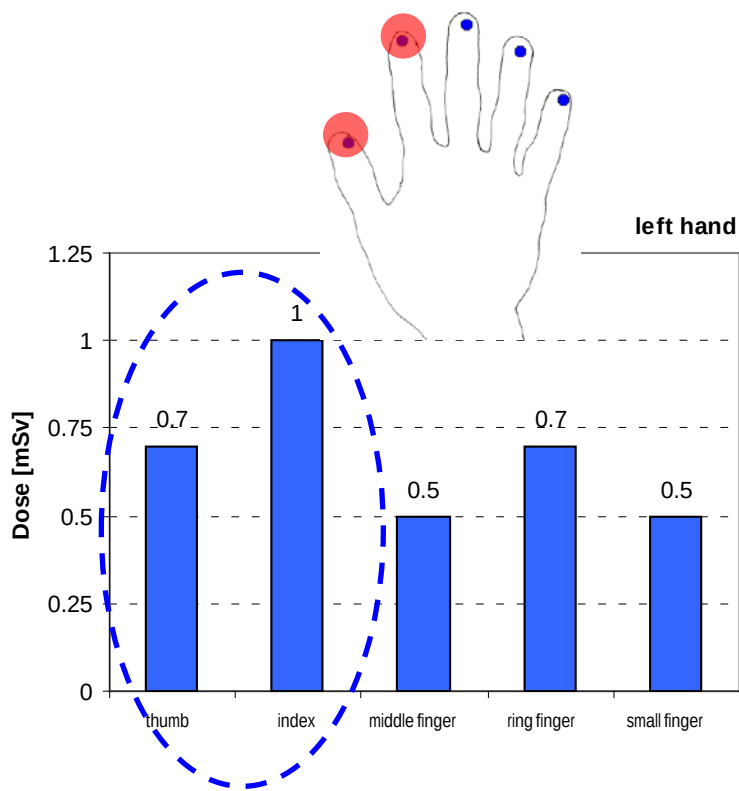
Measurements of finger tips doses with Zevalin, application

