The effectiveness of alcohol-based gel for hand sanitisng in infection control

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ABSTRACT
This article aims to evaluate the evidence relating to the effectiveness of alcohol-based gel for hand sanitisng, or 'handrub', in infection control in healthcare settings with particular reference to renal nursing, as this has become pertinent due to the increasing reliance on evidence-based practice. There is a need to implement better infection control strategies and education, to reinforce knowledge among the public, health professionals and those at high risk of infection not only in renal nursing, but also in other areas of practice. Healthcare-associated infections (HCAIs) put patients’ safety at risk, increase morbidity and mortality, extend the length of hospital admission and increase the cost to the NHS. There is evidence that the prevalence of HCAIs in England can be minimised through the use of different infection control measures. For example, alcohol-based handrub has been found to be associated with minimising the spread of gastrointestinal infections not only in hospital settings, but also in childcare centres. In addition, the UK national guidelines recommend regular handwashing (implementing the right technique) when hands are visibly dirty and hand disinfection with alcohol-based handrub when they are not visibly dirty. This should be before, in between and after different healthcare activities are performed.

Key words: Infection control ■ Alcohol-based gel/handrub ■ Handwashing technique ■ Healthcare-associated infections ■ MRSA

According to the National Institute for Health and Care Excellence (NICE), the prevalence of healthcare-associated infections (HCAIs) in England was 6.4% in 2011 and approximately 300 000 patients contract an HCAI in hospital and community settings every year (NICE, 2014). The most common nosocomial infections are respiratory, urinary and surgical site infections (NICE, 2014). In 2007, meticillin-resistant Staphylococcus aureus (MRSA) sepsis and Clostridium difficile infection were associated with 9000 deaths in hospital and community care settings in England (NICE, 2014). Evidence shows that these figures have decreased since the implementation of quality standards and national guidelines in regard to infection prevention and control (NICE, 2014). However, there is a need for improvement in this area of practice because HCAIs put patients’ safety at risk, increase morbidity and mortality, extend the length of hospital admission and cost the NHS around £1 billion a year (Sydnor and Perl, 2011; NICE, 2017).

An important aspect of nursing practice is the prevention of infection transmission in healthcare settings and the use of alcohol-based 'handrub' (hand-sanitising gel), which plays a crucial role in infection control (World Health Organization (WHO), 2018a). As part of the strategy introduced by the Cleanyourhands campaign in 2004 (National Patient Safety Agency, 2011; Stone, 2012), health professionals and other employees are often provided with their own alcohol-based handrubs while healthcare clients and visitors to healthcare settings are provided with alcohol-based handrub dispensers attached to the bedsides, in the corridors and at the main entrances of hospitals, supported by posters or publicity. The handrub cleansing technique is simple to use and saves healthcare providers time lost in accessing and using handwashing facilities because the handrub is often easily available.

The aim of this review is to evaluate the evidence relating to the effectiveness of alcohol-based handrub in infection control in healthcare settings, especially in renal nursing practice, as this has become pertinent due to a growing focus on evidence-based practice (EBP) in nursing. This is against the backdrop of the tremendous difficulties faced by modern medicine with regard to bacterial resistance to antibiotics (Martens and Demain, 2017). Subsequently, there is a need to implement better strategies in infection control and education to reinforce knowledge among the public, health professionals and those at high risk of infection, not only in renal nursing but in other areas of practice.

Evidence supporting the use of alcohol-based handrub for hand hygiene
EBP is a complex process that requires a combination of evidence, clinical expertise, patient contribution and care delivery in order to make the right clinical decision (Sackett et al, 1996; Barker, 2010). The EBP approach is considered to be of great importance, because it supports health professionals in making decisions based on clinical and scientific information. When EBP is applied correctly, including the right evidence for the right patient at the right stage of illness or health, patients have a better view of their condition and healthcare
experience (Craig and Smyth, 2007). In addition, the Nursing and Midwifery Council (NMC, 2015) clearly states that ‘we must deliver care based on the best available evidence or best practice’.

