

TOO CLEAN OR NOT TOO CLEAN?

The Case for Targeted Hygiene in the
Home and Everyday Life



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Executive summary

Key points

- Hygiene in the home and everyday life is vital for protecting the public's health by preventing the spread of harmful microbes and hence reducing the risks of contracting infectious diseases.
- A new survey commissioned by RSPH shows that the importance of hygiene is fairly well understood by the public, including its role in reducing pressure on the NHS and tackling antibiotic resistance.
- Exposure to diverse mostly non-harmful microbes from other people, domestic animals and the natural environment is important to help build a healthy microbiome (the array of many micro-organisms hosted by our bodies in the gut and respiratory tract). There is a general understanding among the public about the importance of a healthy microbiome.
- However, the survey also reveals public confusion about the relationship between dirt, germs, cleanliness and hygiene, and that while the importance of hygiene is well understood, the times and situations where it is most necessary are not.
- Furthermore, a worrying one in four (23%) of those surveyed believed hygiene in the home was not important, thinking children need to be exposed to harmful germs to build their immune system. This misconception has likely gained traction from sections of the media frequently posing the question: 'are we too clean?'
- This report outlines a more focused approach to hygiene – Targeted Hygiene – whereby the spread of infection is prevented by intervening at critical points to break the chain of infection. Firstly, by focusing hygiene in the places and at the times that matter, Targeted Hygiene sustains exposure to the beneficial microbes required for a healthy microbiome. Secondly, it prevents infections which need treatment with antibiotics that can adversely affect the microbiome.
- RSPH supports Targeted Hygiene as the key to improving standards of hygiene practice in home and everyday life, while simultaneously supporting a healthy microbiome.

Calls to action

- The school Personal, Social, Health and Economic (PSHE) education curriculum should include ensuring an understanding of the chain of infection and the need for Targeted Hygiene.
- Manufacturers of cleaning and hygiene products should recognise their role in promoting hygiene best practice by developing clearer labelling and simple information leaflets to be issued with their hygiene products.
- Stakeholders with an interest in hygiene – including those with a focus on the environment, allergies and antimicrobial resistance – should work together to develop a common approach to hygiene in the home and everyday life, with consistent terminology, to avoid conflicting public messaging from different lobbying groups.
- Action needs to be taken to educate those working in the media about key issues relating to the importance of Targeted Hygiene to help ensure they do not give confusing and counter-productive messages.



1. Introduction

1.1: The importance of hygiene for the public's health

Antibiotic resistance is a global health priority and an urgent public health threat: overuse and misuse of antibiotics has allowed the development of antibiotic resistant bacteria which may in future lead to difficulties treating infections with antibiotics.^{1,2} Hygiene has a crucial role in tackling antibiotic resistance, namely by preventing the spread of infection and therefore reducing the demand for antibiotics (whether correctly prescribed or not). Hygiene also prevents the spread of antibiotic-resistant bacterial strains across communities, reducing the harm caused by such strains.

This report aims to explore the public's understanding and practice of hygiene and has been prompted by the recent publication of a white paper commissioned by the International Scientific Forum on Home Hygiene (IFH).³ It is clear that hygiene is a vital tool for tackling some of the UK's key health issues, protecting the public's health, reducing pressure on the NHS and tackling antibiotic resistance. Our newly emerging understanding of the human microbiome in human health is also adding weight to our awareness of the important role of hygiene. The microbiome is the genetic material of all the microbes on and inside the body, and is essential for development, immunity and nutrition.²⁷

'Hygiene' refers to the prevention of the spread of harmful microbes and is something that is practised on a daily basis, whether by flushing the toilet, washing hands or washing clothes. The importance of hygiene in the home and everyday life is sometimes understated, but is crucial for tackling some of the most pressing health concerns of our time.

Most obviously, hygiene has a crucial part to play in preventing the spread of infectious disease. Infectious disease greatly impacts health and remains at unnecessarily high levels in the United Kingdom. Studies have suggested that around **one in four people experience an infectious intestinal disease each year, with around one in twenty experiencing norovirus** (the leading cause of infectious intestinal disease across the globe).^{4,5} The **average number of colds per year is estimated at between four and six for adults and six to eight for children.**⁶ Good hygiene has the power to prevent these diseases by reducing the spread of harmful microbes, known as pathogens.⁷

Emergence of new pathogens or new strains of existing pathogens is also an ongoing concern. In the event of a pandemic, hygiene in the home and everyday life is a crucial first line of defence during the early critical period before mass vaccination or other measures become available.⁸

Another reason that the prevention of infectious disease is of particular importance is that the UK has an ageing population. Ageing leads to a reduction in the capacity of the immune system (known as 'immunosenescence') and therefore greater susceptibility to infection, so with a growing number of at risk individuals in a community, infectious disease is an increasingly relevant concern.

