



Lesser and lesser – the impact of small volumes in hand disinfection on quality of hand coverage and antimicrobial efficacy

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Background

- WHO*: Apply a palmful of alcohol-based handrub and cover all surfaces of the hands. Rub hands until dry (IB).
- Efficacy of hand rub (78% ethanol) according to applied volume (EN 1500)**
 - 4 ml effective
 - 3 ml effective
 - 2 ml not sufficiently effective
- Recent data suggest an application of 1.1 ml***

Sources: *Anonymous (2009) WHO guidelines on hand hygiene in healthcare

**Goroncy-Bermes P et al. (2010) J. Hosp. Infect. 74: 212-218.

***Macinga DR et al. (2013) Inf. Control Hosp. Epidemiol. 34: 299-301.



Aim of study

- to determine hand coverage and efficacy of three hand rubs applied with various volumes.



Products

Product	Active agent (%)	Recommended volume	Volume of one push*
Purell Advanced Instant Hand Sanitizer	Ethanol (70%, v/v)	1.1 mL	1.3 mL
Purell Advanced Instant Hand Sanitizer Foam	Ethanol (70%, v/v)	1.1 mL	0.7 mL
Sterillium Comfort Gel	Ethanol (85%, w/w)	2 mL	1.6 mL

*pump applicator of each product



Methods I

Efficacy according to ASTM 1174 and ASTM 2755

- 12 subjects per test
- Blinded products
- Contamination of hands with *Serratia marcescens*
 - ASTM 1174: 5 mL
 - ASTM 2755: 0.2 mL
- Baseline sampling (glove juice method)
- Second contamination of hands with *Serratia marcescens*
- Application of hand rubs
- Sampling, serial dilution, spread on TSA, incubation (25° C for 48 h)
- Neutralizing agents: TLHC
- Calculation of log₁₀-reduction

- FDA requirement: at least 2 log₁₀-reduction



Results I

Efficacy

Type of hand rub	Applied volume as recommended by manufacturer	Mean log ₁₀ -reduction (ASTM E 2755-10)	Mean log ₁₀ -reduction (ASTM E 1174-06)
Gel (70% ethanol)	1.1 ml	1.97 ± 0.45	1.85 ± 0.60
Foam (70% ethanol)	1.1 ml	1.96 ± 0.31	1.60 ± 0.55
Gel (85% ethanol)	2 ml	2.90 ± 0.33	2.06 ± 0.33



