

# Infection Control in Practice: A Scientific Perspective on Hand Hygiene

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- 7% of hospital patients acquire healthcare-associated infection
- 4.3 million people each year in the EU
- At least half of these infections are preventable
- Proper hand hygiene is the most effective, simplest, and most cost-efficient intervention
- Ignaz Semmelweis, 1847



Ignaz Semmelweis



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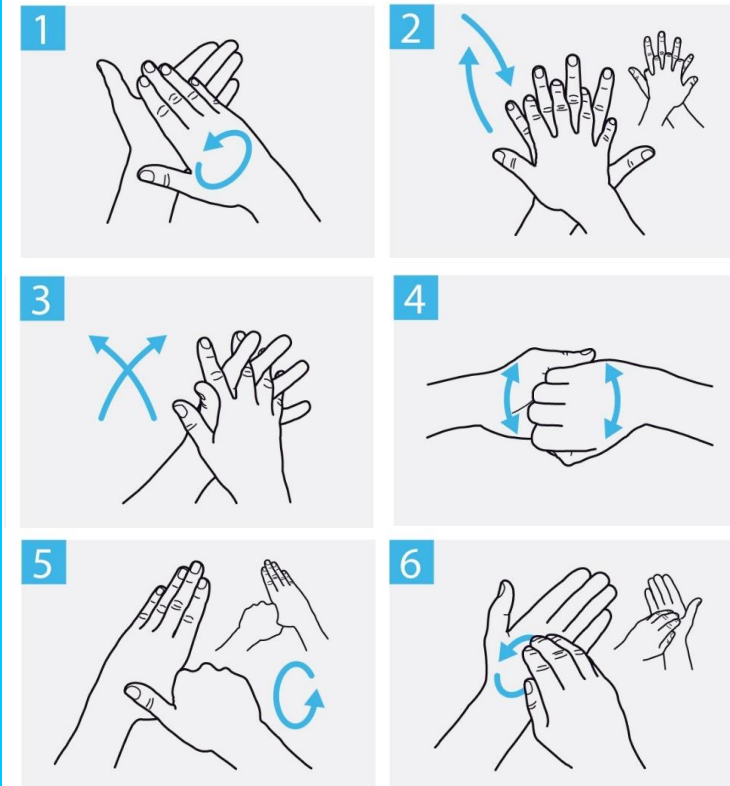


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Proper hand hygiene effectively reduces the number of germs on the hands.





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Handrubbing is only effective if the **entire hand surface** is covered with an **adequate volume** of ABHR





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## Real World Data: Hand coverage of healthcare workers (HCW)

**5,200 HCW**

**28% failed**

**Singapore**

right after  
a hand hygiene training

Szilagyi et al.: A large-scale assessment of hand hygiene quality and the effectiveness of the "WHO 6-steps" BMC Infect Dis. 2013 May 30;13:249. doi: 10.1186/1471-2334-13-249.

**986 HCW**

**27% failed**

**UK, NHS hospitals**

during hand hygiene demo

Bansaghi et al: Measuring incomplete hand hygiene technique in NHS hospitals. IPS Infection Prevention 11th Annual Conference, 2018, Glasgow, UK.

**1,269 HCW**

**33% failed**

**Hungary**

right after  
a hand hygiene training

Lehotsky et al.: [Hand hygiene technique assessment using electronic equipment in 26 Hungarian healthcare institutions] 2017 Jul;158(29):1143-1148. doi: 10.1556/650.2017.30792.

# ADEQUATE HANDRUB VOLUME

World Health Organization (WHO):

- 'a palmful of the product'
- duration of the process: 20-30 seconds

U.S. Centers for Disease Control and Prevention (CDC)

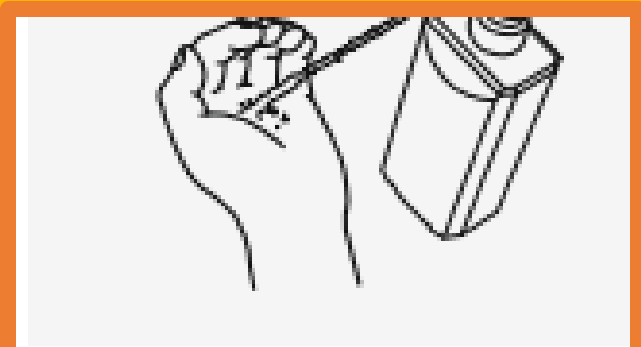
- the entire hand surface should be covered
- keep the hands wet for at least 15–20 seconds
- 'read the label to learn the correct amount'

Two most common test methods: European Norm EN 1500, North American standard ASTM E1174

- 2 x 3 ml product

ISO 23447:2023: Hand Hygiene Performance

- at least 1.5 ml (cover the entire hand surface)