The prevention of ill health through practising good hygiene has the power to alleviate some of the burden on the health system. The NHS has been described as in 'crisis' due to significant demand and insufficient funding and resources to meet population needs. Promoting good health and preventing illness are now key parts of government strategy for increasing the sustainability of the NHS.^{9,10} In addition, there may be an increased level of home-based healthcare – rather than hospital-based care – in the future, and good hygiene practices in the home will be vital for reducing the chance of hospitalisation in these cases.



1.2: Supporting the human microbiome

The study of the human microbiome is an exciting, newly-emerging field with profound implications for the public's health. The microbiome refers to the microbes inhabiting our body –including the gut, skin, and respiratory tract.¹¹ It has been suggested that these microbes constitute an organ that is as vital for health as the liver or kidneys. **The microbes in the gut alone can weigh up to two kilos and contain around 100 trillion bacteria.**¹²

Research is now showing the extent to which 'good bacteria' in the body, and especially in the gut, can influence health – impacting on mental health, weight gain and more. 'Good bacteria' are critical for maintaining health, and an imbalance may lead to various diseases, including gastrointestinal disorders.²⁸ Around 80% of the immune system is located in the gut because of the large population of microbes residing there.¹² It is becoming increasingly clear that diverse exposure to human, animal and natural environments, particularly in early life, is key to building a healthy microbiome,^{13,14} and that

failure to do so may be associated with rising levels of allergic, autoimmune and other diseases.^{14,15} However, this failure is not a result of being 'too clean'.

Epidemiological studies indicate that there are multiple underlying causes of reduced microbial exposure, including urbanisation, access to clean water and food, caesarean sections rather than childbirths, and lifestyle changes such as bottle rather than breast feeding, reduced sibling interaction, and reduced outdoor activity.¹⁴ It is also becoming clear that excessive antibiotic use can adversely affect the microbiome.¹⁶ Antibiotics are damaging to the diversity of the microbiome as they reduce the population of 'beneficial', as well as harmful, microbes. Therefore, in order to maintain a healthy microbiome it is important to avoid infections which necessitate using antibiotics. In this way, practising good hygiene has a role in maintaining a diverse and healthy microbiome.

1.3: Our survey

The findings presented in the remainder of this report are the results of a nationally representative online survey commissioned by RSPH in September 2018 and conducted through the independent polling company, Populus. The polling was designed in order to better understand the public's hygiene practices – both inside and outside the home – as well as their beliefs and knowledge about concepts related to hygiene.

2. Dismantling the ‘Hygiene Hypothesis’

Although the notion of diverse microbial exposure being key to good health is now correctly accepted by many, there is also a worrying and possibly related misconception about hygiene. This is the belief that good hygiene itself can be problematic because it is responsible for reducing contact with important microbes. This concept dates from the introduction of the ‘Hygiene Hypothesis’ in the late 1980s which suggested that rising rates of allergies in children were linked to lower incidence of infectious disease in early childhood, and that an underlying cause was ‘improved household amenities and higher standards of personal cleanliness’.¹⁷ The concept of over-cleanliness was widely publicised in the 1990s.¹⁸

However, the original ‘Hygiene Hypothesis’ has since been refuted. It is now understood that what is important is diverse exposure to microbes that are mostly harmless, rather than infections from harmful microbes.¹⁴ Furthermore, as discussed in section 1.2, the underlying cause of reduced exposure to beneficial microbes is now understood to be attributed more to lifestyle changes (more C-sections, less outdoor activity, more antibiotics etc.) than to hygiene and cleanliness.