However, there appears to be limited research published recently with respect to the effectiveness of alcohol-based gel and this explains the age of articles used in the current review. Earlier work by Rotter (1984) recognised the challenge of comparing the effects of disinfection procedures on infection ratios for routine activities. The findings of the test model revealed that the use of alcohol in adequate concentrations is highly effective compared with approaches that rely on disinfectant detergents, which act like soap and which may cause dissemination of pathogens (Rotter, 1984).

However, in a systematic review conducted by Stout et al (2007) on the clinical effectiveness of alcohol-based products in increasing hand-hygiene compliance and reducing infection rates, it was found that alcohol-based handrubs are often used as part of a multi-component intervention rather than in isolation, this being the reason why it is difficult to evaluate their effectiveness individually. Although nine of the studies discussed in this review included handrubs as part of the technique for reducing HCAIs, one of the studies compared an alcohol-based handrub and plain soap with medicated soap and found a significantly lower number of infections with the medicated soap in combination with the alcohol-based handrub.

Gopal Rao et al (2002) reported a relative reduction of 17.5% in infection rate when alcohol-based handrub was available at the bedside. Three other studies have also reported lower infection rates as a result of staff using alcohol-based handrub, but failed to indicate statistical results (Brown et al, 2003; Hilburn et al, 2003; King, 2004). Pittet et al (2000) monitored healthcare professionals’ compliance with hand hygiene before and during a hand hygiene campaign in a teaching hospital in Geneva, Switzerland. Subsequently, the authors reported a reduction of 41% in the HCAIs rate over a period of 4 years as well as a reduction in MRSA infection from 2.16 to 0.93 episodes per 10 000 patient days. Despite the findings, the authors did not attribute the reduction rate solely to hand hygiene, although they found that compliance with using alcohol-based handrub increased from 48% to 66% during the same period and the prevalence of nosocomial infections decreased.

In another study, Trick et al (2007) reported a reduction in vancomycin-resistant enterococci infection from 0.5 to 0.32 cases per 1000 patient days in an intervention study involving alcohol-based handrub supported by educational sessions. Nonetheless, the authors failed to state how they had approached patients for education in terms of hand hygiene and infection control and they reported that alcohol-based handrub was the product of preference among health professionals. In practice, staff often use alcohol-based handrub on its own, especially since the removal of chlorhexidine surgical scrub from most clinical areas as the conventional soap for handwashing, due to its impact on healthcare providers’ skin integrity (WHO, 2009). However, chlorhexidine surgical scrub is still provided as the conventional soap for handwashing with patients who are positive for MRSA and/or patients cared for in strict isolation, because of its antimicrobial properties (Doebbeling et al, 1992). It is evident that this action supports the WHO’s proposal that alcohol-based handrub is safe and efficient for hand cleansing because of its good skin tolerability (WHO, 2009). It does not require water, it is suitable for busy health professionals and rapidly kills most bacteria and viruses associated with respiratory and gastrointestinal infections (Sandora et al, 2005). Furthermore, the Health Protection Agency (HPA) and Department of Health (DH) guideline on C. difficile infection (HPA and DH, 2008) strongly recommends the use of alcohol-based handrub after handwashing with soap and water in order to get rid of the remaining microorganisms, but it also highlights the limitations of alcohol-based handrub used on its own when caring for patients who may be isolated due to diarrhoea or those diagnosed with C. difficile infection. According to Kramer et al (2002), the antimicrobial efficacy of the alcohol-based handrubs they tested may be insufficient to prevent the spread of pathogens involved in HCAIs.

Sandora et al (2005) sought to demonstrate that good standards of hand hygiene help reduce the spread of infections in families who are in out-of-home child care. In a randomised controlled trial of a multifaceted intervention including alcohol-based handrub and hand hygiene education to reduce infection transmission, the authors studied 292 families with children aged between 6 months and 5 years who were cared for outside the home for 10 hours or more a week. The focus in the intervention group was to increase the use of alcohol-based handrub by supplying these families with a handrub to use at home for a period of 5 months in conjunction with biweekly hand hygiene educational material. The control group, on the other hand, was instructed not to use any handrub for 5 months and families were, instead, supplied with bi-weekly educational material about eating a healthy diet, including fruit and vegetables.

