



Development, validation and test of a skin sampling method for assessment of metal exposure


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Many times, every day, throughout life



Metal skin exposure



Daily, short, frequent  Continuous, "low-dose" skin exposure
???

Sensitization, elicitation, depot-formation, skin penetration

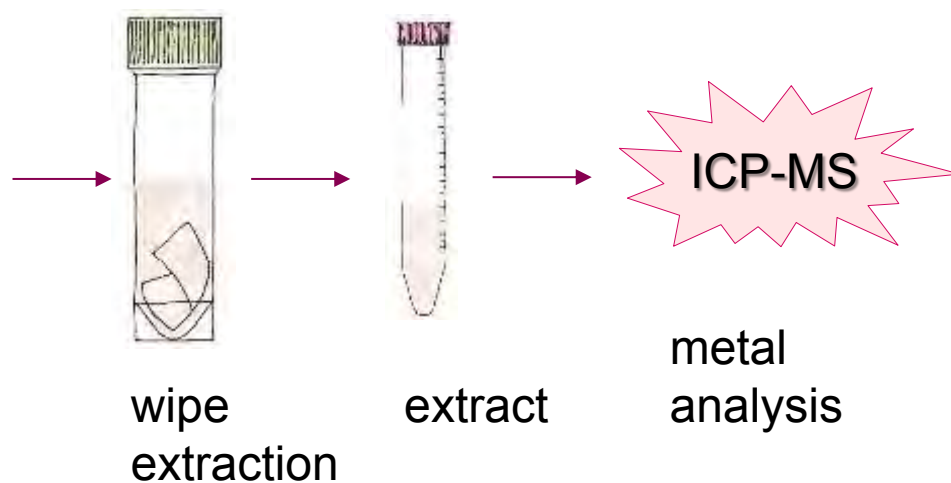
We wanted an approach to learn more about metals on skin

What is normal?

Which metals are there?

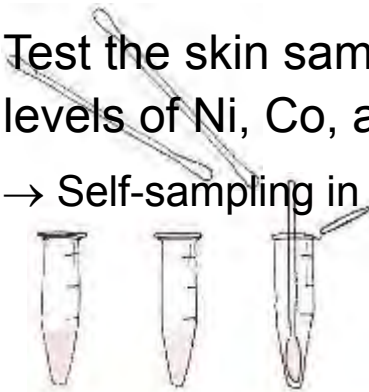
Quantification of metal skin dose

- Acid wipe sampling
 - high recovery of metals
 - sampling by operator on defined skin area
 - contamination is minimised



