

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

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Citation:

Munoz-Figueroa GP and Ojo O (2018) The effectiveness of alcohol-based gel for hand sanitising in infection control. *British Journal of Nursing*, 27(7): 382 – 388

Abstract

This article aims to evaluate the evidence relating to the effectiveness of alcohol-based gel 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, healthcare workers and those at high risk of infection not only in renal nursing, but in other areas of practice. Healthcare associated infections (HCAIs) put patients' safety at risk, increase morbidity, mortality, extend the length of hospital admission and increase the cost to the National Health Service (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 gel has been found to be associated with minimising the spread of gastrointestinal infections not only in hospital settings, but also in child care centres. In addition, the UK national guidelines recommend regular hand washing (implementing the right technique) when hands are visibly dirty and hand disinfection with alcohol-based gel when hands are not visibly dirty. This should be before, in between and after different healthcare activities are performed.

Keywords: Infection control, alcohol-based gel, hand washing technique, Healthcare associated infections, MRSA, C. difficile

Key Points

- Prevention of infection transmission is an important aspect of nursing practice and the use of alcohol-based gel plays a crucial role in it.
- Alcohol-based gel is simple to use, saves healthcare providers time lost in accessing and using hand washing facilities in different healthcare settings.
- There is a need to implement better strategies in infection control and education, to reinforce knowledge among the public, healthcare workers and those at high risk of infection.
- NICE recommendations on hand hygiene include compliance by everyone involved in direct care with hand decontamination, preferably using alcohol-based gel unless dirt is visible; before, between and after healthcare activities are performed.
- Local trusts' policies support the use of alcohol-based gel, because these agents are effective against micro-organisms responsible for most of the HCAs.

Introduction

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 a 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, Methicillin-resistant staphylococcus *aureus* (MRSA) sepsis and Clostridium *difficile* infection (CDI) 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 standard and national guidelines in regards 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, mortality, extend the length of hospital admission and it costs around 1 billion pounds a year to the National Health Service (NHS) (NICE 2012, Sydnor and Perl 2011). An important aspect of nursing practice is the prevention of infection transmission in healthcare settings and the use of alcohol-based gel plays a crucial role in infection control (WHO 2017a). As part of the strategy introduced by the Cleanyourhands campaign in 2004 (Stone 2012), healthcare workers and other employees are often provided with personal hand rubs while healthcare clients and visitors to healthcare settings are provided with alcohol-based gel dispensers attached to the bedsides, in the corridors and at the main entrance of the hospitals, supported by posters or publicity. The alcohol-based gel cleansing technique is simple to use, saves healthcare providers time lost in accessing and using hand washing facilities because it is often easily available.

Therefore, the aim of this review is to evaluate the evidence relating to the effectiveness of alcohol-based gel in infection control in healthcare settings, especially in renal nursing

practice as this has become pertinent, because evidence-based practice in nursing gains traction. This is against the backdrop of the tremendous difficulties faced by modern medicine with respect to the resistance of bacterial infections 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, healthcare workers and those at high risk of infection, not only in renal nursing but in other areas of practice.

The Evidence Supporting the Use of Alcohol Based Hand Rub

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

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 of 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 which rely on disinfectant detergents which act like soap that 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 gels 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. While nine of the studies discussed in this review included alcohol-based gels as part of the technique for reducing HCAs, one of the studies compared an alcohol-based gel and plain soap with medicated soap and found a significantly low number of infections with the medicated soap in combination with the alcohol-based gel.

Rao et al. (2002) reported a relative reduction of 17.5% in infection rate when the alcohol-based gel provided, was attached to the client's bedside. Three other studies have also reported lower infection rate after the alcohol-based gel intervention but failed to indicate statistical results (Brown et al. 2003, Hilburn et al. 2003, King 2004). Pittet et al. (2000) monitored healthcare providers' 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% of HCAs rate in 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 to hand hygiene only, although they found that compliance to using alcohol-based gel 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 gel supported by educational sessions. Nonetheless, the authors failed to state how they approached patients for education in terms of hand hygiene and infection control and they reported that alcohol-based gel was the product of preference among healthcare

