

# Alcohol gels: the end of an era?

Dr Andrew Kemp PhD (Bio), Dr Vanessa Hodgkinson MBBS, BSc, FRCA, FFPMRCA and Miss A Bugg MSc (Microbiology) take a retrospective and prospective view of the use of alcohol gels as hand sanitisers in healthcare.

In many national healthcare systems around the world there is significant pressure placed on clinical staff through the publication of guidance documents. Probably the best-known guidance document for hand hygiene is the WHO guide.<sup>14</sup> This document forms the basis of most local guidance documents.

Most published guidance documents include recommendations for the use of alcohol hand gels, and in some cases (including in the USA), instead of washing hands.<sup>1,2</sup> The most recent test results using the Bacteria Specific Rapid Metabolic Assay (BSRMA) to detect bacterial counts on hands,<sup>3,4</sup> suggest new guidance is needed.

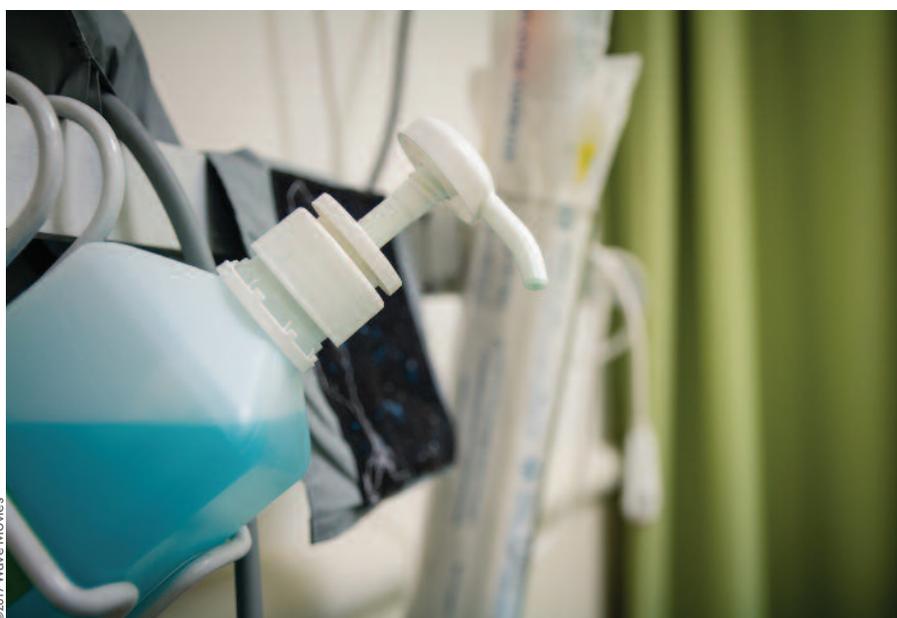
In order to discover the most effective method of hand decontamination, in both the short term and long terms, the hands of administrative staff were tested for bacterial bio burden following the use of antimicrobial soap, alcohol gel, alcohol liquid hand rub and a 5th generation Silane Quaternary Ammonium Compound (SiQAC). In a further series of tests, a combination of hand wash, followed by a single application of the 5th Generation SiQAC, and then either an alcohol gel, or alcohol liquid hand rub were used.

The data shows that the most successful results from products used in isolation were achieved using the 5th generation SiQAC. However, in order to meet the WHO requirements for 5 moments in hand hygiene,<sup>14</sup> the best combination was found to be hand wash, followed by application of a single daily dose of the 5th generation SiQAC, followed by regular use of liquid alcohol hand rub.

## Traditional techniques

Since the days of Semmelweis, clinicians working in healthcare have understood the

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fact that there is a link between Healthcare Acquired Infections (HAIs) including Surgical Site Infections (SSIs) and hand washing.<sup>5</sup> Since those days, clinical staff have used soap and running water to decontaminate hands regularly throughout their work day.