A total of 1802 respiratory illnesses occurred in the study population, of which 443 (25%) were secondary; the rate was not significantly different between the intervention and control groups. There were 252 gastrointestinal illnesses during the study, of which 28 (11%) were secondary, but the rate was significantly lower in the intervention group compared with the controls. It was also found that families with higher usage of alcohol-based handrub had a lower secondary respiratory illness rate than families with less usage. Consequently, using handrub was associated with minimising the spread of gastrointestinal infections not only in the hospital environment but also in childcare centres where client groups are also prone to infections.

In another study, Hall et al (2010) evaluated the effect of the dried residues of two handrubs on the survival of MRSA and Acinetobacter calcoaceticus-baumannii (ACCB). The study compared an alcohol-based gel (hand gel A) extensively used in UK hospitals with an aloe vera-based gel containing the copper biocide CuAL42 (hand gel B). It was found that MRSA and ACCB survived for 8 hours on hand gel A residues, whereas hand gel B residues did not allow MRSA to survive and ACCB survived less than 30 minutes. However, the study had some limitations; although the authors described the laboratory methodology, they failed to state the methodology used when
approaching the actual research project and there were concerns around conflicts of interest. Despite the shortcomings of the study, it raises the issue of the variation in performance between different types of handrubs/hand gels, which is an aspect that is not often taken into account in research studies and, perhaps, not appreciated by healthcare professionals.

According to WHO guidelines on hand hygiene, health professionals can prevent exposure to microbiological agents by implementing standard infection control measures at the right time: as well as being low cost, these can be effective (WHO, 2009). This argument is supported by the NICE recommendations on hand hygiene as a standard principle to prevent HCAIs, which states that everyone involved in providing direct care should comply with hand decontamination, preferably using an alcohol-based handrub unless dirt is visible or the hands are soiled with blood or body fluids (NICE, 2017).

National and international guidelines are pivotal for evidence-based practice because they help improve existing plans in health care, in order to standardise services and promote a responsive patient-centred approach (WHO, 2018b). For example, although the current levels of suspected and confirmed outbreaks of norovirus in hospitals in England are lower than in previous years (2009–2016) (Public Health England, 2018), there is a need to continue surveillance. In this regard, the Norovirus Working Party (2012) recommendations for the management of vomiting and/or diarrhoea in hospitals and community settings, and norovirus outbreak control, include: closing affected bays, signage on doors informing all visitors of the closed status and encouraging strict hand hygiene.

**Handwashing with soap and water versus the use of alcohol-based handrub**

Stone et al (2012) evaluated the national Cleanyourhands campaign, and also aimed to report trends in selected HCAIs in relation to rates of hospital procurement of alcohol-based handrub and soap. This campaign involved providing alcohol handrub at the bedside, promoting hand-hygiene practices, including the use of posters to remind health professionals to clean their hands, hand-hygiene audits and institutional engagements. The results showed that the increased procurement of soap was independently related to reduction in *C. difficile* infection throughout the entire study. They also showed that increased procurement of alcohol-based handrub was independently related to reduced MRSA bacteraemia, but this was only the case in the final four quarters of the study (Stone et al, 2012).

Hand hygiene with soap and water has been proven to be effective; it potentially reduces episodes of diarrhoea by 31% (Ejemot-Nwadiaro et al, 2015), reduces incidence of respiratory infections in community settings by 21% (Aiello et al, 2008) and kills spore-forming pathogens (WHO, 2018a). However, it requires access to other facilities (sink and disinfectant soap) and sufficient time to carry out the procedure correctly. Furthermore, it is crucial to perform handwashing at the right time, such as (Pickering et al, 2010):

- Immediately after using the toilet
- Before feeding someone
- When caring for patients with diarrhoea.