professionals. In practice, staff often use alcohol-based gel on its own especially since the removal of Chlorhexidine surgical scrub from most clinical areas as the conventional soap for hand washing, due to its impact on healthcare providers' skin integrity (WHO 2009). However, Chlorhexidine surgical scrub is still provided as the conventional soap for hand washing in patients that are MRSA positive and/or patients on strict isolation, because of its antimicrobial properties (Doebbeling et al. 1992). It is evident that this action supports the proposal of the World Health Organization (WHO), that alcohol-based gel is safe and efficient because of the good skin tolerability (WHO 2009). It does not require water, it is suitable for busy care providers, rapidly kills most bacteria and viruses associated with respiratory and gastrointestinal infections (Sandora et al. 2005). Furthermore, the Health Protection Agency and the Department of Health (HPA & DoH 2009) guidelines on the *Clostridium difficile* infection strongly recommend the use of alcohol-based gel after hand washing with soap and water in order to get rid of the remaining microorganisms but, it highlights the limitations of alcohol-based gel used on its own when caring for patients who may be isolated due to diarrhoea or those diagnosed with *Clostridium difficile* infection. According to Kramer et al. (2002), the antimicrobial efficacy of the alcohol-based hand gels they tested may be insufficient to prevent the spread of pathogens related with HCAs.

Sandora et al. (2005) sought to demonstrate that good standards of hand hygiene help reduce the spread of infections in families with children who are in out-of-home child care. In a randomized controlled trial of a multifaceted intervention including alcohol-based hand sanitizer and hand hygiene education to reduce infection transmission, the authors studied 292 families with children aged between 6 months and 5 years in out-of-home child care for 10 hours or more weekly. The focus in the intervention group was to increase the use of alcohol-based gel by supplying families in this group with Purell Instant hand sanitizer

(GOJO industries, Inc, Akron OH: active ingredient: 62% ethyl alcohol) to use at home for a period of 5 months in conjunction with biweekly hand hygiene educational material. On the other hand, the control group was instructed not to use hand sanitizer for 5 months, instead they were supplied with biweekly educational material about healthy diet including fruit and vegetable. A total of 1802 respiratory illnesses occurred in the study of which 443 (25%) were secondary and the rate was not significantly different between the intervention and control group. 252 Gastro Intestinal (GI) illnesses occurred during the study of which 28 (11%) were secondary but the rate was significantly lower in the intervention group than control group. It was also found that families with higher usage of alcohol-based gel had a lower secondary respiratory illness rate than families with less usage. Consequently, the usage of alcohol-based gel is associated with minimizing the spread of GI infections not only in hospital environment but in child care 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 hand gels on the survival of MRSA and *Acinetobacter calcoaceticus-baumannii* (ACCB). This involved examining the ability of the residues of an alcohol-based gel A, extensively used in the United Kingdom (UK) hospitals and an Aloe vera-based CuAL42 copper biocide-containing hand gel B to support the survival of MRSA and ACCB. It was found that MRSA and ACCB survived for 8 hours on hand gel A residues compared to hand gel B which residues did not allow MRSA to survive and ACCB survived less than 30 minutes. However, there were some limitations in this study, while the authors described the laboratory methodology, they failed to state the methodology used in approaching the actual research project and there were also concerns around conflicts of interest. Despite the shortcomings of the study, it raises the issue

of the variation in performance of different types of hand gels which is an aspect not often taken into account in research studies and perhaps not appreciated by healthcare providers.

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

National and International guidelines are pivotal in evidence-based practice because they help improve upon existing plans in healthcare, in order to standardize services and promote responsive patient-centred approach (WHO 2017b). For example, although the current levels of suspected and confirmed outbreak of norovirus in hospitals in England were lower than previous years (2009 – 2016) (Public Health England 2018), there is need to continue to maintain 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 measures include; closing affected bays, signage on doors informing all visitors of the closed status and encouraging strict hand hygiene.

Hand Washing with Soap and Water versus the use of Alcohol based Gel

Stone et al. (2012) evaluated the national Cleanyourhands campaign which sought to report trends in some selected HCAs in relation to rates of hospital procurement of alcohol hand rub and soap. This campaign involved the provision of alcohol hand rub at bed side, promotion of hand hygiene practices including the use of posters to remind healthcare

workers 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 study, while increased procurement of alcohol hand rub was independently related to reduced MRSA bacteraemia, only in the last four quarters of the study (Stone et al. 2012).