While it is possible that cleaning practices used excessively at unnecessary times might reduce the diversity of beneficial microbes in the home environment, there is a lack of evidence to either support or refute this. If home cleanliness is a factor its impact on the microbiome is likely to be low relative to lifestyle factors.¹⁴ Indeed, microbiological data indicates that, after cleaning or cleaning and disinfection, microbes on environmental surfaces return to pre-cleaning levels in a very short time. The role of hygiene in reducing exposure to good microbes has typically been overstated in the media, and the crucial role of hygiene for preventing infection has sometimes been disregarded.

Despite the progress in our understanding, some media coverage continues to promote the idea that a low microbiome diversity (and its harmful health effects) could be avoided if people started being less clean or hygienic. A small scale audit conducted by the International Scientific Forum on Home Hygiene (IFH) of 36 articles published in the UK and US from 1998 to 2017 found that 70% emphasised the role of home cleanliness as a causative factor in rising health problems, referring to the home environment as being ‘too clean’, ‘too hygienic’ or ‘over-sanitised’.¹⁸

In our survey, we found that almost one in four (23%) of the public agreed with the statement ‘hygiene in the home is not important because children need to be exposed to harmful germs to build their immune system’, which might suggest a belief that harmful infections can be beneficial to children’s development. This is a potentially harmful belief which could lead to children being exposed unnecessarily to harmful or even life-threatening infections.

Similar sentiments were expressed when respondents were asked to identify factors that prevent children coming into contact with bacteria which they believe to be beneficial to their child’s health. Although 59% and 56% of people identified lifestyle factors such as using too many antibiotics and spending too much time indoors as causative factors, almost as many people (55% and 52% respectively) still hold the view that keeping homes too clean and using too many antibacterials were important. Only 22% and 9% respectively identified C sections (rather than natural childbirth) and bottle feeding (rather than breast feeding) as possible factors.

“ One in four agreed that hygiene in the home is not important because of the need for children to be exposed to harmful germs. ”



These results suggest the public may have a poor understanding of the factors reducing diversity of the microbiome and, of particular concern, may believe that decent household hygiene is actively harmful to the microbiome and children's health. When we asked respondents where they tended to get hygiene information from, nearly three in four (73%) said they got at least some of their knowledge from the media, followed closely by family (76%) and health services (81%). This highlights the role the media as well as family and health services may have played in spreading misleading and inaccurate information.

Despite this, the majority of people acknowledged the importance of hygiene in the home in general, with only 2% of those surveyed saying hygiene in the home was not at all important. The survey also indicated that people were generally aware of current issues which are now making hygiene even more important.

Overall, our survey suggests an encouraging level of awareness of the importance of hygiene in regards to antibiotic resistance, pressure on the health system and the prevention of ill health, but also suggests that conflicting myths around the 'Hygiene Hypothesis' remain prevalent and potentially harmful.

3. Introducing Targeted Hygiene

Breaking the chain of infection

Growing acceptance of the importance of the human microbiome to health requires that our hygiene practices are carefully designed to maximise protection against microbes that cause infection whilst at the same time sustaining exposure to the more beneficial microbes – that is, those in the human, animal and natural environments which are required to maintain a healthy and diverse microbiome.