Methods II

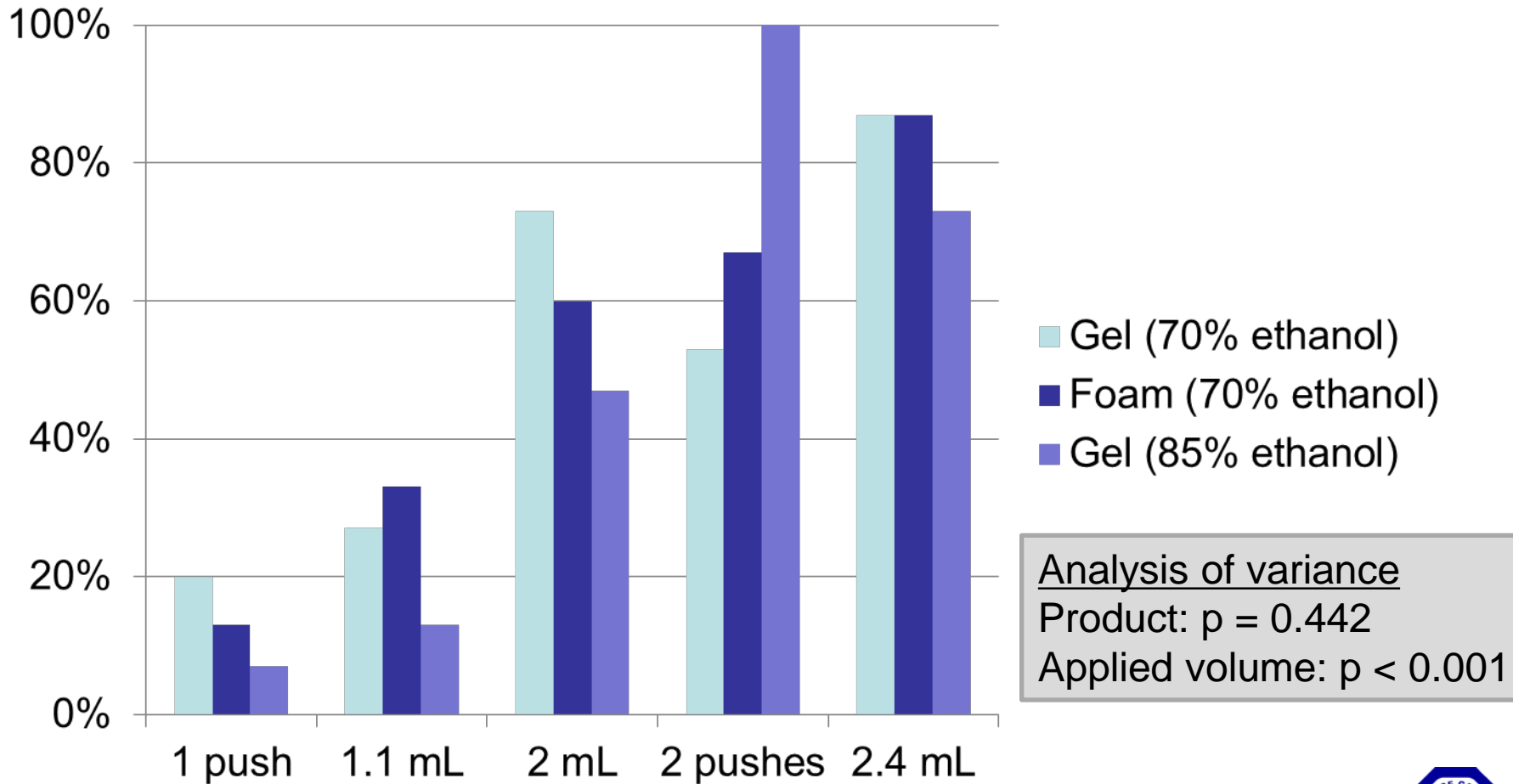
Hand coverage using different volumes

- 15 subjects
- Applied volumes
 - 1 push
 - 1.1 mL
 - 2 mL
 - 2.4 mL
 - 2 pushes
- Responsible application technique
- Randomization of blinded products and applied volumes
- Fluorescence with Visirub (1.96%)
- Evaluation of hands after application (UV light)
 - Blinding of investigators
- Frequency of completely covered hands