Apply a palmful of the product in a

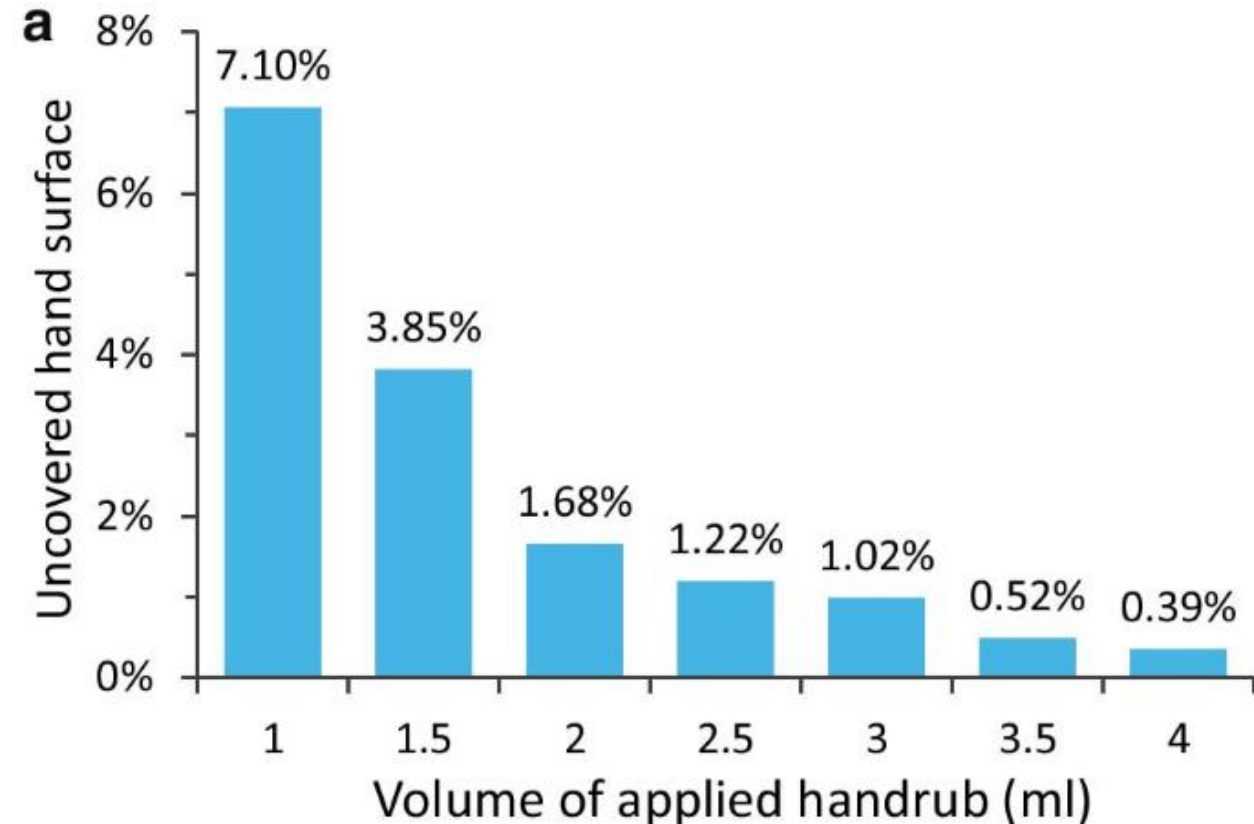
## How to handrub?

RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED

⌚ Duration of the entire procedure: 20-30 seconds



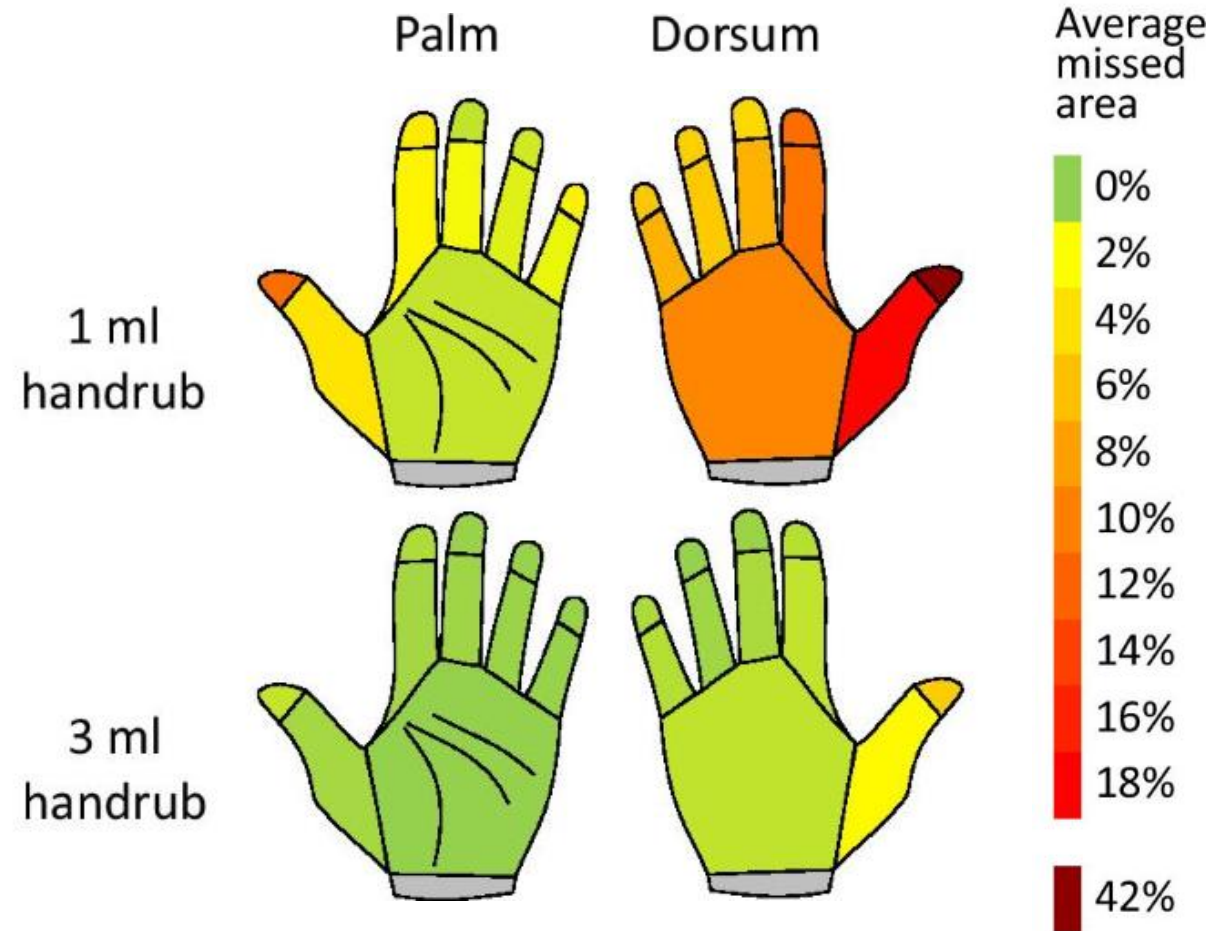
# EFFECT OF HANDRUB VOLUME ON COVERAGE



Reference: Voniatis et al. (2021) A large-scale investigation of alcohol-based handrub (ABHR) volume: hand coverage correlations utilizing an innovative quantitative evaluation system. *Antimicrob Resist Infect Control*, 10: 49.

Volume of ABHR used  
(Electronic sensing system)  
28 M hand hygiene events:  
86% used a single dose,  
(even 0.75 ml)

Reference: Kenters et al. (2020) Product dose considerations for real-world hand sanitiser efficacy. *Am J Infect Control*, 48: 503-506.