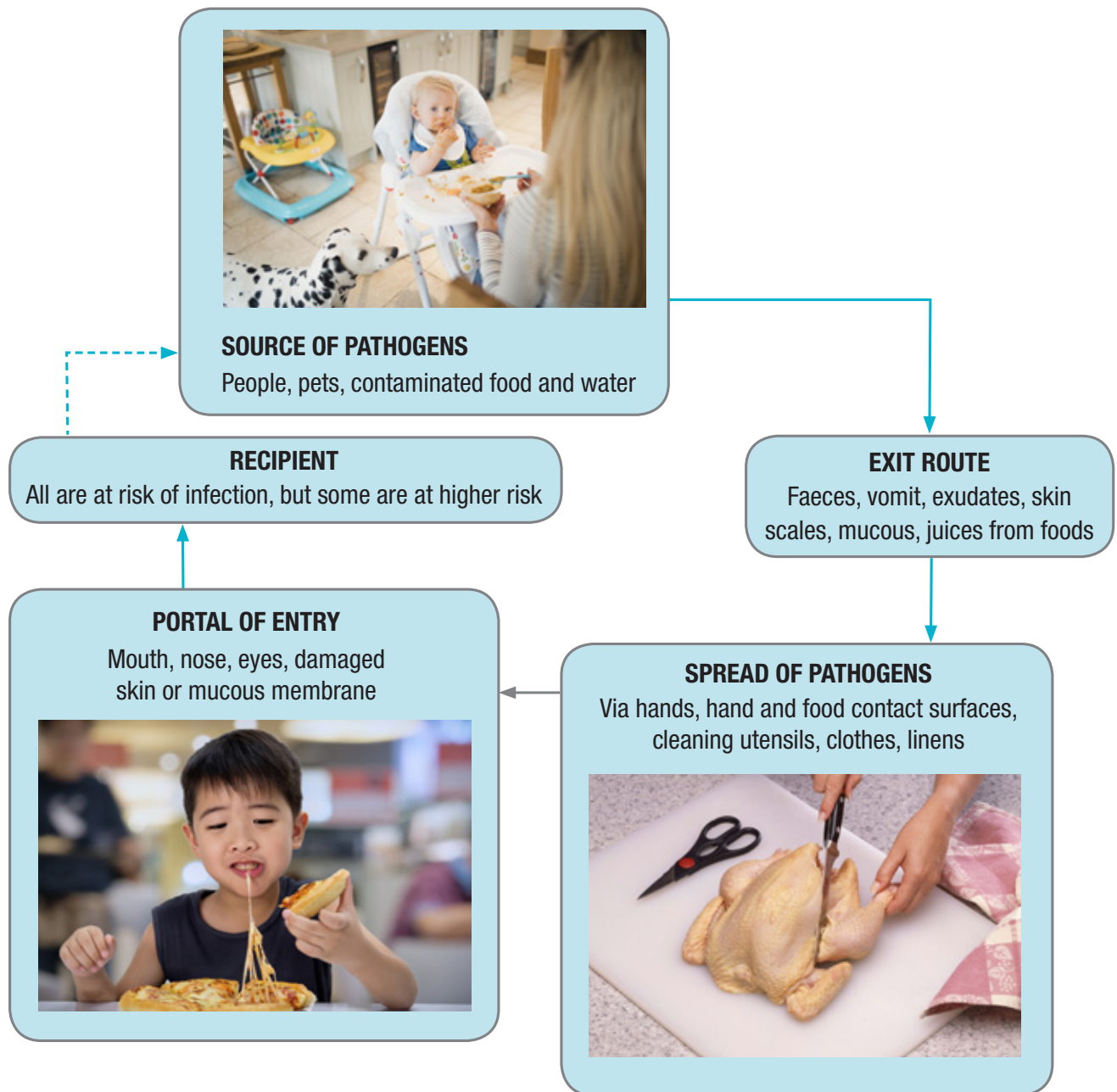
Since the 1980s, a risk-management approach for hygiene in the home and everyday life has been developed by the International Scientific Forum on Home Hygiene (IFH) known as 'Targeted Hygiene'.¹⁹ Targeted Hygiene means focusing our hygiene practices in places and at times when harmful microbes are most likely to be spreading in order to break the chain of infection (illustrated in Fig. 1).

This contrasts with historical approaches equating hygiene with eradicating dirt – incorrectly regarded as the main source of harmful microbes. An analysis of UK and US media coverage suggests that we still largely see hygiene as synonymous with cleanliness, and that the terms 'cleaning' and 'hygiene' are often used interchangeably, causing confusion about what hygiene really means.¹⁸

Targeted Hygiene means recognising that the main sources of harmful microbes (called pathogens) are typically not places which are 'dirty', but contaminated foods, domestic animals (pets), people who are infected, or people who are themselves healthy but are 'carriers' of microbes which are potentially harmful to others (e.g. *Staphylococcus aureus* or its resistant form, MRSA). Since the presence of potential sources of harmful microbes in the home is inevitable, this means that the way to protect ourselves from infection is by stopping these microbes from spreading at the times that matter as shown in Fig. 1.



Figure 1: The chain of infection



The times when harmful microbes are most likely to be spread – that is, the times when we need to practise hygiene are:

- During food handling.
- Whilst eating with fingers.
- Using the toilet.
- Coughing, sneezing and nose blowing.
- Handling and laundering 'dirty' clothing and household linens.
- Caring for domestic animals.
- Handling and disposing of refuse.
- Caring for an infected family member who is shedding infectious microbes into the environment by vomiting or diarrhoea, or by touching foods or hand contact surfaces.

