

# Ten to fifteen seconds are needed for complete skin coverage with alcoholic hand disinfectant

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*To the Editor*—Kramer *et al*<sup>1</sup> demonstrated the microbiocidal effectiveness of 15 seconds of alcoholic hand disinfection and of reducing the time recommendations for alcoholic hand disinfection in standard operating procedures to increase compliance. However, a survey of infection control professionals in Germany revealed some concerns with implementing such a practice.<sup>2</sup> One such concern is the time needed to reach complete coverage of the hands with the alcoholic disinfectant.<sup>3</sup>

We conducted an experimental study during the Freiburg congress of infectious disease and infection control (Freiburger Infektiologie- und Hygienekongress) and a consulting center (BZH) meeting in 2019 to find out what volume–time combination might be sufficient to reach almost 100% skin coverage regardless of the rubbing technique used.

## Material and methods

Volunteers were randomly assigned to scrub their hands as fast as they could for 5 seconds, 10 seconds, 15 seconds and 30 seconds either with 3 mL or 6 mL alcoholic hand disinfectant containing a fluorescent marker (Visirub in 500 mL Sterilium classic pure Paul Hartmann AG marketed by Bode Chemie Hamburg, Germany). The exact volume was placed on the palm with a pre-filled syringe and the time stopped at the first counter. A video sequence of the rubbing technique was taken. A blinded observer then judged the percentage of skin coverage under ultraviolet light (Derma Lite Check Box, Bode Chemie Hamburg, Germany) and photographed the result at a second counter. Ten photos of each group were judged by a second observer as quality control. This observer also watched 10 videos with the best and worst results of each group to determine whether a specific rubbing technique giving optimal results can be identified. We used the Student *t* test with  $P < .05$  to test for significant differences between groups. Because no personal or otherwise identifying data were recorded, no written consent was needed according to the EU General Data Protection Regulation (GDPR).

## Results

In total, 356 hand rubs, randomly assigned to each group, were analyzed, but 4 data sets were discarded for protocol violation. Figure 1 shows the distribution of skin coverage of each group.

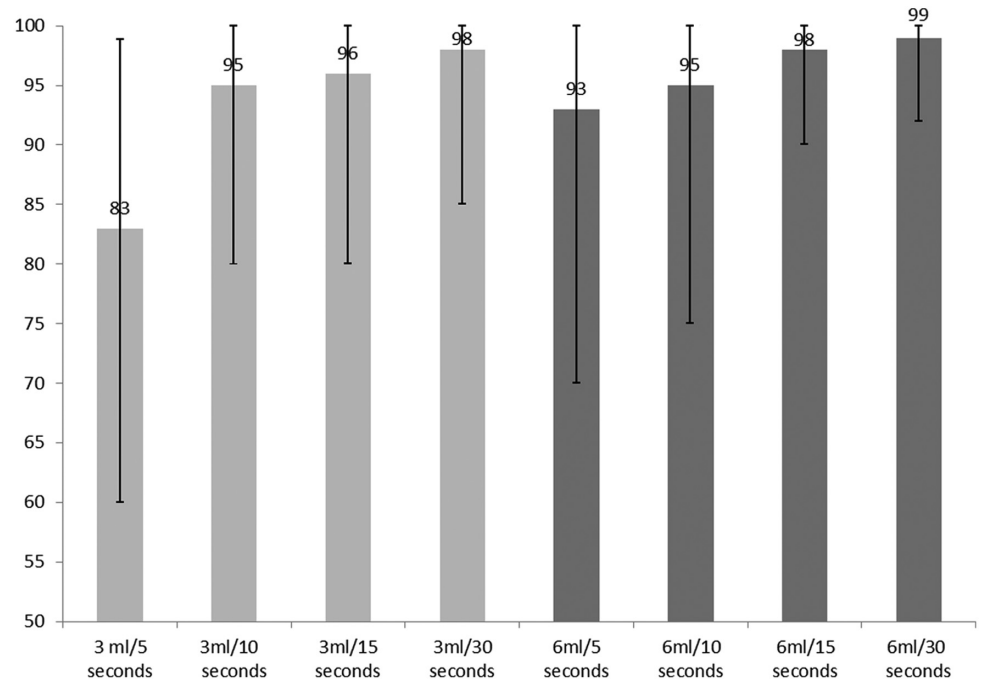
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The 3 mL per 5 seconds group was significantly worse than all other groups ( $P < .001$ ) and showed the largest range of coverage. A duration of 10 seconds resulted in 95% coverage regardless of volume, which was still significantly less compared to 15 and 30 seconds ( $P = .0011$ ). Differences between 15 and 30 seconds were not significantly different regardless of whether 3 mL or 6 mL was used ( $P = .06$ ). The second observer confirmed the results of the first observer, and no specific rubbing technique (classified as 3-step approach, modified 3 step-approach, 6 step-approach, modified 6-step approach and free style) could be identified as superior.

## Discussion

We have shown that even within 5 seconds complete coverage of the skin of the hand is feasible by some high-performing individuals, especially if the disinfectant volume used is doubled from 3 mL to 6 mL. However, the mean coverage was significantly worse and the range of coverage larger compared to longer rubbing times, independent of the volume used. Although 95% coverage within 10 seconds seems clinically acceptable, almost complete coverage was seen after 15 seconds, with no additional benefit of longer rubbing time, independent of rubbing technique. In the Kramer study,<sup>1</sup> the real observed disinfection time was ~10 seconds regardless of the recommended 15 seconds or 30 seconds in the standard operating procedure. Stahmeyer *et al*<sup>4</sup> reported an average disinfection time of 7.6 seconds in real-life observations in intensive care units. The recommendation of 15 seconds duration for alcoholic hand disinfection seems to be safe regarding acceptable skin coverage. Microbiocidal effectiveness has been proven elsewhere.<sup>1,5</sup> In addition to the benefit of increasing overall compliance, a realistic time recommendation might also help increase the real rubbing time, which would result in more optimal skin coverage. Clearly, best performers exist among the hand rubbers. Multiple different techniques were used and no unique technique could be identified as superior. This finding is consistent with the results of Tschudin-Suter *et al*, who described the similar effectiveness of a 3-step approach compared to the conventional 6-step approach under experimental conditions<sup>6</sup> and in real life.<sup>7</sup> Our study was limited by the fact that the participants were infection control practitioners and physicians with special interest in hospital hygiene. However, these groups of healthcare workers might be highly theoretically trained but maybe not the most frequent performers in daily life. Thus, we believe that our results can be extrapolated to healthcare workers in general and that optimal skin coverage with an alcoholic hand disinfectant can be reached within 10–15 seconds.



**Fig. 1.** Mean skin coverage in % and range of distribution with different volume/time combinations using fluorescent marker in alcoholic hand disinfectant.

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**Conflicts of interest.** S.S.S. is a shareholder of BZH-Beteiligungs-GbR and receives royalties from Springer, Thieme, and Consilium infectiorum. T.H. is a shareholder of BZH-Beteiligungs-GbR and receives royalties from Springer, Elsevier, and Thieme.

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## The varying specificity of urine cultures in different populations

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*To the Editor*—Diagnostic testing is essential in distinguishing patients who have a disease from those who do not. The accuracy of a test is described by sensitivity and specificity. Sensitivity reflects how many patients *with* disease have a positive test, and specificity reflects how many patients *without* disease have a