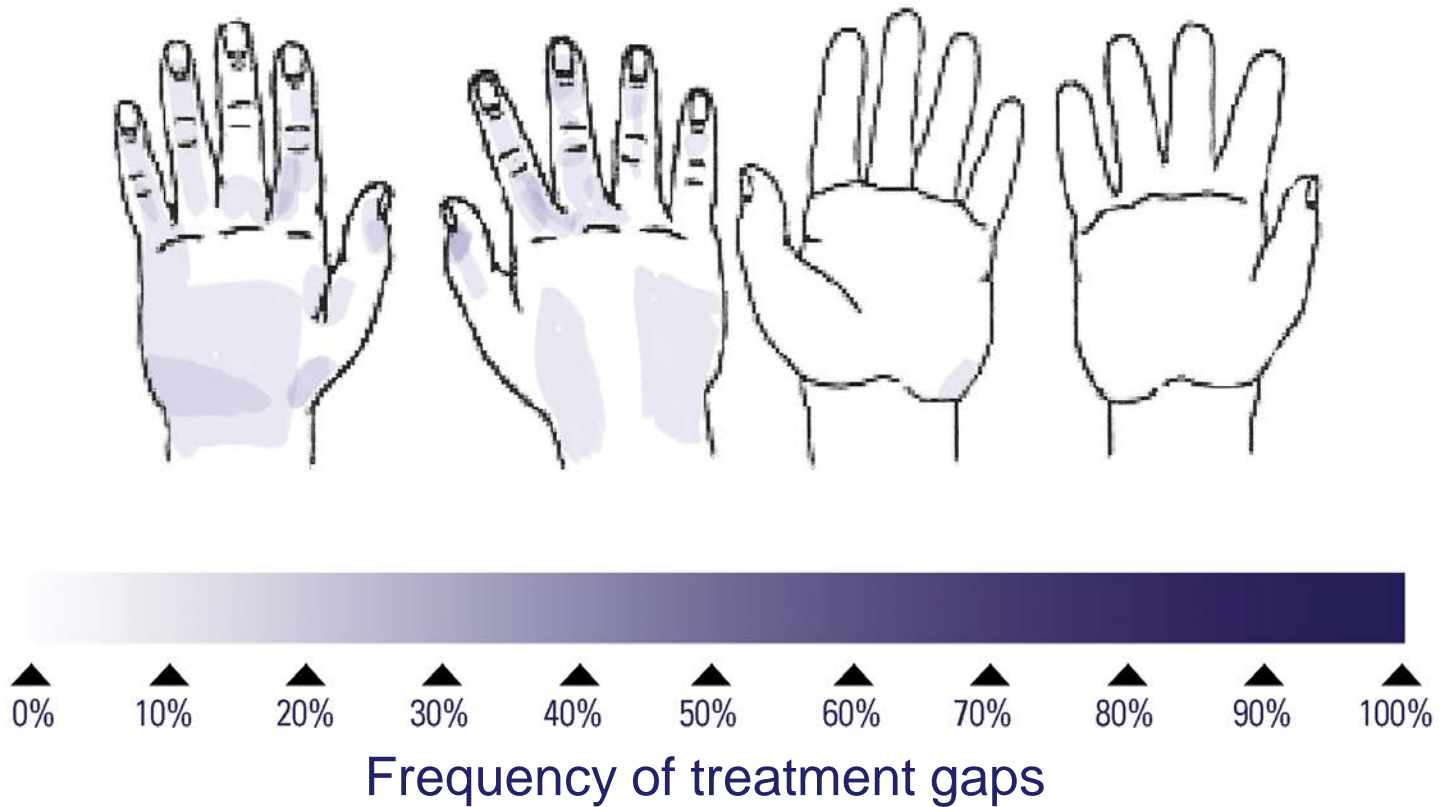
Results II

Proportion of completely covered hands



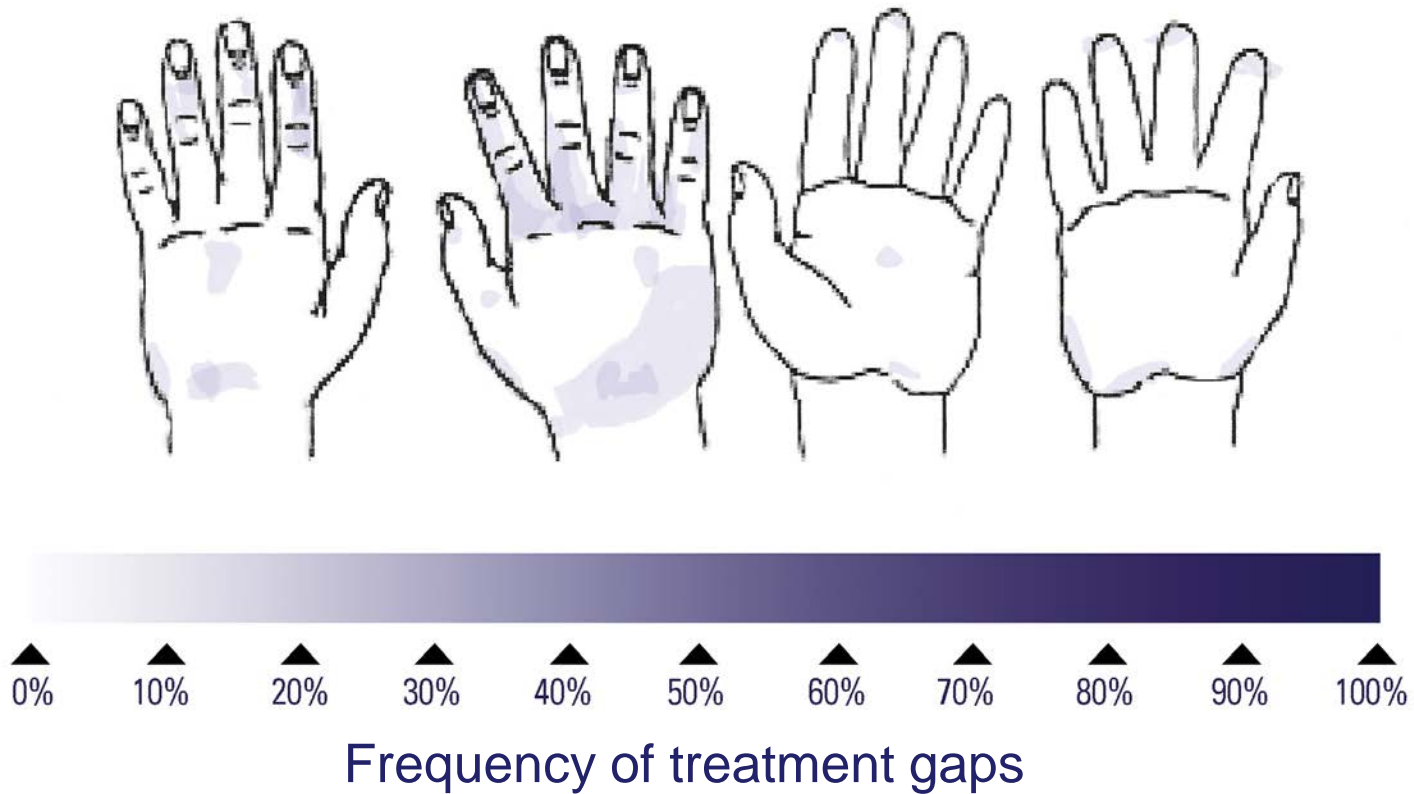
Example

Gel with 70% ethanol (1.1 mL)



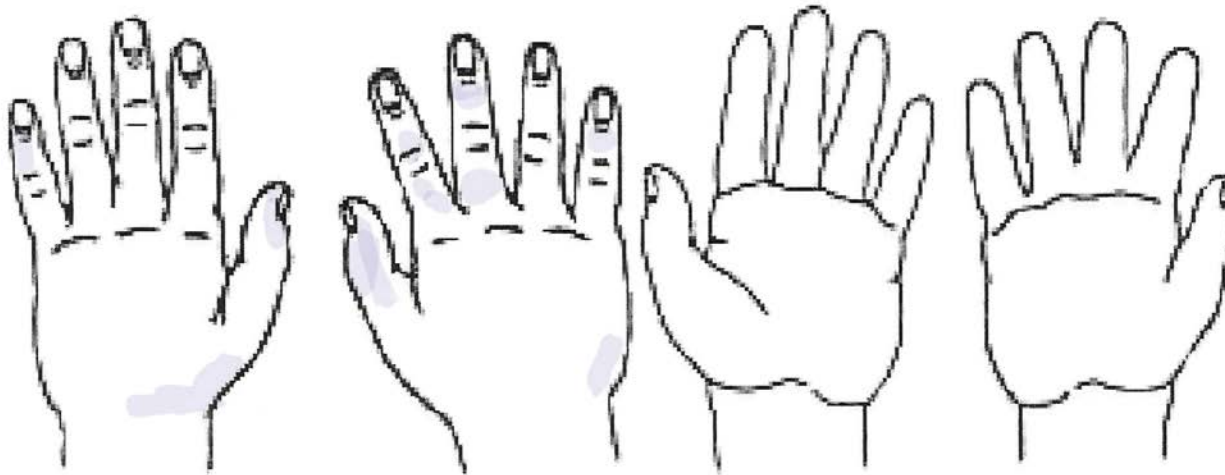
Example

Foam with 70% ethanol (1.1 mL)



Example

Gel with 85% ethanol (2 mL)



Discussion

- Comparison with published efficacy data*: doubts that gel / foam (70% ethanol) applied with 1.1 mL achieve a 2 log₁₀ reduction
- Aim to completely cover both hands not fulfilled with 1.1 mL (all products)

*Source: Macinga DR et al. (2013) Inf. Control Hosp. Epidemiol. 34: 299-301.



Conclusions

- Our data indicate:
- Hand rubs recommended with a volume of 1.1 mL per application are not suitable to ensure best possible coverage of both hands.
- Hand rubs based on 70% ethanol (v/v) and applied with 1.1 mL do not fulfill the current ASTM efficacy standard requirements.
- Infection control practitioners should try to ensure patient safety by not reducing the volume of hand rub required for adequate hand disinfection.