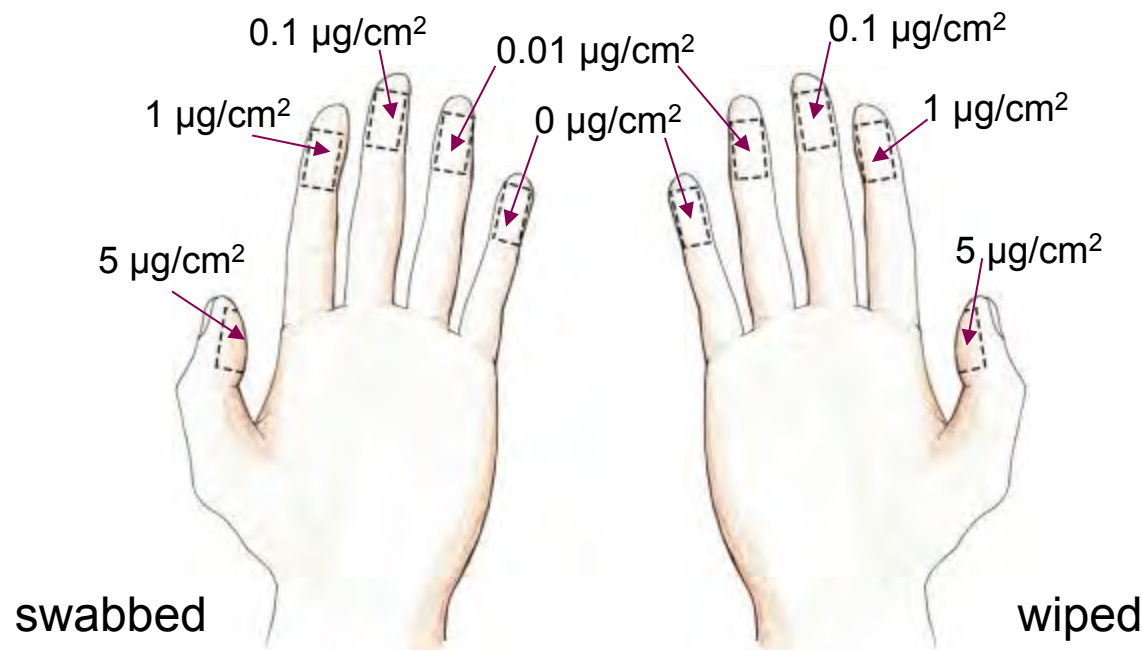
Aim of study

- Modify acid wipe sampling into a practical, self-sampling method
 - Skin sampling by one single swab
- Compare efficiency (recovery) of sampling by swab with wipe sampling
 - Laboratory study with 5 volunteers
- Test the skin sampling by swab in volunteers to quantify snapshot levels of Ni, Co, and Cr on skin (leisure activity)
 - Self-sampling in 17 volunteers



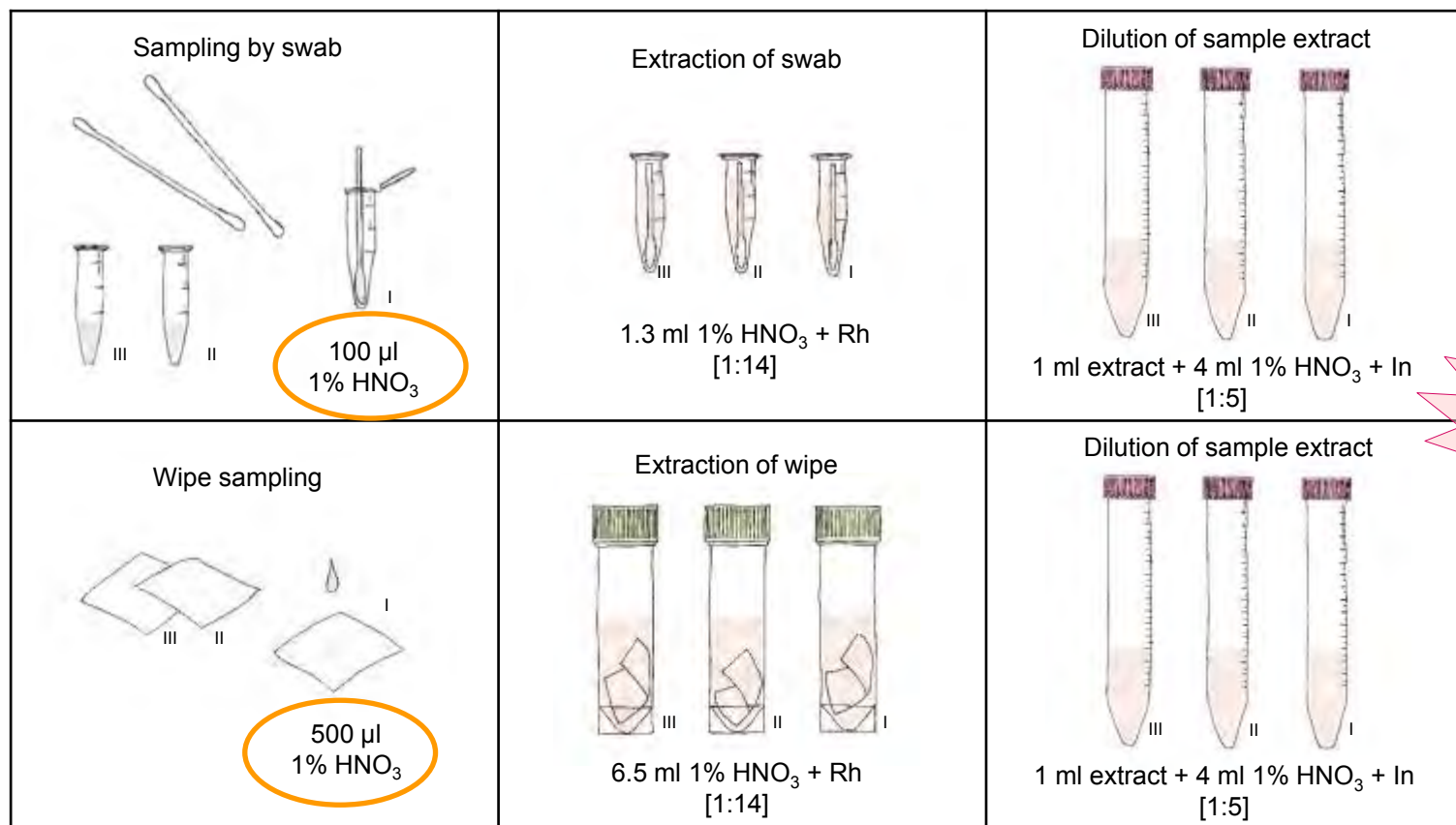
Lab study: Recovery of skin sampling by swab / wipe sampling