- Injection to patient
- Activity: 300 MBq
- Application time: 10 minutes



Measurements of finger tips doses with Zevalin, application

- Left hand holding the 3 way stopcock
- Thumb and index exposed

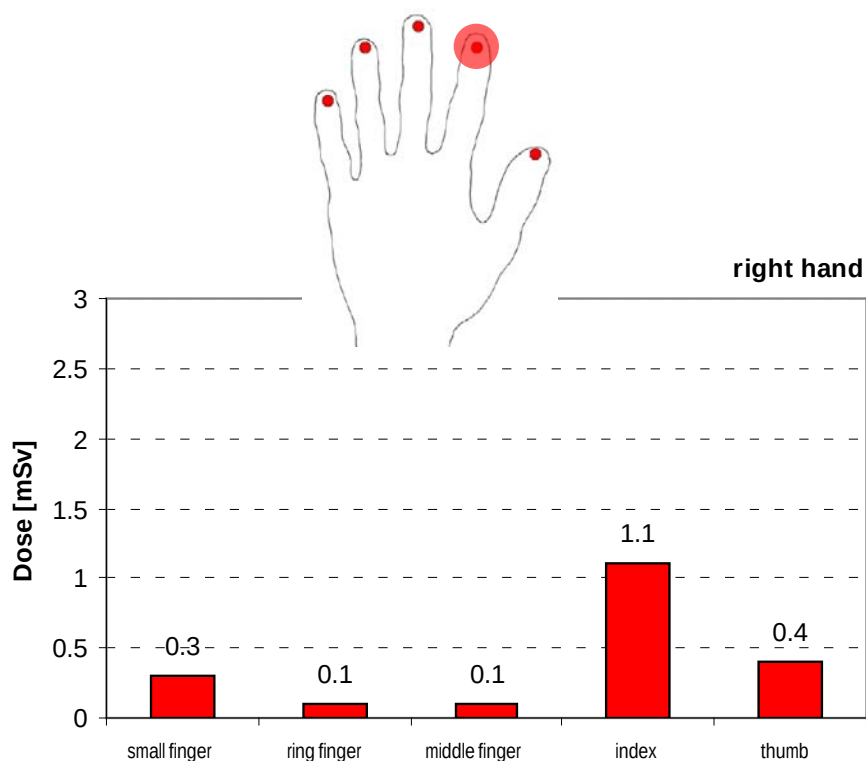
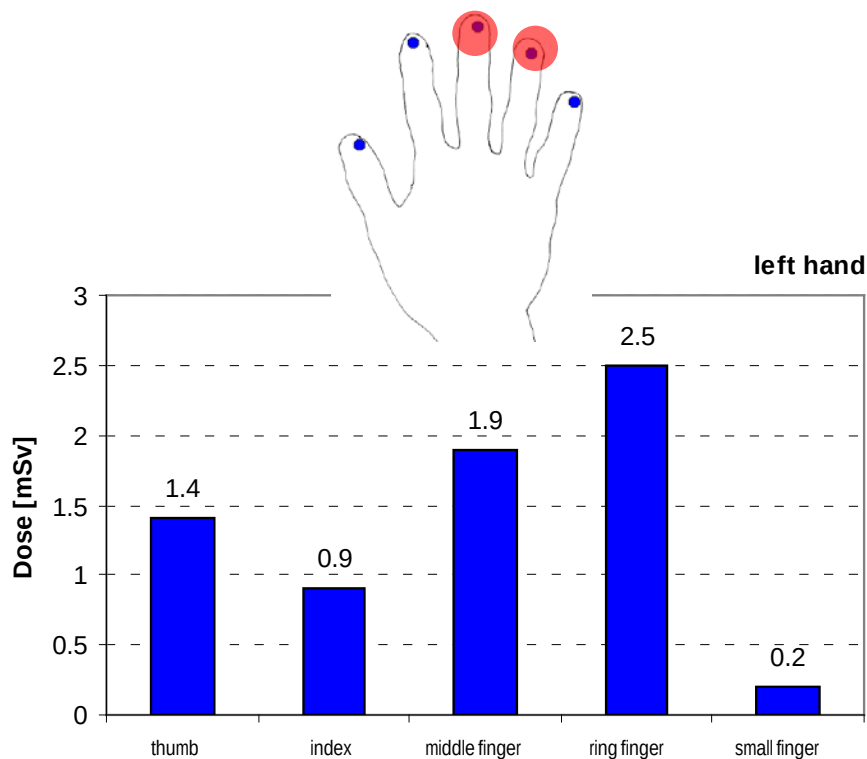


N. Stritt, SFOPH, ERPAN 2011



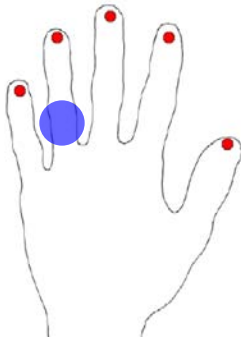
Measurements of finger tips doses with FDG, preparation

- FDG (F-18) preparation of 4 doses, 370 MBq from a vial containing 25 GBq
- Duration: 3 minutes per preparation (calibration, syringe preparation)