The alternative to handwashing when hands are not visibly dirty is alcohol-based handrub, which does not require access to a sink and water, or drying with a potentially contaminated tissue. Alcohol-based handrub rapidly kills most bacteria and viruses (Sandora et al, 2005). It can be considered to be as effective as medicated soap (Girou et al, 2002) and it contains emollients, which are less drying and damaging to the skin (Larson et al, 2005). It is believed that handwashing removes lipids from the skin, whereas alcohol-based handrub only redistributes them (Kampf et al, 2002; Huber et al, 2006). It is important to highlight that the preferred method of hand hygiene depends on a number of factors and that health professionals are responsible for assessing these factors, including the type of task to be carried out and the severity of contamination (Huber et al, 2006).

**Infection control and implications for renal nursing practice**

Hand hygiene is particularly important in renal nursing practice where renal replacement therapies rely on functional vascular access, either an arteriovenous fistula/graft or a central venous catheter (CVC), for haemodialysis (Figure 1) or a Tenckhoff catheter for peritoneal dialysis (PD) (Figure 2), which are critical to the patient’s life because without one of these they cannot be dialysed. A CVC is considered a valid choice for vascular access in end-stage renal failure, when patients require haemodialysis in acute settings or in planned procedures because their permanent vascular access—an arteriovenous fistula/graft—has become dysfunctional because of stenosis or infections.

Infection is a CVC complication that can be prevented; however, it remains a major reason for CVC removal (Santoro et al, 2014). An additional problem encountered in haemodialysis units is blood-borne virus (BBV) transmission. The Renal Association (2009) guidelines provide strategies that not only highlight the importance of hand hygiene, but also the appropriate and frequent monitoring and testing for BBV infection, which is a major occupational hazard for health professionals, as well as being a risk for other patients in renal dialysis units. These strategies include the isolation of patients known to be BBV positive and the haemodialysis machines used by them, and using double transducer protectors on the dialysis blood circuit machines—all of which has helped reduce the transmission of BBV in the past three decades (Duerden et al, 2002; Renal Association, 2009).

The use of personal protective equipment, including well-fitting gloves, disposable plastic aprons, and alcohol handrubs when hands are not visibly soiled have been recommended for infection control in renal nursing (Duerden et al, 2002). Almost 50% of reported HCAIs are due to health professionals transmitting pathogens by hand even if they wear gloves, and so handwashing is essential after glove removal (Tenorio et al, 2001; Keitelz et al, 2014). Therefore, there should be clear instructions and guidelines on gloving technique placed next to every apron and gloves dispenser, to remind health professionals to use the appropriate technique (Duerden et al, 2002). These
Hand hygiene procedures play a pivotal role in preventing infection transmission due to the frequent need to manipulate the patient’s catheter.

Around 4000 patients in the UK who dialyse at home use a PD catheter (NICE, 2011; Catley, 2015). Technically, PD does not involve vascular access but if infection is introduced via the PD catheter or the exit site, the patient will develop peritonitis, which can scar the peritoneum membrane and therefore affect PD efficiency. Peritonitis is a common cause of interruption in PD treatment and the root cause of illness in PD patients (Li et al, 2010; Kidney Research UK, 2013), and may lead to hospitalisation. If the whole PD catheter is colonised, it will need to be removed (requiring planning for surgery and recovery) and the patient already established on PD will have to be switched to haemodialysis (which will mean creating an extra available slot in haemodialysis for the patient to be dialysed)—this change can have a psychosocial impact on the patient.

Therefore, PD requires high standards of general hygiene, especially hand hygiene, to ensure patients’ safety and to maintain high standards of infection control. Although international guidelines do not recommend which soap or alcohol handrub is most effective in hand decontamination, some local guidelines promote the use of chlorhexidine 4% solution to wash hands for 2 minutes and the use of alcohol-based handrub afterwards. The International Society for Peritoneal Dialysis 2010 guidelines update highlights the importance of using alcohol gel handrub after handwashing because, if the water used for handwashing is contaminated, the alcohol gel offers an extra layer of protection to prevent peritonitis (Li et al, 2010). This underscores the importance of testing the water from different sinks in hospital settings, following up the results and liaising with the infection control team as soon as the results are known.

