The Leading Source of Scientific, Professional & Consumer Information

Newsletter

December 2018

Please share this resource

If you find this newsletter of value, please encourage your colleagues to join our mailing list. With your help we want to reach as many people as possible. Ask them to sign up here.

To get the latest news and research as it happens, follow IFH on Twitter...

Contents

1. Hand, surface and laundry hygiene: Can we use “infection risk reduction” as the basis for selecting the “right” intervention? QMRA says “yes we can”

Traditionally, selecting the “right” hygienic cleaning practice (detergent-based, disinfectant, heat), etc is based on its ability to produce a target $\log_{10}$ reduction (e.g 3, 4 or 5) in contamination as determined by standardized or other lab test methods. This is despite lack of evidence that, in practice, this is appropriate to reduce infection risks to an acceptable level, or that it is the most sustainable approach (i.e. does not represent unnecessary overuse of resources such as biocides, heat, water, etc).

Researchers at the University of Arizona are showing how Quantitative Microbial Risk Assessment provides a way to develop hygiene procedures based on their ability to reduce infection risk. QMRA involves using published data (initial pathogen level, transfer rates via hands and surfaces, infectious dose, etc.) to model the chain of infection and give a quantitative estimate of infection risk. This is then used to estimate the $\log_{10}$ reduction (LR) in surface or hand contamination needed to reduce the infection risk to an acceptable level.

In their most recent study [1], Reynolds et al constructed a model (using data from the literature) quantifying rates of transfer of rotavirus, rhinovirus and influenza A where a contaminated surface was touched with the fingers, and the fingers then touched the mouth, nose or eyes. The data was then used to calculate the infection risk, and infection risk reduction achieved by decontamination of the surface before touching. Case 1 utilized a single touch, while case 2 assumed 6 hours of contact activities.

From this they estimated that, for a single touch of the surface (Case 1), an average, 4 LR was sufficient to achieve a 10^{-6} safety target level (i.e. a risk of infection from hand to mouth less than 1 in 1 million) for rotavirus and rhinovirus, whilst influenza virus required a 1.23 LR or less. The smaller value for influenza reflects its higher infectious dose (numbers of virus particles required to cause infection) relative to rhino and rotavirus.

Under case 2 conditions, it was estimated that a 1.23 LR reduced the infection risk below one in a million for influenza A, but only one in one thousand for rota and rhinovirus. In order to also reduce risk of infection for rotavirus and rhinovirus below one in a million, a 5 $\log_{10}$ reduction (one of the highest current efficacy claims for disinfection products) was required.

Although the authors agree that the quality of the data generated by QMRA is dependent on the quality of data used in the modelling, it provides a practical approach to ensuring that hygiene interventions are appropriate to their intended use i.e. breaking the chain of infection transmission. In particular, their study demonstrates that risk reduction targets for low-infectious-dose viruses such a norovirus, rhinovirus and rotavirus may be more challenging to achieve than for enveloped viruses such as influenza, and bacterial strains.

---

2. IFH white paper – you can't make omelettes without cracking eggs! Sustainable use of hygiene resources

This latest data from Reynolds et al is a further example of how QMRA can be used to develop hygiene procedures for use in home and everyday life settings which are both effective and sustainable.

In October, IFH released a white paper calling for an integrated strategy for developing and promoting hygiene behaviour change in home and everyday life.[2] It calls for a balanced approach where importance of hygiene is balanced against environmental, antimicrobial resistance, human safety etc issues. To achieve this, the paper proposes a "risk management" approach (which we call targeted hygiene) where hygiene practices are focused on breaking the chain of infection transmission via critical sites and surfaces, thereby ensuring cost effective use of cleaning and hygiene products.

The paper also proposes a framework for developing hygiene practices which addresses the question "how can we combine the necessary resources in the most "sustainable manner" to reduce microbes to a safe level in any given situation". This involves using QMRA to estimate the total $\log_{10}$ reduction required to reduce contamination to a "safe level" based on the expected contamination level and exposure risks in that situation. To reduce contamination on hands, surfaces and fabrics, use of one or more resources (water, heat, mechanical action, detergent, and microbiocides) is inevitable, but all of these processes consume resource (water, energy) or have potential environmental and other impacts (detergent, microbiocides). The framework sets out how these resources can be combined to achieve the total LR required in the most effective and sustainable manner. The framework is further described in other publications. [3] [4]

One example where this is being employed is in development of low temperature laundering. [5] Data show that low temperature laundering is accompanied by significant reduction in hygiene efficacy, but this can be compensated by using detergents containing active oxygen bleach (which delivers low level microbiocidal action sufficient to compensate for lack of heat inactivation), or increasing cycles times to increase detachment of microbes from fabrics

A further example is the way in which cleaning of surfaces prior to application of disinfectant is advised because disinfectants are inactivated by organic soiling. Why don't we take account of the fact that the cleaning process also contributes to the hygiene effectiveness of the procedure?

3. References

1. The paper can be found at: Wilson AM, Reynolds KA, Sexton JD, Canales RA. Modelling surface disinfection needs to meet microbial risk reduction targets. Appl. Environ. Microbiol. 2018 Sep 15;84(18):e00709-18.

2. Containing the burden of infectious diseases is everyone's responsibility: a call for an integrated strategy for developing and promoting hygiene behaviour change in home and everyday life. https://www.ifh-homehygiene.org/review/containing-burden-infectious-diseases-everyones-responsibility-call-integrated-strategy

3. Bloomfield SF, Carling PC, Exner M. A unified framework for developing effective hygiene procedures for hands, environmental surfaces and laundry in healthcare, domestic, food handling and other settings. GMS Hyg Infect Control. 2017;12:Doc08. DOI: 10.3205/dgkh000293, URN: urn:nbn:de:0183-dgkh0002937 Available at: http://www.egms.de/en/journals/dgkh/2017-12/dgkh000293.shtml.

4. Bloomfield SF. Developing an Evidence-Based Approach to Domestic Hygiene Which Protects Against Infection Whilst Also Addressing Sustainability Issues, Tenside Surf. Det. 55(5) (2018) 356-363. DOI 10.3139/113.110576. https://www.hanser-elibrary.com/doi/pdf/10.3139/113.110576

5. Brands B, Brinkmann A, Bloomfield SF, Bockmühl DP. Microbicidal action of heat, detergents and active oxygen bleach as components of laundry hygiene. Tenside Surf. Det. 2016;*53*:495-501.