Fig. 2 shows the places that matter for Targeted Hygiene. The surfaces most often responsible for the spread of harmful microbes in the above situations (and therefore where hygiene practices are the most important) are surfaces such as the hands, hand contact surfaces, food contact surfaces and via cleaning cloths.²⁰ Hygienic cleaning of hands is particularly important after handling food, using the toilet, coughing, sneezing, handling pets, disposing of waste and caring for those who are sick. Hygienic cleaning of food contact surfaces is vital after preparing raw foods such as meat and poultry, or before preparing ready to eat foods such as sandwiches and snacks. Hygienic cleaning of cleaning cloths and other cleaning utensils is important after they have been used to clean a contaminated surface.

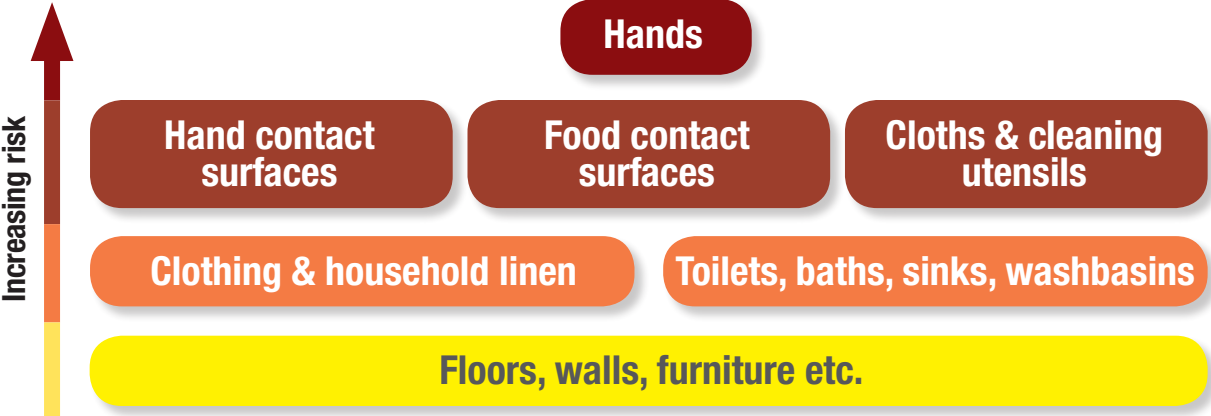
Clothing, household linens, toilets, sink and bath surfaces can also contribute to establishing a chain of infection, although risks associated with these surfaces are normally somewhat lower as they rely on other 'chain links' such as hands to transfer the microbes from the fabric or sink surface to a susceptible person. Advising people how often to launder clothing or clean bathroom and toilet surfaces is extremely difficult, but regular cleaning and laundering can contribute to preventing spread of infection particularly where there is someone who is infected (e.g. with norovirus, cold virus or food poisoning) or who is more vulnerable to infection. For infections such as the cold, flu, and norovirus, spread of infection may also be airborne and so good ventilation is important.

Cleanliness achieved by routine (non-targeted) daily or weekly cleaning of floors and furniture may contribute to preventing exposure to harmful microbes, but there is little data to suggest that its contribution is significant relative to hygienic cleaning at critical points at key times. Although surfaces such as floors and furniture may look visibly dirty and may have high levels of microbes, they are usually lower risk because harmful microbes are unlikely to be present.

Getting the public to understand and visualize the concept of breaking the chain of infection by targeting the links in the chain is key to getting them to practise effective Targeted Hygiene. The principles and practice of Targeted Hygiene, including advice on how to make hands, surfaces, clothing and more hygienically clean are set out in the self-learning resources produced by IFH and the UK Infection Prevention Society.²¹

Targeted Hygiene is also important because it represents a more effective use of resources than routine non-targeted cleaning. However, it is important that hygiene practices are as sustainable as possible without sacrificing on infection prevention. For example, laundry detergents that produce clean clothes at less than 30 degrees are promoted as being more sustainable in terms of reducing domestic energy consumption but may be insufficient for preventing spread of infectious and antibiotic resistant microbes via clothing.^{22,23}

Figure 2: Ranking of sites and surfaces based on risk of infection transmission



Furthermore, since the 1990s, there has been lobbying against the use of disinfectants or antibacterials in the home because of as yet unproven concerns that their use may contribute to antibiotic resistance.^{24,25} However, these products are sometimes necessary to break the chain of infection, and in doing so this avoids the need for antibiotic treatments. Targeted Hygiene addresses the need to balance the importance of maximising infection prevention with ensuring efficient and economic use of resources. The benefits of Targeted Hygiene are summarised in Figure 3.