A little over 20 years ago there was a significant step change that saw a massive increase in use of alcohol gels in healthcare facilities. At around that time, there was a significant and growing amount of media attention, and pressure on the UK government to solve the problem of *Methicillin Resistant Staphylococcus Aureus* (MRSA) and other 'superbugs', a term adopted by the media. For those who remember that time of mass introduction of alcohol gels, fear and almost hysteria gripped

the nation. Headlines of "Flesh eating bugs" helped to galvanise public opinion, with alcohol gels being portrayed to all as the answer to stopping the spread of these dangerous resistant bacterial species.

In research terms, there was little efficacy data to work with, we have therefore been playing a game of "catch up" since, trying to prove the efficacy of alcohol hand gels already in widespread use in our healthcare facilities.<sup>2,3,4</sup> In the face of increasing numbers of bacteria that have resistance to antibiotics and to disinfectants, it is becoming even more important that we understand the true effects of our hand sanitation options.

Another matter of considerable concern to those who use these gels every day, is the damage that can be caused to skin at least in part by the drying effect of alcohol.<sup>9,10,11,12,13</sup>

Current World Health Organization (WHO) guidance does not actually recommend the use of alcohol gels over hand washing.<sup>14</sup> However, the US Centres for Disease Control and prevention (CDC) does recommend the use of alcohol gels as preferred to hand washing. Their guidance states that "Alcohol-

based hand sanitizers are the most effective products for reducing the number of germs on the hands of healthcare providers. Antiseptic soaps and detergents are the next most effective and non-antimicrobial soaps are the least effective".<sup>1,2</sup>

This is a clear contradictory position to that of the WHO statement: "Alcohols are not good cleansing agents and their use is not recommended when hands are dirty or visibly contaminated with proteinaceous materials".<sup>14</sup> This apparent contradiction in advice makes the important choice of which guidance to follow an even more complex decision for clinical teams when deciding the best method of hand hygiene for their areas of practice. It is also not now backed by the evidence, which heavily weighs in favour of hand washing over time.<sup>4</sup> In fact, it is only recently that any research has been published on the effects on skin bacterial counts of alcohol gels past 10 mins from application.<sup>4</sup>

There can be no doubt that there is the potential to transfer bacteria from patient to patient on the hands of clinical staff,<sup>17</sup> and as such cross contamination from the hands of clinical staff remains a potential danger to all patients in healthcare facilities.

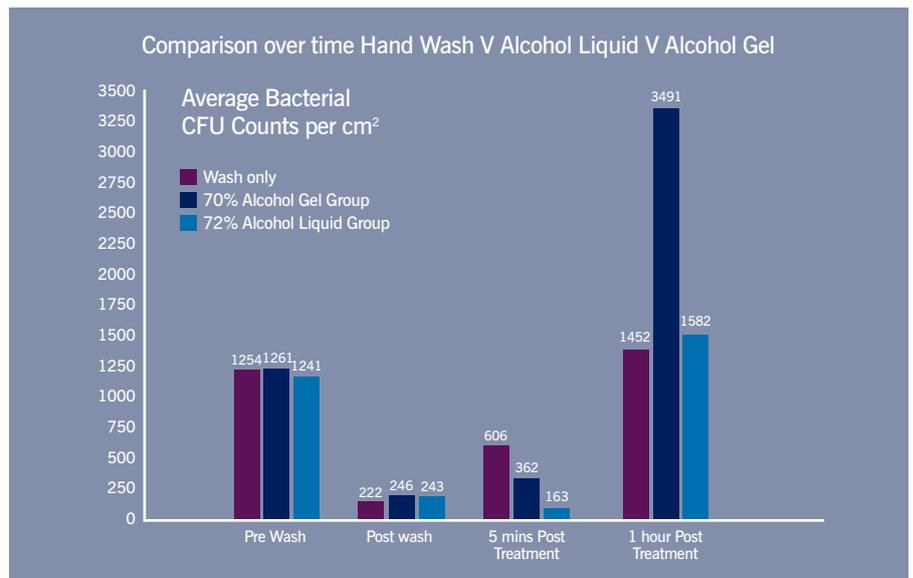
Yet another important factor in the WHO guidance is compliance, including the correct frequency of use (as per manufacturers' instructions). These are thought to be probably as important as the choice of hand disinfectant.<sup>1</sup> A highly efficacious product used less frequently than recommended, or applied incorrectly is perhaps of less use than, a less efficacious product used more frequently and applied correctly.<sup>14</sup> The question then remains: "What advice should healthcare institutions choose to follow, as their strategy for disinfecting hands?"