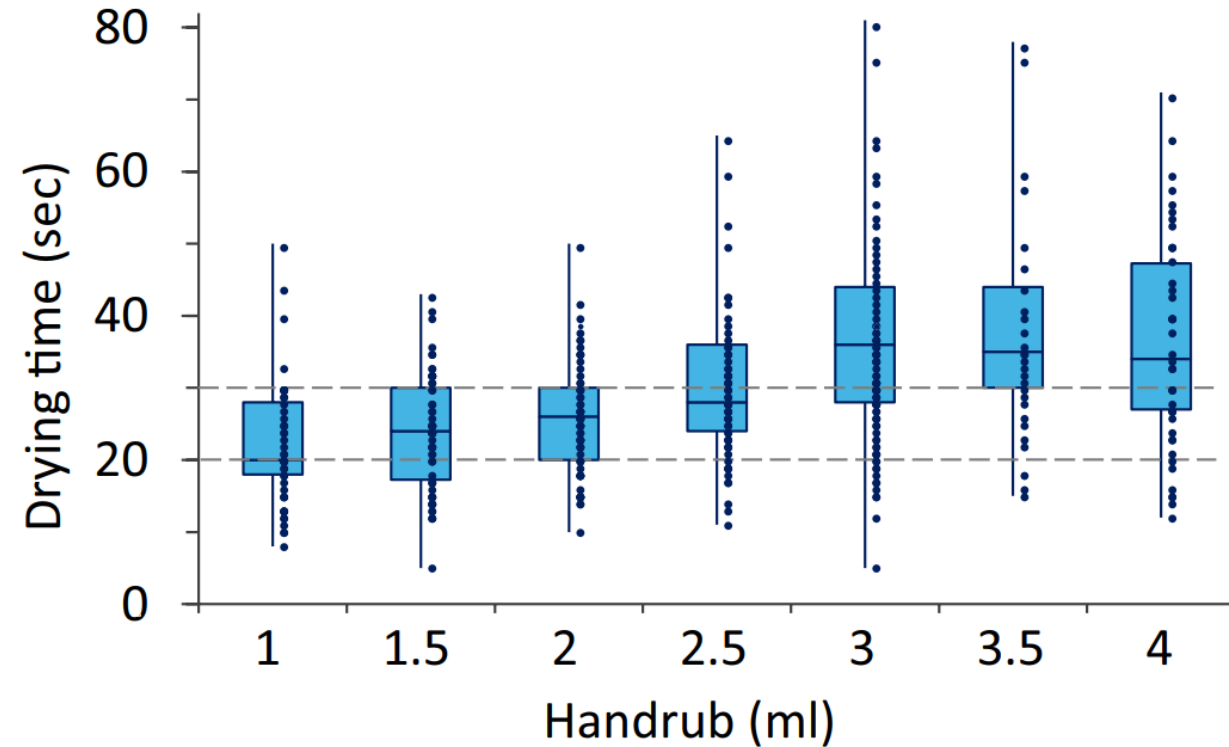


Reference: Voniatis et al. (2021) A large-scale investigation of alcohol-based handrub (ABHR) volume: hand coverage correlations utilizing an innovative quantitative evaluation system. *Antimicrob Resist Infect Control*, 10: 49.