Hand hygiene with soap and water has been proven to be very effective, it potentially reduces episodes of diarrhoea by 31% (Ejemot et al. 2015), reduces the incidence of respiratory infections in community settings by 21% (Aiello et al. 2008) and kills spore-forming pathogens (WHO 2017a). 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 hand washing at the right time such as: immediately after using the toilet, before and after eating, after changing or assisting someone to the toilet, before feeding someone and when caring for patients with diarrhoea (Pickering et al. 2010). The alternative to hand washing when hands are not visibly dirty, is alcohol-based gel which does not require access to a sink or water or drying with a potentially contaminated tissue or surface. Alcohol-based gel rapidly kills most of bacteria and viruses (Sandora et al. 2005). It is 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 hand washing removes lipids from the skin whilst alcohol-based gel only re-distributes them (Huber, Holton and Terezhalmay 2006, Kampf et al. 2002). It is important to highlight that the preferred method of hand hygiene depends on a number of factors and healthcare practitioners are responsible for assessing these factors including the type of task to be carried out and the severity of contamination (Huber, Holton and Terezhalmay 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 HCAs 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; Reitzel 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.

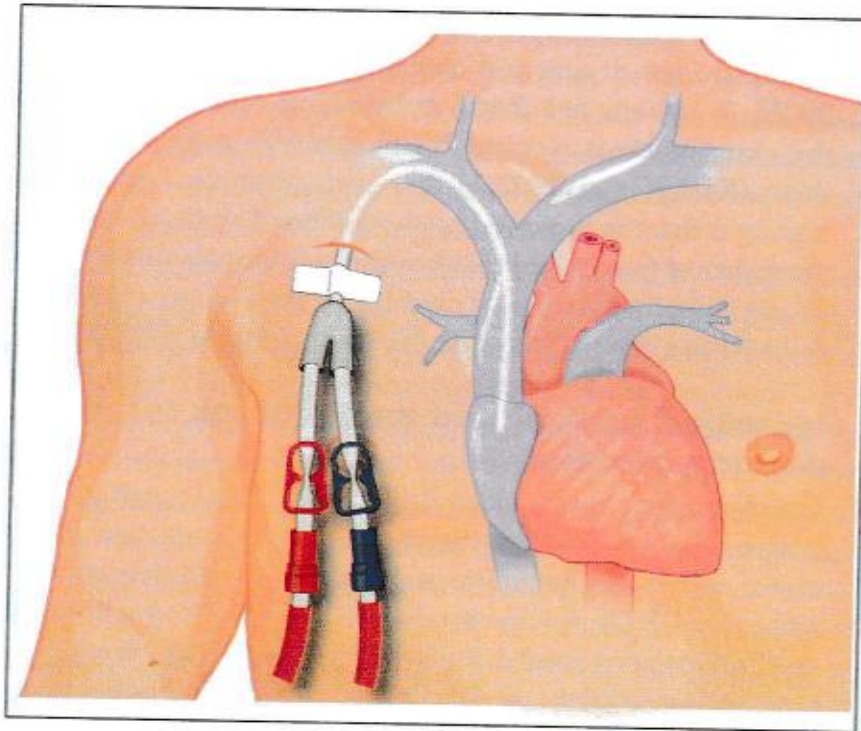


Figure 1 Long Term Dialysis Catheter

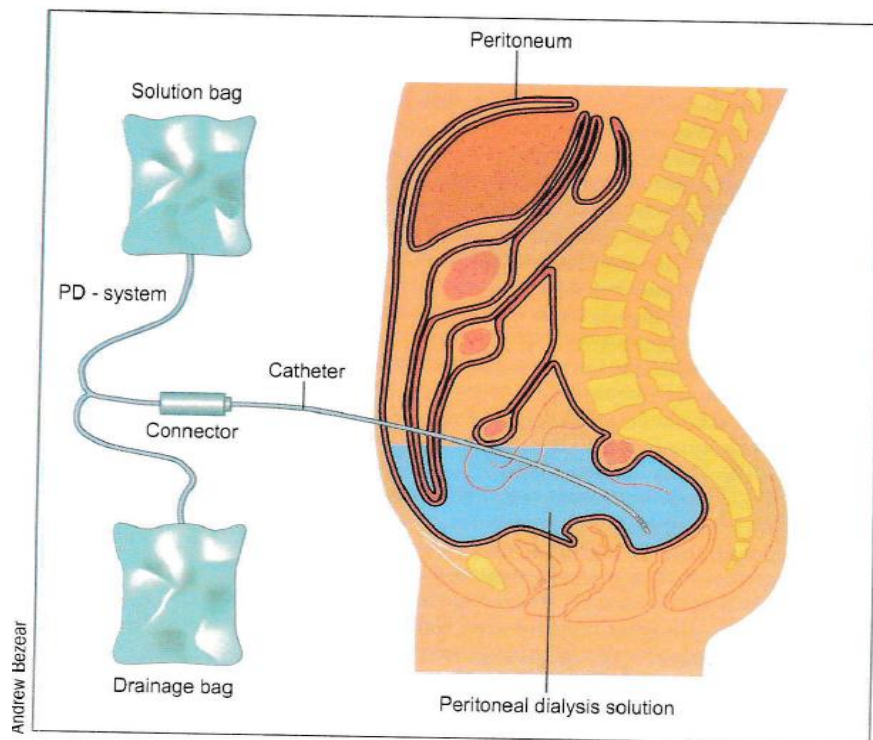


Figure 2 Peritoneal Dialysis

Limitations of the use of Evidence in Nursing Practice.

Despite the growing use of evidence in nursing practice, there are some factors that inhibit the understanding and implementation of EBP in nursing and these include:

- The busy environment of the wards and frequent shortage of staff which limits the time to appropriately use the internet to search for relevant evidence (Gerrish et al. 2007).

- Nurses' lack of knowledge and expertise to interpret and translate data into practice (Beyea and Slattery 2006).

- Nurses might feel they do not have authority to make change (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 change of practice or further research. However, in the light of current financial constraint, the funding of research projects and change of policies and procedures may not be seen as a priority.