**Efficacy testing vs outcome studies?**

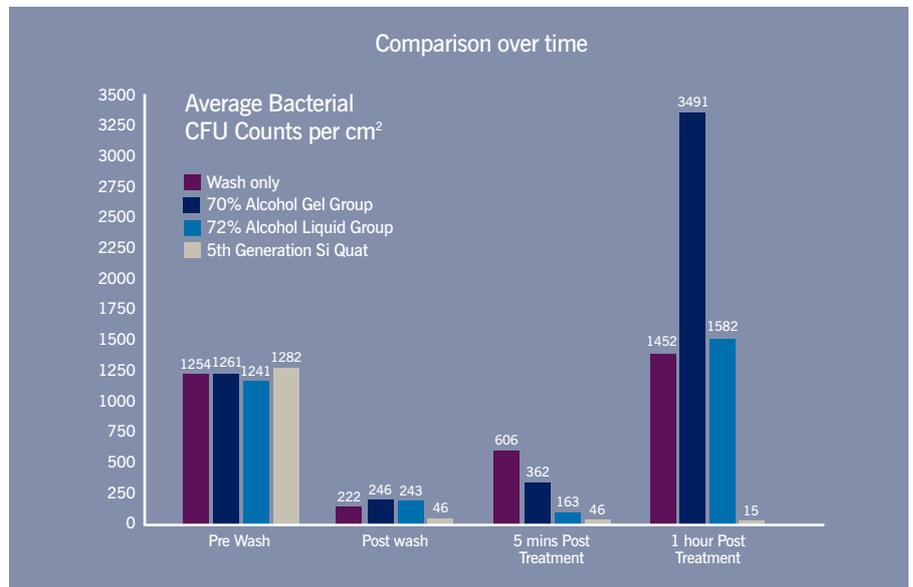
What evidence should we be looking for in order to adapt our practices, efficacy testing or patient outcome studies? There is a significant difference between the evidence provided by efficacy tests, which look at Colony Forming Units (CFUs), and outcome studies which are extremely difficult, costly and take up large amounts of the researcher's time to do in large enough numbers of patients to be statistically relevant.

In its guidance the WHO admits that not enough evidence has yet been gathered linking hospital HAI or SSI rates to either hand sanitation or surface bio burden,<sup>14</sup> reasoning that in order to be statistically relevant, the number of people required in a sample large enough to prove a reduction in infection rates of just 1% from 2% to 1% is 2500 and from 7% to 5% is 3100.<sup>14</sup>

The immediate difficulty of controlling extraneous variables particular to HAIs in samples of this size is well known. If such studies of this size and nature were to be done, they should also include, surface and hand bacterial CFU counts as a way of reducing at least some of the variables.



Graph 1 (above) demonstrates the adverse effects of alcohol gel over time, when used in isolation as per the US CDC guidance.



Graph 2 shows a comparison with between alcohol gel, alcohol liquid and a 5th generation SiQAC in isolation, after hand washing with soap and running water.