# DRYING TIME

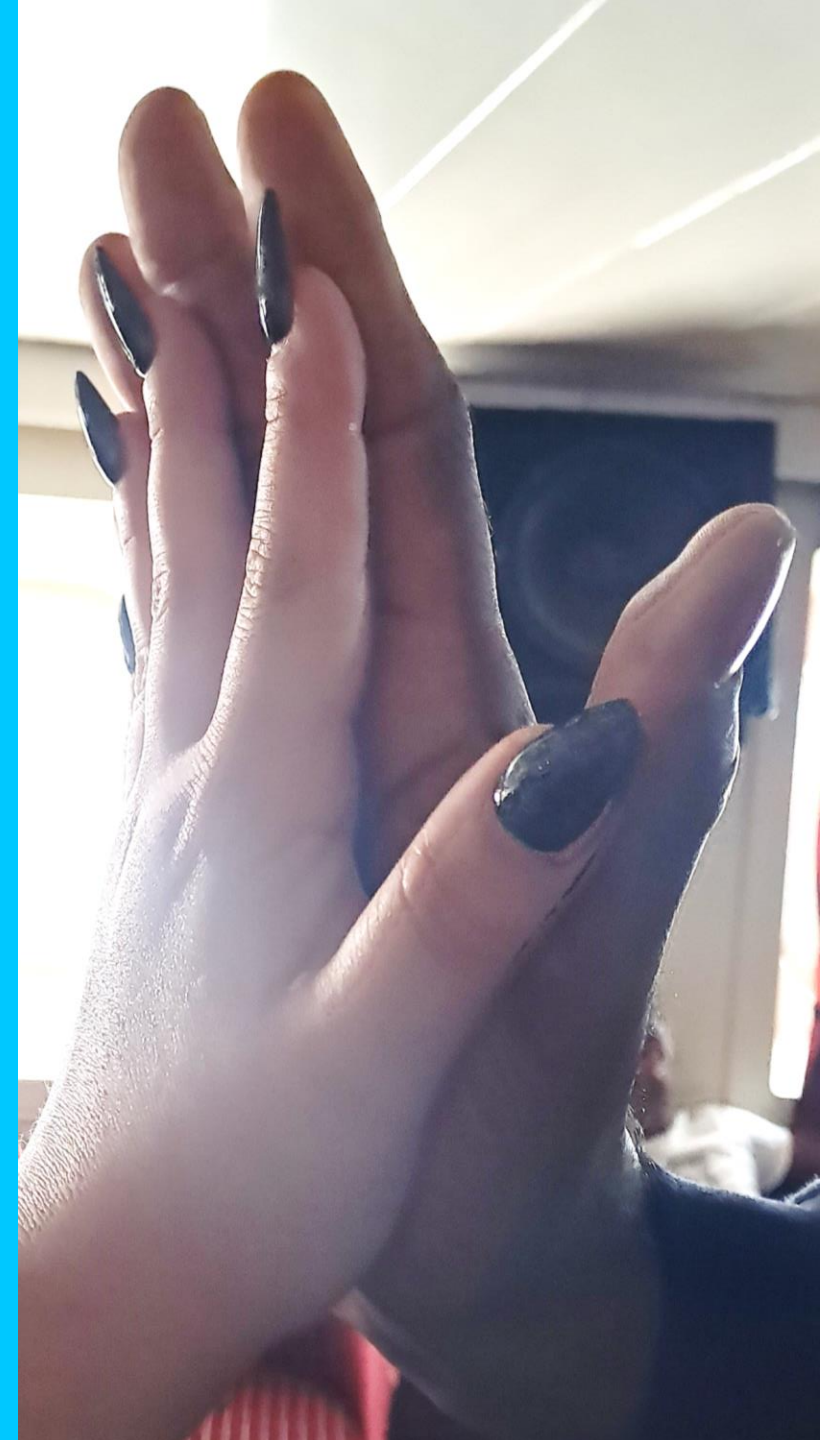
WHO: 20-30 seconds

CDC: 15–20 seconds



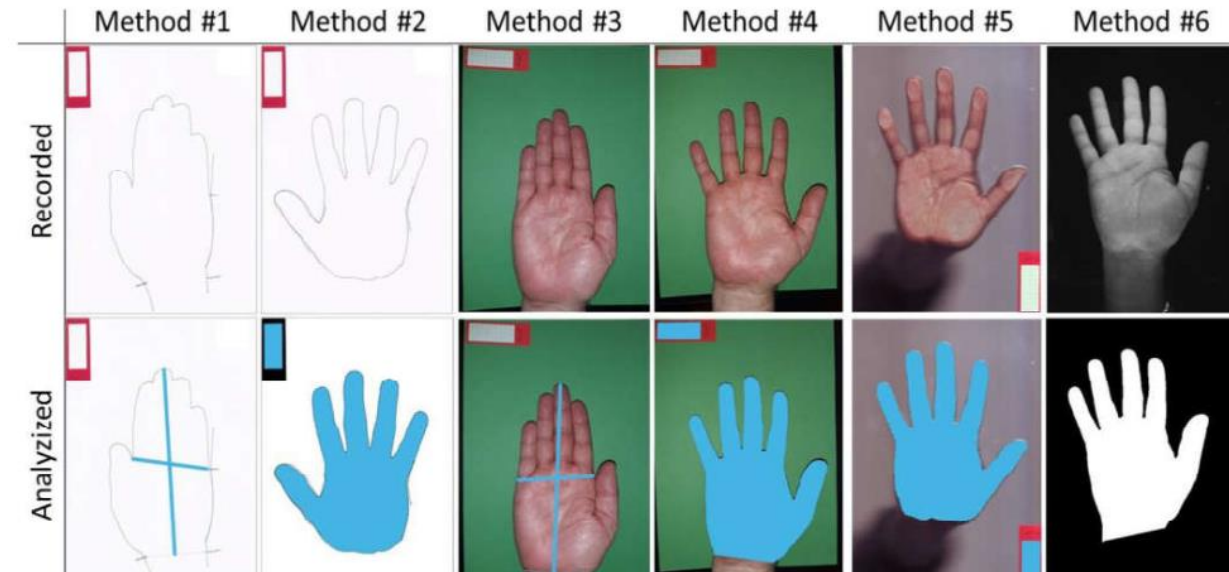
Reference: Voniatis et al. (2021) A large-scale investigation of alcohol-based handrub (ABHR) volume: hand coverage correlations utilizing an innovative quantitative evaluation system. *Antimicrob Resist Infect Control*, 10: 49.

A personalized,  
hand size-  
dependent  
handrub volume  
provides a feasible  
solution



