Author's response to reviews

Title: How does healthcare worker handwashing behaviour impact upon the transmission of MRSA between patients? : an analysis using a Monte Carlo model

Authors:

Clive B Beggs (C.B.Beggs@bradford.ac.uk)
Simon J Shepherd (S.J.Shepherd@bradford.ac.uk)
Kevin G Kerr (kevin.kerr@hdft.nhs.uk)

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Author's response to reviews: see over
Reviewer: Rezhan Hussein

1. I am not sure about the usefulness of the study.

While we respect the reviewer’s opinion, we point out that, to our best knowledge, the risk of MRSA transmission via the hands of healthcare workers has never before been systematically calculated. With respect we believe our data are of relevance to infection control strategies which place significant emphasis on the frequency of hand-washing as a control measure and make an important contribution to the evidence base on optimum hand hygiene frequency. We would also point out that Reviewer No. 2 comments that our manuscript is “an article of importance in its field”.

2. Some assumptions are made which is not necessary accurate e. g. "Alcohol hand gel is superior to hand washing" in reality there is some debate about the effectiveness of alcohol based gel in C. difficile spores.

We agree with the reviewer that there is debate around the effectiveness of alcohol-based products against some healthcare-associated pathogens. However, in the model we used published data on the relative efficacy of hand rub versus soap. We have amended this line in the manuscript to denote that the relative efficacies were based on published data.
3. The document has spelling errors “foussed, practised”.

We thank the reviewer for pointing out typographical errors which we have corrected with the exception of “practised” which, we believe is correct usage.

Reviewer: Ronan Murray

1. Quite a few missing full-stops in the manuscript.

We have added the full-stops in the revised version of the manuscript.

2. The terms MRSA, S. aureus, staphylococci and pathogenic staphlyococci are used interchangeably through the manuscript – the terminology should be made consistent (ie refer only to MRSA).

We thank the reviewer for pointing out these differences in terminology and we now use methicillin-resistant S. aureus and MRSA throughout.

3. Similarly, the terms “hand hygiene”, “hand washing” and “hand cleansing” are also used interchangeably – this should be changed to one term only.

We have standardised the terminology throughout.

4. The use of gloves and other personal protective equipment is common with patients with exudative wounds, drains, tracheostomies etc etc whether or not they are known to be colonised with multiresistant organisms. Was the use of intermittent PPE factored into the assumptions? If not, then this should be stated.

This iteration of the model did not consider the intermittent use of PPE accordingly a statement to this effect has been included in the manuscript.
5. The term “efficiency” is used initially when referring to hand cleansing process, however the term “efficacy” is used in table 1 – as these have different meanings, it needs to be made clear which is meant.

We thank the reviewer for pointing this out and now use the term ‘efficacy’ throughout the text.

6. Using this simulation model, the average probability / risk of MRSA transmission from patient A to B with no hand cleaning is 4%. Whilst accepting that this is lower than a single exposure to a highly communicable disease (eg varicella, measles), in the setting of healthcare transmission of bacteria, that risk is in my opinion quite high, rather than ‘relatively low”, particularly as several HCWs may make the patient A-to-B journeys on numerous occasions in a shift, which would increase this risk in the real-life setting.

The comment ‘relatively low’ has been removed from the text and an appropriate comment addressing this point has been added to the discussion. With regard to the reviewer’s statement about the number of journeys undertaken, we must point out that the probability of transmission is constant no matter how many journeys are made by the healthcare worker (i.e. a 4% risk means that one transmission event will occur every 20 journeys – however, the risk is still 4% if only 10 journeys are made).
7. The statement: “The intervention of the hand cleansing process is clearly visible for six of these inpatient movements in figure 1©, whereas on 6 occasions the fact that the HCW did not wash his/her hands is evident” - I take this to mean that the 6 interactions with the probability of transmission of 1 are the ones where the authors claim that hand cleansing didn’t occur – but given the efficacy of hand cleansing is not 100%, how can you be sure that the probability of 1 in these events is due to the lack of hand cleansing (i.e., that transmission occurred because the hand cleansing was performed but was ineffective)? Perhaps insert the word “effectively” before “wash his/her hands” to make it clearer?

The text has been expanded to clarify analysis of Figure 1 (c).

8. Due to the number of assumptions made in the model, there should be a paragraph outlining the limitations of the applicability of the data to clinical practice (e.g., the lack of control for patients likely to be at risk of higher transmission such as those with exudative wounds and pneumonitis, inability to adjust for intermittent PPE use, environmental contamination effects not considered)

A paragraph stating the assumptions and limitations of the model has been added to the discussion section.
9. Similarly, I think the first line of the first paragraph should be ‘tempered’ to reflect the fact that this is a mathematical modelling exercise based on a number of assumptions, rather than a longitudinal hospital / patient-based study of colonisation risk. Additionally, it should be clear that the results shouldn’t be extrapolated to other “healthcare associated bacterium” (eg C. difficile, Acinetobacter spp, Pseudomonas) where environmental niches and transmission patterns are likely to be different to MRSA.

The comments about Clostridium difficile and Acinetobacter have been noted and an appropriate statement added to the text.

10. Re: the line “Indeed, as high risk events become more infrequent, other factors, such as the admission of colonized patients onto wards, tend to become more dominant” suggest inert the words “MRSA” between “of” and “colonised”.

The word ‘of’ has been added to the text.