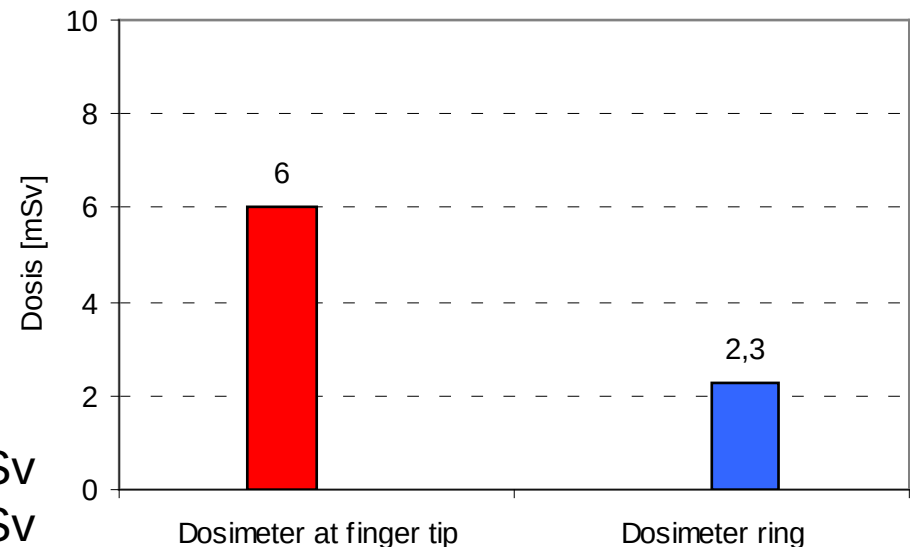




Comparison finger tips and normal ring dosimeter, Y-90, labelling



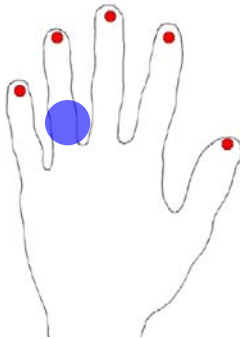
- Extremity dose per month
- Maximal measurement at finger tip:
 - Measurement for 1 patient: 6.0 mSv
 - 1 Patient per month (norm): 6.0 mSv
- Measurement official ring dosimeter
 - Measure during one month: 2.3 mSv
 - Many other manipulations are made during the month



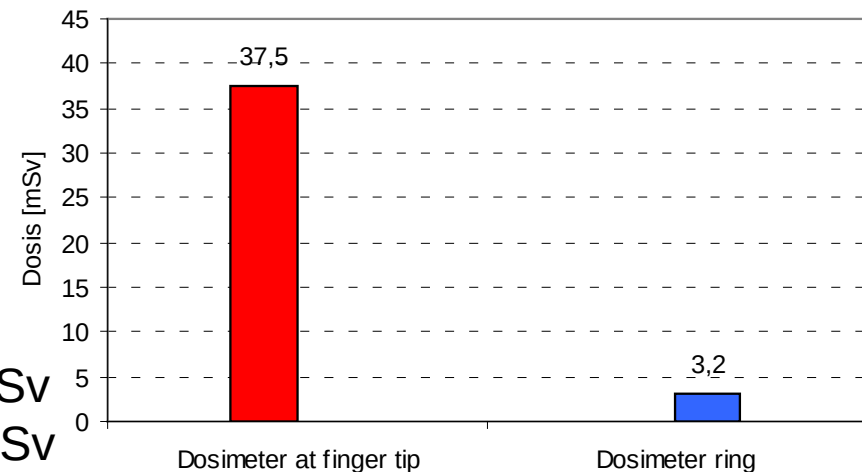
Ratio of the measurement
max Finger tip / ring finger: **2.5**

■ **Underestimation of the dose**

Comparison finger tips and official ring dosimeter, F-18, preparation



- Extremity dose per month
- Maximal measurement at finger tip:
 - 4 patients, max. index finger: 2.5 mSv
 - 60 patients per month (norm): 37.5 mSv
- Measurement official ring dosimeter
 - Measure during one month: 3.2 mSv
 - Many other manipulations are made during the month



- Ratio of measurement
max finger tip / ring finger: **10**
- **Underestimation of the dose**

Results from the audit

- When working with beta-emitters, Plexiglas shielding as well as tongs should be used
- Manipulation of a few seconds of the therapeutic activity can lead to an extremity dose of several mSv



Results from the audits

- The dose rate to hands can be reduced by a factor 1000 by using the appropriate tools with beta (shielding, tongues, etc)
- Contrary to widely spread opinion, the time factor does not play a major role when suitable shielding is used

Without shielding

with shielding



Results from the audits

With a high patient turnover, and the corresponding increased quantities of radiopharmaceuticals, some manipulations should be automated