- Test of recovery for the two methods in parallel tests
- Skin dose range 0-5 $\mu\text{g}/\text{cm}^2$ Ni, Co, Cr



Lab study:

Experimental steps



ICP-MS

Lab study:

Average recovery of skin dose (n=5) I+II+III

| Metal applied on skin ^a ($\mu\text{g}/2\text{cm}^2$) | Recovery of Ni % (Mean \pm SD) | | Recovery of Co % (Mean \pm SD) | | Recovery of Cr % (Mean \pm SD) | |
|---|-------------------------------------|-------------------------|-------------------------------------|-------------------------|-------------------------------------|-------------------------|
| | Wipe | Swab | Wipe | Swab | Wipe | Swab |
| 5 | 87 \pm 11 | 54 \pm 3 ^b | 85 \pm 11 | 54 \pm 3 ^b | 85 \pm 12 | 53 \pm 4 ^b |
| 1 | 101 \pm 10 | 45 \pm 12 | 98 \pm 9 | 44 \pm 11 | 98 \pm 10 | 40 \pm 11 |
| 0.1 | 98 \pm 11 | 44 \pm 3 | 101 \pm 8 | 44 \pm 3 | 100 \pm 13 | 40 \pm 3 |
| 0.01 | 64 \pm 37 | 46 \pm 10 | 102 \pm 8 | 46 \pm 6 | 98 \pm 34 | 44 \pm 5 |

^a Results from control areas (little fingers dosed with vehicle) were used for background correction.