	No hygiene	Targeted Hygiene	Routine non-targeted cleaning
	Not handwashing, cleaning surfaces etc. at all	Cleaning and disinfection in the places and times where and when harmful microbes are most likely to be spread	Routine indiscriminate cleaning and disinfection of the home, including floors
Pros		<p>Effective reduction in infection risk because it intervenes where and when harmful microbes are most likely to be spread</p> <p>Reduced time and effort relative to non-targeted cleaning</p> <p>Keeps use of resources like heat, water, detergents and disinfectants to a minimum</p> <p>Exposure to beneficial microbes kept to the maximum</p>	Cleanliness can generate a sense of wellbeing, thereby contributing to health
Cons	Increased risk of exposure to harmful microbes		<p>Infection risk not reduced relative to Targeted Hygiene but with increased time and effort</p> <p>Increased use of resources – and corresponding impact on environment, sustainability, human safety, antibiotic resistance</p> <p>Does not ensure maximum exposure to good microbes (although whether this is problematic is unclear)</p>

Figure 3: The pros and cons of different hygiene strategies.

Figure 4: Break the chain of infection



4. The public's hygiene practice

In our survey, we asked about the extent to which people practise Targeted Hygiene.

- Nearly three-quarters (73%) of respondents said they 'always' washed their hands thoroughly with soap after using the toilet and after preparing raw meat. This seemed to tally well with the perceived risk to health of those actions, with over three quarters (76%) believing handling raw meat and not washing hands with soap afterwards was highly risky for health, and over half (57%) believing not washing hands with soap after using the toilet was high risk.
 - On the other hand, failure to practise good hygiene was linked with low risk perception: almost one in four people (22%) said they never washed and dried dish cloths between use, and almost one in three people (32%) believed this was low risk; similarly, one in five people (20%) said they never washed towels and/or bed linen at 60 degrees or above and almost half (43%) said this was low risk.
- Therefore, it appears that the public tend to practise good hygiene when they understand that not doing so would be risky for health, but there are gaps in public understanding of where that risk may lie.**
- Interestingly, there was also a gender difference in risk perception and hygiene practice, with men consistently more likely than women to say unhygienic behaviour had low or no risk for health. Women also tended to indicate better hygiene practice – for example, men were twice as likely as women to say they never washed their hands after sneezing.
 - There also remained a misunderstanding that being hygienic involves the removal of dirt: almost two-thirds of those we surveyed (61%) said touching a child's dirty hands after they have been playing outside was likely to spread harmful germs, despite the fact that there is little evidence that outdoor dirt and soil is contaminated with harmful microbes (unless there are animals nearby). Over one third of respondents (36%) believed dirt was usually or always harmful. This signifies a conflation of the understanding of cleanliness and hygiene – people may believe that dirt is a good signal of harmful germs and therefore that visual cleanliness indicates a surface is hygienic.
 - Around three in four (72%) said it was very important to remove germs from inside the toilet, despite the fact this is largely achieved by the flushing action, and almost four in five people (79%) said it was very or fairly important to remove germs from the floor. This indicates a lack of understanding that it is key to remove harmful microbes from places where the probability of being exposed to those microbes is high, rather than places such as in the toilet where harmful microbes may be found but are less likely to be spread.





The power of language

A lack of understanding of hygiene can also be compounded by confusing terminology, for example when words such as bacteria, pathogens, microbes and germs are used interchangeably and without explanation. The growing understanding of the microbiome and the need for exposure to beneficial microbes necessitates clearer communication with the public when referring to microbes as to whether they may be harmful or not.

A survey by IFH of media coverage¹⁸ from 1998-2017 found that of 18 articles surveying microbes in homes, two-thirds emphasised the large numbers of microbes typically found on surfaces, quoting numbers ranging from hundreds to millions per sample area; and yet, most did not say that finding large numbers is normal and that most of those microbes are unlikely to be harmful. Terms used for microbes were mostly 'germs' (10 of 18 articles) or 'bacteria' (11 of 18 articles) but only four articles mentioned that the microbes identified were not usually harmful to health.

