

## HAND HYGIENE IN HOSPITALS: ALCOHOL-BASED SOLUTIONS

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### Author

Tania Marin BHSc MPH

### Summary

#### Question

What is the best available evidence for the effectiveness of alcohol-based hand-rub solutions for hand hygiene, to control transmission of infections in health care institutions?

#### Clinical Bottom Line

Hand hygiene is the global standard for preventing the transmission of infection in hospital settings.<sup>1-4</sup> The contamination of healthcare workers hands is an important source of transmission of healthcare-associated infection in hospitals,<sup>2</sup> with an estimated 20% to 40% of healthcare-associated infections being attributed to cross infection from hands of healthcare workers.<sup>3</sup> Although the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) recommend the use of alcohol-based hand sanitizers (hand-rubs) to prevent health care-associated infections, their efficacy and time effectiveness have yet to be evaluated.<sup>3</sup>

- A randomized controlled trial (RCT) investigated whether a 15-second application of alcohol hand sanitizer achieved comparable wettability of hands to a 30-second application. Participants were observed over four days alternating between 15-second and 30-second hand-rubbing: group one was not given any training in the technique of hand antisepsis; group two were given training in hand antisepsis techniques before the last two days. Three milliliters (ml) of hand sanitizer (ultraviolet-light-active for detection) was applied to the hands for either 15 or 30 seconds. Those untrained wetted on average 77.1% of their skin (48.8% to 92.6%) during the 15-second application and 82.2% of the hand surface (53.5% to 96.0%) during the 30-second hand-rub. After training, on average, 86.9% (68.5% to 97.1%) of the hand surface was wetted during 15-seconds, and 90.6% (78.1% to 96.2%) in 30 seconds. It was shown that reducing the application interval (30 to 15 seconds) did not significantly alter the area of wetted skin; however, training in the correct technique increased the wetted skin area. Authors concluded that there is no difference between the two intervals and training improves wettability. It was recommended that new and untrained health care workers should be instructed in hand antisepsis using hand sanitizers.<sup>1</sup> (Level 1)
- An RCT compared two hand sanitizers for their ability to control transmission of nosocomial infections in intensive care units (ICU). Participants were randomized to one of two hand sanitizers: ethanol (61% w/v) plus chlorhexidine gluconate (CHG; 1.0% solution); or ethanol only (70% v/v). The number of aerobic colony-forming units (CFUs) were examined immediately after application of the hand sanitizer and again after spending between four and seven minutes in an ICU common area, by taking handprints. Participants tested the alternative product after a three-day washout period. Both products were well-tolerated by participants. When compared to ethanol only, the ethanol plus CHG was associated with significantly lower aerobic CFU counts immediately after use, and after the time spent in the ICU common area. Moreover, a trend toward less frequent acquisition of antibiotic-resistant pathogens on hands was observed in the ethanol plus CHG group. Authors reported that the addition of CHG to alcohol-based hand sanitizers may be beneficial in reducing bacterial contamination on hands for up to several hours after application due to a cumulative efficacy (after use, CHG accumulates on the skin). Therefore, the addition of CHG to hand sanitizers could be an effective approach to enhancing and extending the duration of antimicrobial activity.<sup>2</sup> (Level 1)
- An RCT compared the effectiveness of three hand hygiene protocols during routine inpatient care: protocol 1 (P1) hand-rubbing with alcohol covering all hand surfaces (in no particular order); protocol 2 (P2) hand-rubbing with alcohol using a standard seven-step technique; and protocol 3 (P3) handwashing with CHG using the same standard seven-step technique. Ethanol 70% and CHG 2.5% (Microshield\* Handrub, Johnson & Johnson, New Brunswick, NJ) was compared to handwashing with CHG 4% (Microshield\*4, Johnson & Johnson) and water. Overall, all hand hygiene protocols resulted in a significant reduction in bacterial load (77.65 x 10<sup>2</sup> cfu/ml). Although all differences between protocols were insignificant, P1 had the largest reduction in hand bacterial load, followed by P3 and P2. Compared with P1, P2 and P3 resulted in slightly greater bacterial load reductions, after adjusting for staff category, and took the least time to undertake. Authors concluded that alcohol hand-rubbing covering all hand surfaces in no specific order was just as effective as alcohol hand-rubbing using the seven-step technique and CHG handwashing. It was recommended that hospitals promote alcohol hand-rubbing for hand hygiene using the CDC alcohol hand-rubbing protocol.<sup>3</sup> (Level 1)