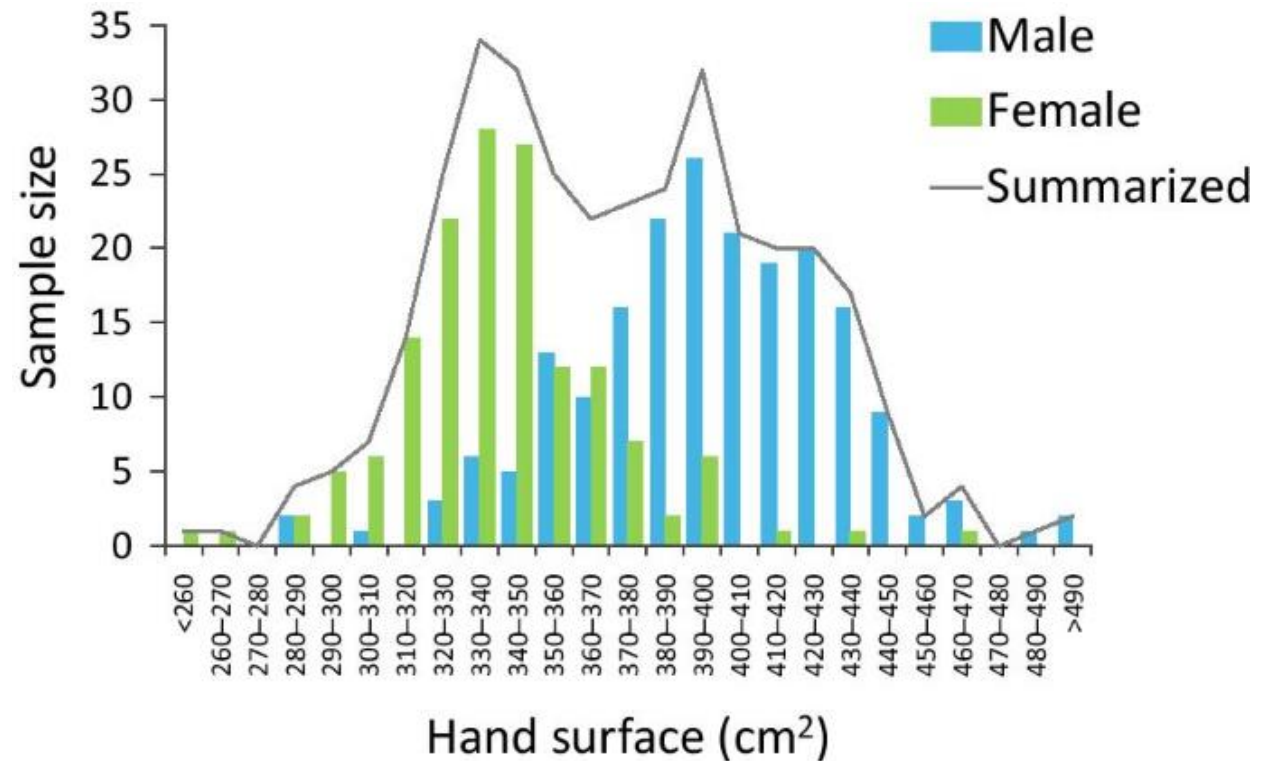
# HOW TO MEASURE

## Automated Area Assessment method



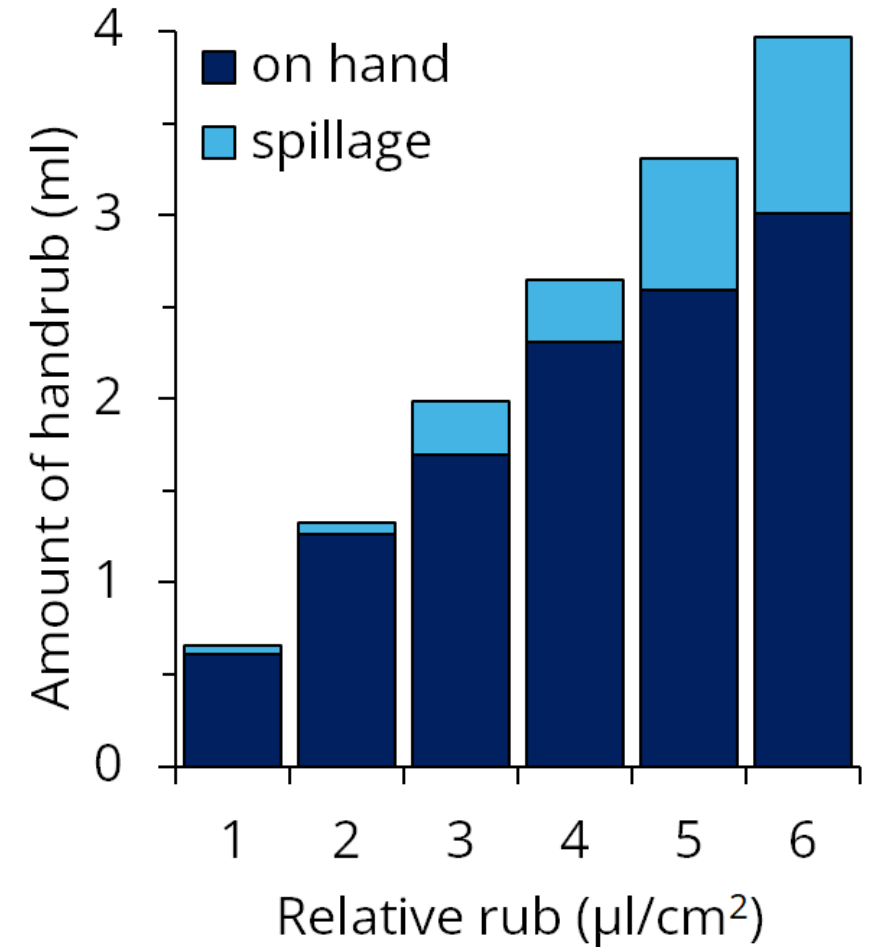
Reference: Bansaghi Sz, Haidegger T. (2020) Towards objective hand size assessment and a standardized measurement technique. In: Szakál A (ed.) 20th IEEE International Symposium on Computational Intelligence and Informatics Proceedings (CINTI 2020). Budapest, Hungary: IEEE Hungary Section, pp. 139-144.