Measure taken by the regulatory body after audit/measurements

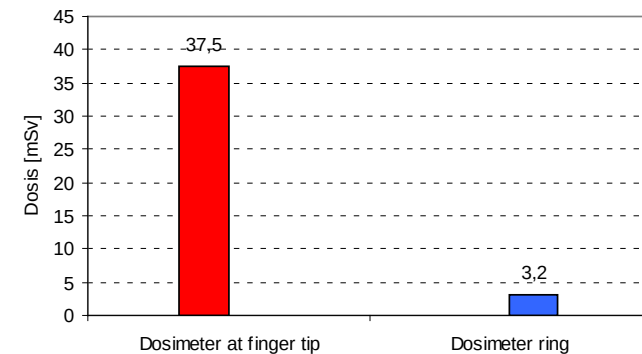
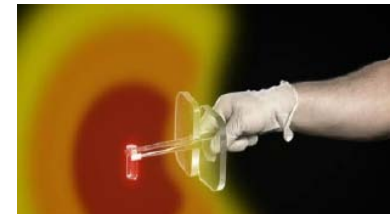
Publication information tools such as:

- Guideline with recommendations on how to reduce extremity doses
- Information DVD was produced with example of good practice and suggestions to reduce the extremity doses
- Distribution to all nuclear medicine departments



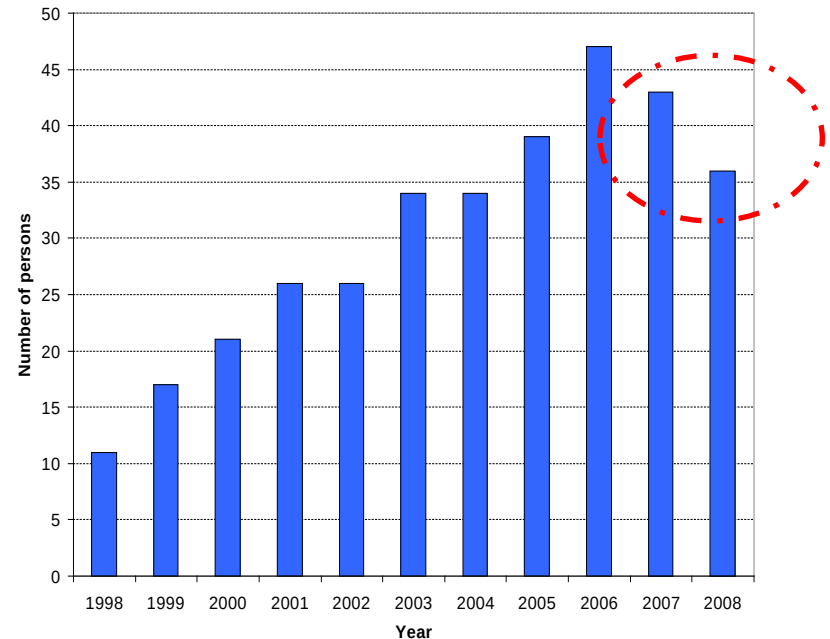
Conclusion

- Increase of extremity doses in Switzerland
- Measures taken by the authority:
 - Audit in the nuclear medicine department
 - Training (DVD, etc)
 - Measurement of finger tips doses
 - Video and optimisation discussion with RPO about
 - Use of appropriate shielding
 - Use of appropriate automatic device
 - Optimisation possible on all steps (labelling, calibration, chromatography, injection, etc.)
 - Underestimation of the finger dose
 - Further optimisation needed



Conclusion (2)

- Audit, training and awareness of the danger and risk by the medical staff lead to a decrease of the extremity dose since 2007 (start of the audit)
- Decrease of the number of persons
 - 30% with a yearly dose $> 50\text{mSv}$
- Increase of PET-CT, etc and therapeutic application with beta and alpha
- Further follow up and action from regulatory body are needed to reduce this trend in extremity dose of medical staff
- ORAMED (Workshop Barcelona 2011) recommendations will be published soon





Schweizerische Eidgenossenschaft
Confédération suisse
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Federal Department of Home Affairs FDHA
Federal Office of Public Health FOPH
Consumer Protection Directorate

Thank you for your attention



Bern, Switzerland