- A systematic review evaluated the clinical evidence supporting the use of alcohol-based solutions for hand hygiene in hospital settings. Hand disinfectants and alcohol-based solutions included: 80% ethyl alcohol; benzalkonium chloride and 62–70% ethanol; 0.5% CHG and 70% alcohol; 1% CHG and 60% ethanol; 2% CHG and 60% ethanol; 4% CHG; and 10% or 7.5% povidone iodine. Results were reported for the effectiveness in reducing multiple drug-resistant microorganisms, viruses and fungi (n=26 studies) and evidence regarding skin problems (n=14 studies) and time involved (n=3) when using alcohol hand-rubs. Overall, the review found evidence to support the use of alcohol-based hand-rubs to remove microorganisms including bacteria, viruses, fungi and multiple drug resistance microorganisms. It was found that alcohol-based hand-rubs remove these microorganisms from hands more effectively than handwashing with water and non-medicated soap, or other antiseptic agents; using hand-rub also took less time to complete. For routine hand hygiene, N-propanol was found to be the most commonly used alcohol, and ethanol the least; however, isopropanol 90% was found to be as effective as N-propanol 60% in reducing antimicrobial activity. With the addition of CHG (1%) the 61% ethanol was even more effective. Authors recommended that hand-rubbing with waterless, alcohol-based solutions is effective in the reduction of microorganisms on hands, improvement of compliance with hand hygiene among healthcare workers, and less irritable for the skin than soap or other antiseptic agents. They suggested promoting bedside, alcohol-based hand-rubs as the main hand hygiene compliance tool in hospital settings and noted the ease of introducing these to many locations on the hospital wards without major works required (e.g. sinks or extra plumbing). In the conclusion it was noted that the use of hand-rubs is not recommended if hands are visibly soiled or contaminated with proteins or organic matter.<sup>4</sup> (Level 1)
- A non-randomized intervention study evaluated the effectiveness of different hand disinfectants containing alcohol in reducing the carriage of *Candida* species on the hands of hospital staff. Participants were divided into one of four groups: group 1 – hand rubbing with alcohol-based solution; group 2 – hand washing with 4% CHG; group 3 – hand washing with 7.5% povidone – iodine; or group 4 – hand washing with plain soap and water. Results showed that the groups using 4% CHG, 7.5% povidone – iodine, and alcohol-based hand-rub had significantly lower carriage of *Candida* species (carriage rates 10.5%, 18.7%, 21.1%, respectively), when compared to washing hands with plain soap and water (carriage rate of 50%). Based on these results it was recommended that hospital personnel use an antimicrobial hand disinfectant where there is high risk of *Candida* infection due to its effectiveness when compared to using soap and water.<sup>5</sup> (Level 2)
- A sufficiently powered RCT evaluated the microbiologic effectiveness of the WHO six-step hand hygiene technique and the CDC three-step hand hygiene technique using alcohol-based sanitizer, in acute hospital care in the United Kingdom. Participants were randomized into either: group one – a three-step hand hygiene protocol; or group two – a six-step technique. The six-step technique involved applying a ‘palmful’ of alcohol-based hand-rub in a cupped hand, covering all surfaces, and rubbing six different aspects of the hands. The three-step technique involved applying the alcohol-based hand-rub to the palm of one hand and rubbing hands together, followed by covering all surfaces and finally, continuing to rub until hands are dry. The results showed that the six-step technique was significantly more effective at reducing the bacterial count, when compared to the three-step technique. The six-step technique did not increase the total hand coverage area (98.8% vs 99.0%) however and required 15% more time (42.50 seconds vs 35.0 seconds), compared to the three-step technique.<sup>6</sup> (Level 1)
- An RCT evaluated the effectiveness of three hand hygiene protocols in reducing hand carriage of methicillin-sensitive *Staphylococcus aureus* (MSSA) and methicillin-resistant *Staphylococcus aureus* (MRSA) among healthcare workers. Protocol 1 was the use of alcohol hand-rub, covering all hand surfaces in no specific order, protocol 2 was the use of alcohol hand-rub with the seven-step technique, and protocol 3 was CHG handwashing. The results indicated that all three protocols were equally effective for removal of hand carriage of MSSA and MRSA. Authors recommended the use of alcohol rub (either protocol 1 or 2) as it is faster and more convenient than CHG handwashing.<sup>7</sup> (Level 1)

## Characteristics of the Evidence

This summary is based on a structured search of the literature and selected evidence-based health care databases. The evidence included in this summary is from:

- An RCT involving 20 healthcare workers.<sup>1</sup>
- An RCT involving 51 healthcare workers (from three ICUs) in direct patient contact.<sup>2</sup>
- An RCT involving 120 medical (n=60) and nursing (n=60) staff.<sup>3</sup>
- A systematic review of 26 intervention studies.<sup>4</sup>
- An RCT involving 42 doctors and 78 nurses in direct patient contact.<sup>5</sup>
- An RCT involving 120 nurses (n=78) and doctors (n=42) from 15 acute wards.<sup>6</sup>
- An RCT of three different protocols with 120 HCWs.<sup>7</sup>

## Best Practice Recommendations

- Alcohol hand-rubs are recommended as a convenient and effective routine hand hygiene practice in hospital settings. (Grade A)
- New and untrained healthcare workers should be instructed in the correct techniques for hand antisepsis. (Grade B)
- Alcohol-based hand-rubs should be applied for a minimum of 15 seconds. (Grade B)

## References

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For details on the method for development see Munn Z, Lockwood C, Moola S. The development and use of evidence summaries for point of care information systems: A streamlined rapid review approach. *Worldviews Evid Based Nurs*. 2015;12(3):131-8.

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