In the UK, there is robust guidance to control waterborne pathogens in healthcare settings, to maximise the safety of patients and health professionals. These strategies include a temperature control regimen (DH, 2016). However, in some healthcare settings, the use of additional chemicals, physical and other water control methods plus regular testing and follow-ups are recommended (DH, 2016). In a recent outbreak of carbapenemase-producing enterobacteriaceae (CPE) in a local hospital, different strategies were put in place to educate patients, relatives, health professionals and other staff visiting the ward. These included: having an infection control marshal at the entrance of the ward to make sure that handwashing was carried out when entering and leaving the ward, supporting patients and demonstrating the techniques of handwashing, and having signs on the door to encourage visitors to wash their hands.

**Limitations of the use of evidence in nursing practice**

Despite the growing use of evidence in nursing practice, some factors inhibit the understanding and implementation of EBP in nursing. These include the busy ward environments and frequent staff shortages, which limit the time available to search for relevant evidence on the internet (Gerrish et al, 2007), and nurses’ lack of knowledge and expertise to interpret and translate data into practice (Beyea and Slattery, 2006). There is limited access to computers on the wards for the multidisciplinary team, which are used mostly by the doctors and the ward clerk (Mashiach Eizenberg, 2011). Nurses might feel they do not have the authority to make changes (Rycroft-Malone et al, 2004).
Nurses are often required to comply with trust policies, therefore they cannot simply change practice based on research articles they have read. If research appears to indicate that a change in practice might be desirable, nurses need to approach the trust senior management to discuss the possibility of a change of practice or further research. However, in the light of current financial constraints, the funding of research projects and change of policies and procedures may not be seen as a priority. Staff attitudes and beliefs play an important role in compliance with EBP (Hollemann et al, 2006; Mashiach Eizenberg, 2011). For example, even where staff have been educated about the benefits of alcohol-based handrub in infection control, some appear not to use handrub because they believe that their hands are not contaminated, that the handrub does not work or that it will compromise their skin integrity. Nurses may not want patients to regard them as not knowledgeable if they cannot translate research into practice (Hollemann et al, 2006).

**Recommendations for practice**

There should be a proactive ‘infection control link nurse’ in every clinical setting, who is able to escalate any concerns to the infection control team in a timely manner. In addition, there is a need to increase hand hygiene and handwashing compliance and maintain surveillance of all staff members’ compliance with infection control measures. Regular publication of hand hygiene and infection control audits are recommended in order to promote effective infection control measures.

Clear instructions and guidelines on gloving technique should be placed alongside every glove and apron dispenser, to remind health professionals of the appropriate technique to use these items.

Nurses need to educate patients and relatives about the importance of infection control and hand hygiene: this could be through posters and leaflets relating to handwashing with soap and water, disinfection with alcohol-based handrub and their benefits. They should also be prepared to challenge staff members, patients and visitors who refuse to comply with hand hygiene and infection control measures.

**Conclusion**

The use of evidence is an essential tool to switch the nursing approach from one that seems to rely more on intuition to an evidence-based profession, in order to provide a highly effective health service that benefits patients as well as healthcare institutions and staff. Education in hand hygiene and infection control is pivotal in all clinical settings, but particularly relevant in renal nursing where patients’ vascular access is very important.

Alcohol-based handrub has been associated with minimising the spread of gastrointestinal infections not only in hospital settings, but also in childcare centres—illustrating the role it plays in preventing the wider spread of infection. UK national guidelines recommend handwashing, while implementing the right technique, when hands are visibly dirty and hand disinfection with alcohol-based handrubs. Handrubs should be provided by the bedside and sinks, by hospital and ward entrances, and used when hands are not visibly dirty, in between, before and after healthcare activities are performed. **BJN**

**Declaration of interest: none**


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(accessed 5 March 2018)


Health Protection Agency, Department of Health. *Clostridium difficile*.