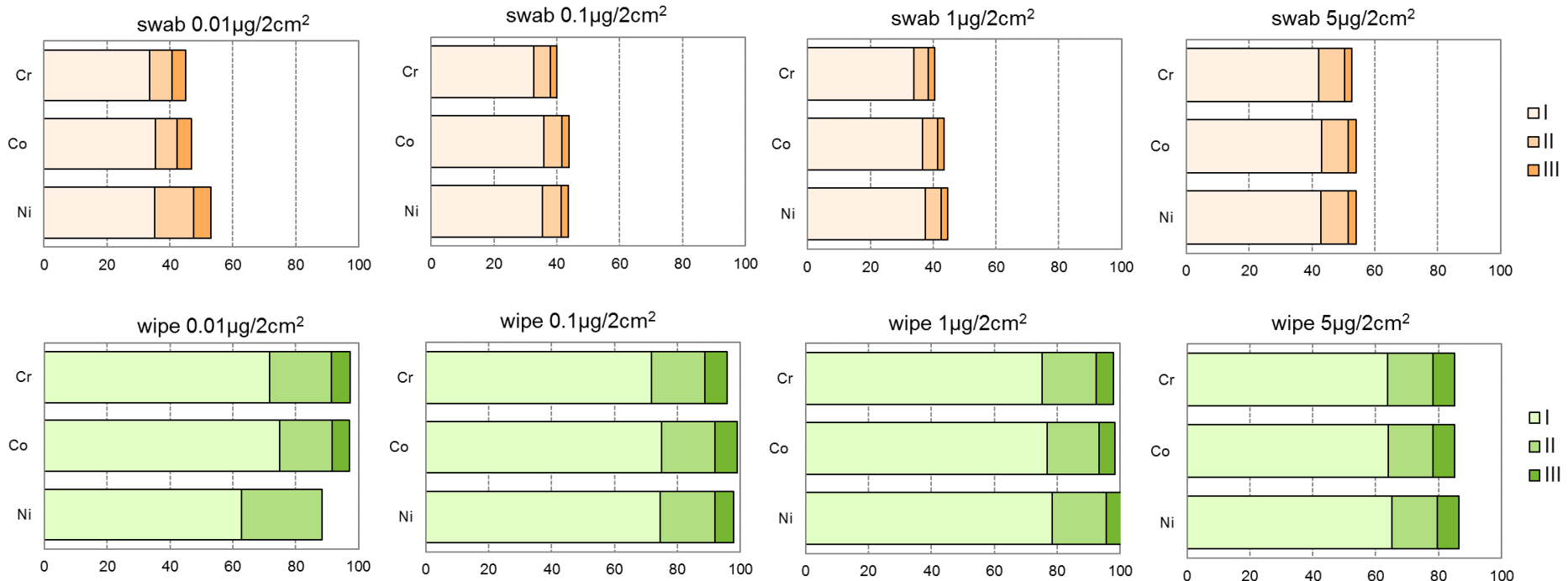
^b n=4

Swab recovery = 40-54 %

Wipe recovery = 85-102 % (one exception)

Lab study:

Average recovery of skin dose (n=5) I, II, III



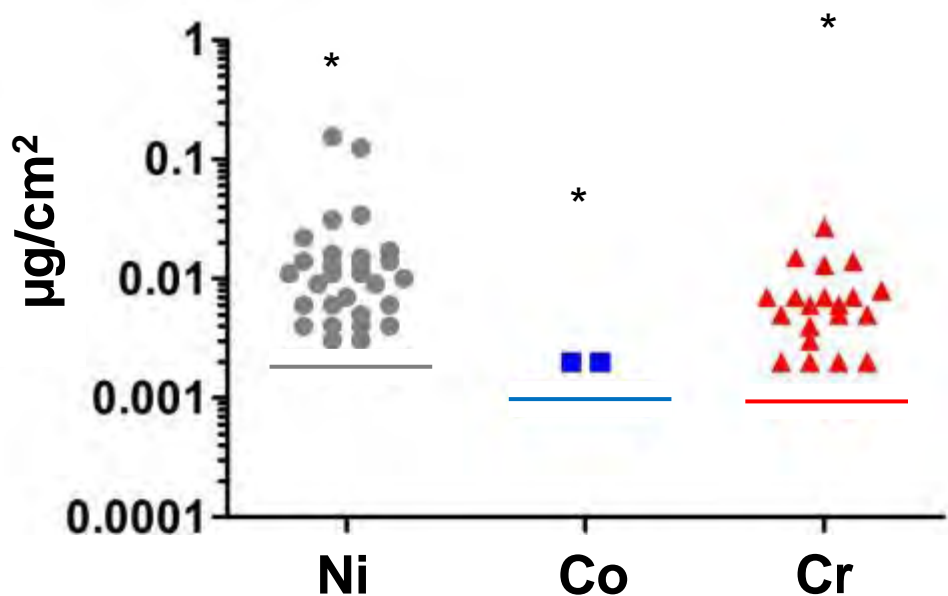
1st tops recovery \approx 33-43%

1st wipe recovery \approx 63-79%

Self-sampling in 17 volunteers

- Sampling kit
- Written and illustrated instruction
 - Wash hands with water+soap
 - Do whatever leisure activity you like for 2 hours (no hand wash)
 - Sample approximately 2cm² on non-dominant index fingertip and thumb
 - Note leisure activities

Skin doses measured by swab n=17, 2h leisure activity



ED₁₀ = 0.78 Ni/cm²
ED₁₀ = 0.0663 Co/cm²
ED₁₀ = 1.04 Cr/cm²

All had detectable metal on skin

Comparison of skin dose, one example

| Activity | Ni [$\mu\text{g}/\text{cm}^2$] | Co [$\mu\text{g}/\text{cm}^2$] | Cr [$\mu\text{g}/\text{cm}^2$] |
|--|----------------------------------|----------------------------------|----------------------------------|
| Grocery shopping (2h) <i>measured</i> | 0.012 | 0.002 | 0.007 |
| Grocery shopping (2h) <i>adjusted</i> | 0.031 | 0.004 | 0.019 |
| Secretary (1h, both hands) | 0.018 | 0.002 | 0.001 |
| Cashier (1h, both hands) | 0.200 | 0.003 | 0.002 |

Conclusion (Pros and Cons)



- Method may be used to measure snapshot levels (population, workers)
- Monitor skin dose "dynamics"
- Follow-up skin exposure in allergic patients



- "clean skin" at start of sampling period not granted but careful washing hands is proven to be pretty ok (preliminary data)
- Requires sample preparation and chemical analysis in laboratory



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THANKS!