This type of study, may then provide the missing evidence of a link between HAIs, SSIs and the frequency of use and choice of hand sanitiser/ surface disinfectant. Published evidence, does not link total bacterial CFU counts, individual species, on hands, surfaces or in the air to either HAI or SSI rates.<sup>40,41,42,43,44,45,46,47</sup>

In the WHO guidance, there is a distinction between types of alcohol used (ethyl, Isopropyl etc). However, no distinction is made between types of alcohol liquid or gel hand rubs, in any publications from either the CDC<sup>1,2</sup> or WHO.<sup>14</sup> This is even though the bacterial count results when using the two types of product have been shown to be significantly different.<sup>4</sup>

In fact, the WHO guide recommends the use of alcohol gels over alcohol liquid rubs, as they appear to have a less damaging effect to the skin over time and multiple applications.<sup>14</sup> The efficacy testing over

extended time periods would not support this and difficult choices will have to be made.

**Efficacy or usability?**

It is a surprise that a literature search will find numerous studies into the efficacy of alcohol gels over periods of up to 10 mins,<sup>39,40,41,42,43,44</sup> yet there is still is only one published study looking at the efficacy of alcohol gels for longer than 10 mins after application to the skin.<sup>4</sup> Again, none of these studies look into a direct linking with either HAI or SSI rates and surface or air contamination levels.

Individually, the persistent bacterial kill of the 5th Generation SiQAC would appear to be the most effective, however in practical use, how can we be assured of low bacterial counts when moving from patient to patient?

During the Swine Flu pandemic, SiQAC hand sanitisers with long term persistent kill of microorganisms were used in the NHS ►

specialist centres set up to deal with patients displaying symptoms. In a speech shortly afterwards, Lord Warner, the then health minister stated: "The scientific evidence proves that persistent products mark a step-change in the fight against the Swine Flu pandemic. The long-lasting nature of the product, combined with its safety, means that persistent hygiene products have the potential to revolutionise the way we deal with flu and superbugs."

There has been a great deal written about alternatives to alcohol, including the use of Triclosan, and Quaternary Ammonium Compounds (QAC's).<sup>17,18,19,20,21,22,47,48,49</sup>

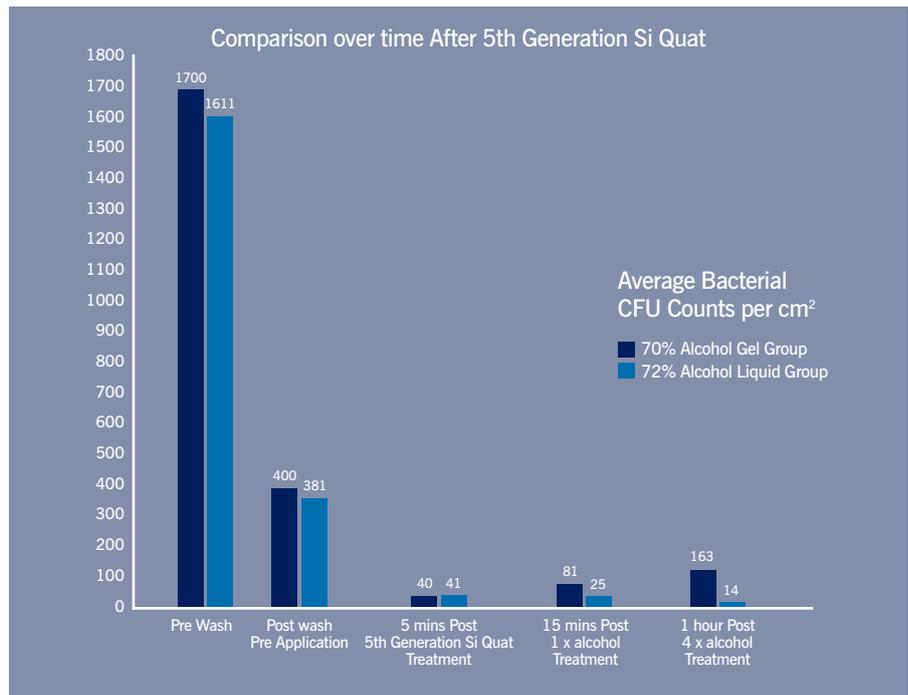
The data in graph 3, demonstrates that after an initial application of the SiQAC, the most cost effective and particle method of interpatient decontamination, is the use of alcohol liquid hand rub. Alcohol gels are again shown to display less efficacy over time than alcohol liquid rubs even when used after the SiQAC. Alcohol gel in isolation, or as a method of interpatient decontamination produces poor results over time. This is due to the significant sugars left in the residue after the alcohol has evaporated.<sup>56</sup>