- Staff attitude and beliefs play an important role in compliance with EBP (Holleman et al. 2006, Mashiach 2011). For example, staff having been educated about the benefits of alcohol-based gel in infection control, some staff appears not to use alcohol-based alcohol gel as some of them believe that their hands are not contaminated, the gel does not work or the gel will compromise their skin integrity.

- Limited access to computers on the wards, for the multi-disciplinary team which are most of the time used by the doctors and the ward clerk (Mashiach 2011).

- Nurses' fear of being judged as unknowledgeable by patients if they cannot translate research into practice (Holleman et al. 2006).

Conclusion

The use of evidence is an essential tool to switch nursing approach from intuition to an evidence-based profession, in order to provide a highly effective healthcare service which benefits patients as well as healthcare institutions and staff. Education in hand hygiene and infection control is pivotal in all clinical settings but highly relevant in renal nursing where patients' vascular access is very important. Alcohol-based gel has been associated with minimising the spread of gastrointestinal infections not only in hospital settings, but also in child care centres. UK national guidelines recommend the use of hand washing (implementing the right technique) when hands are visibly dirty and hand disinfection with alcohol-based gel. These should be provided by the bed side, the sinks, hospitals' and wards' entrance and used when hands are not visibly dirty, in between, before and after healthcare activities are performed.

Recommendations

There should be a proactive 'infection control link nurse' in every clinical setting, able to escalate any concerns to the infection control team in a timely manner. In addition, there is need to increase hand hygiene and hand washing compliance and to maintain surveillance of staff members' compliance to infection control measures.

To place clear instructions and guidelines on gloving technique by every glove and apron dispenser, to remind healthcare workers of the appropriate technique to use these items.

To immediately follow up test results of water that test positive for pathogens with the infection control team.

To educate patients and relatives with respect to infection control and hand hygiene.

To challenge staff members, patients and visitors who refuse to comply with hand hygiene and infection control. In addition, making posters and leaflets relating to hand washing with soap and water, disinfection with alcohol-based gel and their benefits.

To encourage regular publication of hand hygiene and infection control audits in order to promote effective infection control measures.

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