# DISTRIBUTION OF HAND SURFACES



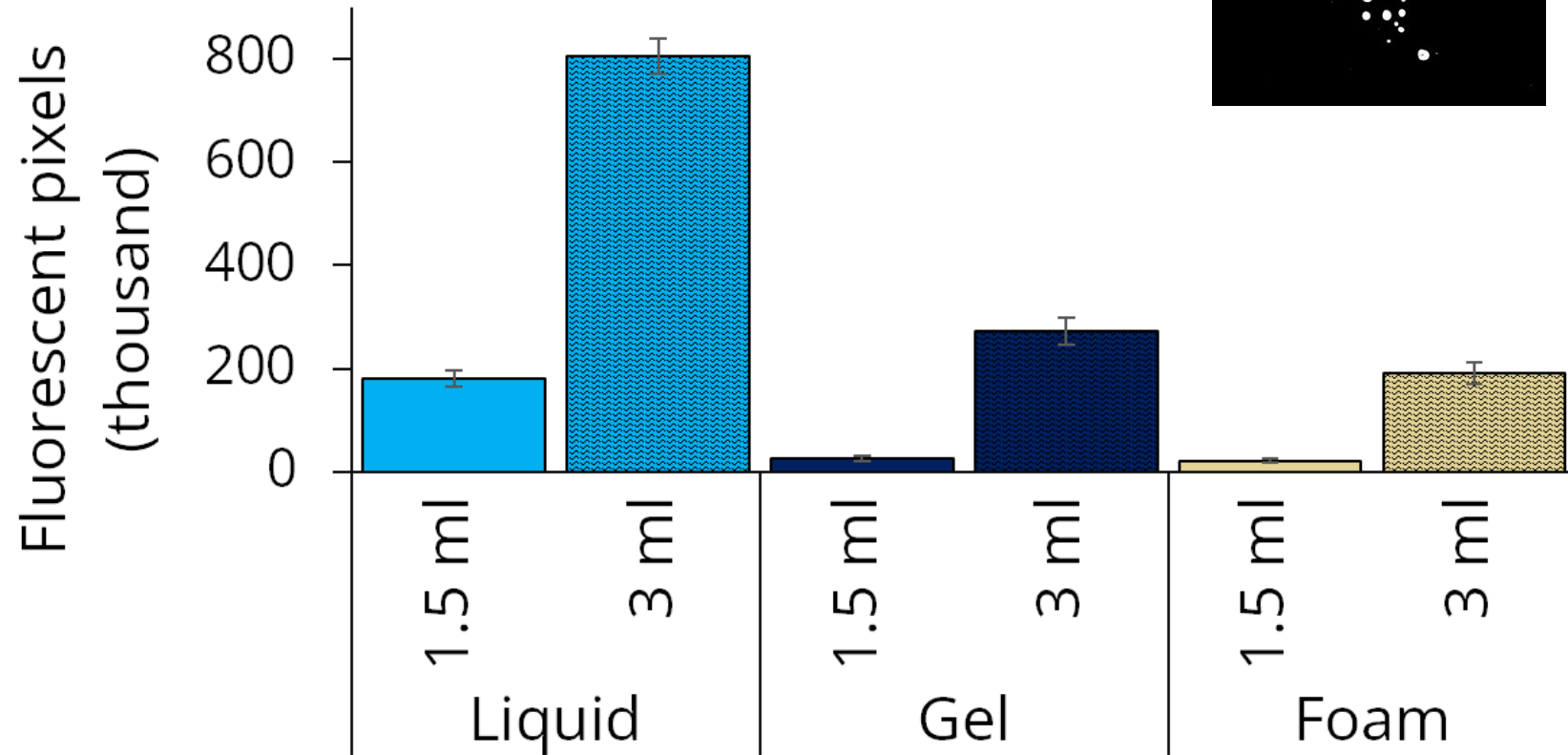
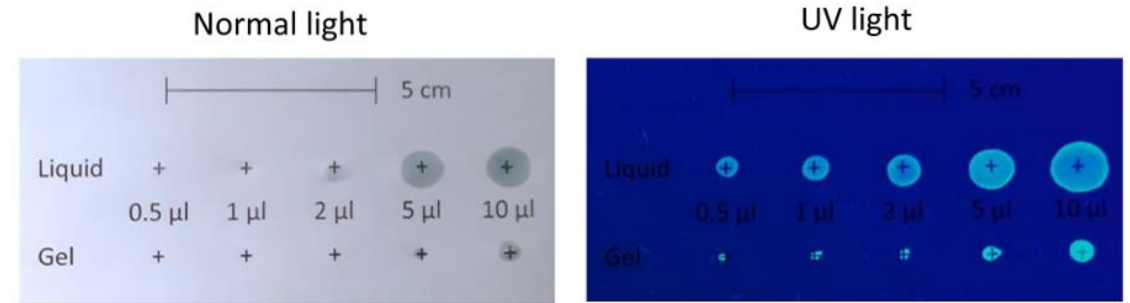
Reference: Voniatis et al. (2021) A large-scale investigation of alcohol-based handrub (ABHR) volume: hand coverage correlations utilizing an innovative quantitative evaluation system. *Antimicrob Resist Infect Control*, 10: 49.