### Conclusions and discussion

In an ideal world every patient would be in their own room with hand washing facilities at the entrance/exit to the room. Other areas in the hospital, such as operating theatres and out patient's clinics would also have far more hand wash facilities available to staff in convenient places. It would, however, be impractical to retro fit most hospitals to this new standard. Other ways have to be found to decontaminate hands between patient contacts.<sup>45,46,50,51,52</sup>

The data in these latest studies shows that, when used in isolation, in the short term and over time, alcohol is less effective than the 5th generation SiQAC. The data also shows, it is still possible to use the 5 moments in hand hygiene recommended by the WHO,<sup>14</sup> adapted to include the use of a persistent compound in the form of a 5th generation SiQAC which will improve efficacy in the short term and over time. It is also clear now that what happens to skin and surfaces over extended time periods is a very important question to have answered before the wholesale introduction of any disinfecting products, let alone products associated with hand hygiene.

There can be no doubt that test methods used by both regulatory bodies and clinical microbiology labs are in need of a significant overhaul. The fact that there is no commonality between the efficacy tests regulators require from skin sanitisers and surface disinfectants, and those individual hospital laboratories are able to perform, speaks volumes about the lack of a connection between the two types of institution. The WHO acknowledges the inefficiencies and inadequacies of current test methods in its latest guidance.<sup>14</sup> At the moment it is therefore, incumbent on the researcher to choose the method they think



Graph 3 (above) shows the effect of applying a 5th generation SiQAC after hand washing with soap and running water. 15 mins later and for the next hour at regular 15 min intervals staff re apply either an alcohol hand gel, or an alcohol liquid.

will best demonstrate the hypothesis they are testing.

When the increase in the use of alcohol gels occurred more than 20 years ago, there was very little evidence of efficacy in use available. The conclusion must be drawn that its large-scale introduction was not based on either clinical outcome evidence, or on efficacy evidence from the regulators. It is hoped that this would not be the case if these products were launched for use today.

In retrospect, it is now difficult to understand the reasons the healthcare profession around the world seems to have simply accepted the pressure to continue to use these products without anything like the amount of scrutiny that would be required for their introduction today. It is therefore most likely that it was a political reaction to the public, fuelled by the media pressure of the day. This could possibly have been helped by significant lobbying on behalf of the chemical industry that produces alcohol gels.

The introduction of new testing methods

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previously only available to the military have given us sight not just on initial efficacy, but also on the efficacy over time of these products.<sup>3,6,7,8</sup>

A significant additional problem, to determining the best choice of antimicrobial, is that there are a multitude of tests required by various regulators that look for Minimum Inhibitory Concentrations (MIC's) of antimicrobial skin disinfectants. It is clear that the MIC of these chemicals bears no relationship to the killing time when actually applied to hands in clinical situations,<sup>14,15,16,28,29</sup> nor does it look at their effects over extended periods of time. Although field testing is difficult to control for extraneous influences, it does appear to give a clearer picture of actual bacterial bioburden in practice.<sup>4</sup> Use of a BSRMA, although not seen until recently due to its delayed release by the military for civilian use, has not only revolutionised the speed of testing of skin bacterial CFU's, it has accurately shown levels of bacterial contamination never seen before using standard methods.<sup>3</sup> Although a number of studies have demonstrated the effect of hand sanitation on HAI rates, none find a positive link between hand cleansing efficacy and surface contamination rates.<sup>14,18,23,26</sup>

As a result we still do not fully understand the effect different hand sanitation techniques have on surface contamination levels, and significantly, we still do not know exactly how much of a role surfaces play in the transmission of HAIs. We therefore need more large-scale studies that integrate all these factors to help answer these most important questions.

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