# SPILLAGE



Reference: Bansaghi et al. (under submission) Evidence-Based Hand Hygiene: What is the Optimal Handrub Volume to Apply

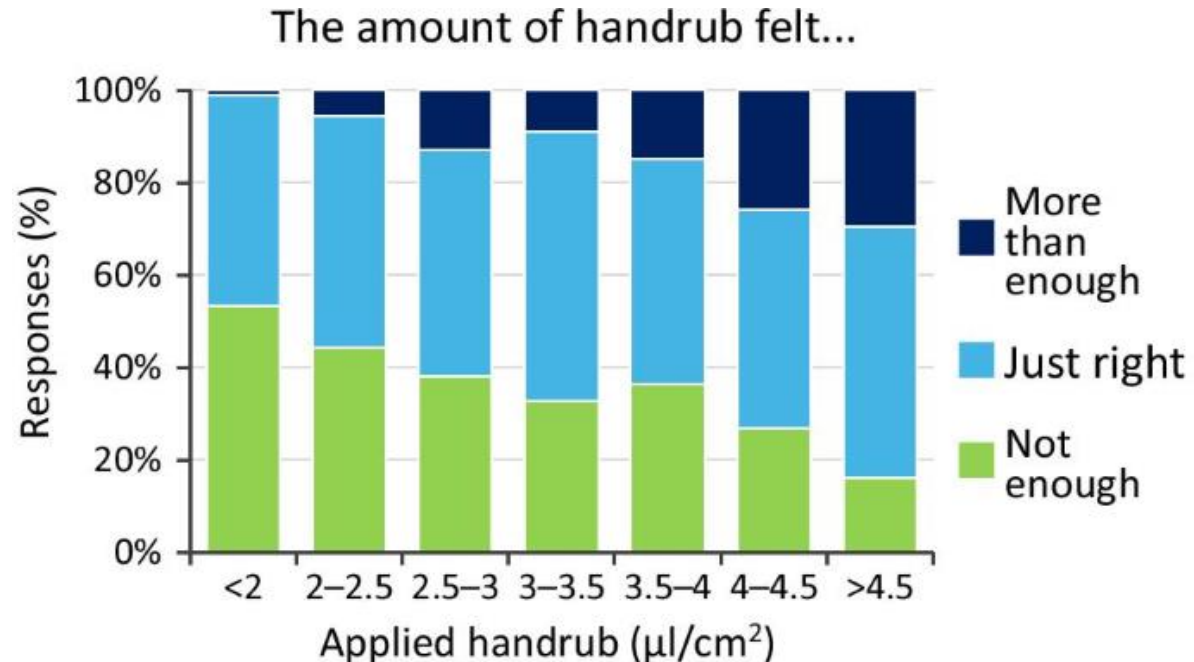
# DIFFERENT HANDRUB FORMATS



Reference: Voniatis et al. (under submission) Evidence-based hand hygiene: Neglected parameters that matter. A Quality Improvement Study

# OPTIMAL HANDRUB VOLUME

- approximately **4  $\mu\text{l}/\text{cm}^2$**  provides sufficient coverage, ensures effective microbial reduction, and reduces spillage, thereby potentially contributing to increased compliance.
- 3 ml of handrub applied to an average-sized hand corresponds to a relative volume of approximately 4  $\mu\text{l}/\text{cm}^2$



Source: Voniatis et al. (2021) A large-scale investigation of alcohol-based handrub (ABHR) volume: hand coverage correlations utilizing an innovative quantitative evaluation system. Antimicrob Resist Infect Control, 10: 49.

# VISION

## Dispensers capable of providing personalized amounts of handrub

Such technology does not yet exist, all of its components are already available on the market

- Hand size can be easily measured with current techniques
- Compliance monitoring systems can identify users
- Some dispensers can set the dispensed volume

We strongly believe this represents the future of hand hygiene