Confusion around terminology was reflected in our survey, with one in five people (19%) believing germs are always harmful, but less than half (43%) understanding that pathogens (the accepted scientific term for harmful microbes) are always harmful. Additionally, around one in five people believed that 'microbes' and 'bacteria' were always harmful (18% and 28% respectively).

The fact that people interpret these terms differently represents a barrier to the adoption of Targeted Hygiene, because it encourages the belief that harmful microbes are found everywhere in our homes in large numbers, especially in places perceived as dirty. Targeted Hygiene depends on differentiating high risk situations where harmful microbes are present from low-risk situations where microbes are either not harmful or there is little chance of exposure to them.

5. Summary of findings

It is clear that good hygiene practice in the home and everyday life is an important health issue and the most cost effective and sustainable way to tackle some of the most demanding health issues of the 21st Century. It is encouraging that our survey found that the public tended to understand the essential role of hygiene for reducing infection risk, preventing the spread of antibiotic resistance and relieving pressure on the health system, but there were clear gaps in their understanding of hygiene, what it is, and how it differs from cleanliness.

Overall, our survey identified several key areas of public misunderstanding:

- the belief that exposure to harmful microbes is beneficial for health;
- a lack of understanding of the importance of lifestyle changes, rather than hygiene and cleanliness, in reducing diversity of the human microbiome;
- gaps in understanding of infection transmission risks. While there was good understanding of the importance of hands as a mean of transmitting harmful microbes, there was poor appreciation of the risks from reusing contaminated dishcloths or by laundering clothing and linens at a low temperature;
- a persistent belief that dirt is associated with harmful microbes whilst visual cleanliness means an absence of harmful microbes;
- confusion over whether the commonly used term 'germs' means 'any type of microbe', or whether it refers specifically to microbes which are harmful.

Changing hygiene behaviour depends not only on promoting good hygiene practice but also improving public understanding and restoring confidence in hygiene.



Getting outdoors and in contact with family, friends, pets and the natural environment helps to sustain exposure to the beneficial microbes needed for a healthy microbiome. At the same time, targeted hygiene must be practised when handling and eating food, in order to break the chain of infection.

6. Calls to action

A multi-faceted approach to improving public understanding of hygiene in the home and everyday lives will be needed going forward if we are to bring about change. We have therefore formulated recommendations aimed at a variety of stakeholders:

- Education in schools on the chain of infection and the Targeted Hygiene approach to breaking the chain of infection should be included in the core curriculum. This should embed best practice of hygiene from an early age and promote consistent understanding of the terminology used to talk about hygiene and hygiene issues. The value of hygiene in the home and everyday life should be promoted in the PSHE curriculum.

A promising development is the e-bug project, launched in 2008, which aims to ensure that all children leave school with a basic understanding of hygiene and antibiotic resistance. The importance of hygiene education in schools has also recently been recognised by NICE in their guidance document on antimicrobial stewardship.²⁶

- We call on manufacturers to help people to understand and practise Targeted Hygiene by developing clearer labelling and simple information leaflets to be issued with their hygiene products. An example of such an information leaflet is shown in Fig. 4 (pages 12-13), showing clearly and simply the when, where and how of keeping one's family healthy by breaking the chain of infection.

With 71% of those we surveyed saying they got some of their knowledge about hygiene from adverts for cleaning and hygiene products, manufacturers have a responsibility to promote best practice.

- More research is needed on the extent to which public misconceptions about hygiene represent a barrier to behaviour change, and whether better understanding of hygiene and hygiene issues can positively impact on outcomes of hygiene promotion interventions.
- Stakeholders with an interest in hygiene – including those with a focus on the environment, allergies and antimicrobial resistance – should work together to develop a common approach to hygiene in the home and everyday life to avoid conflicting messages from different lobbying groups.
- Action needs to be taken to educate those working in the media about key issues relating to the importance of Targeted Hygiene to help ensure they do not give confusing and counter-productive messages.

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8. Acknowledgements

RSPH would like to thank the following for their valuable contributions to this report.

Professor Sally Bloomfield

Honorary Professor at the London School of Hygiene and Tropical Medicine

Professor Lisa Ackerley

RSPH Trustee and independent food safety consultant

Paul Morris

Founder & CEO, Addmaster

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Global RD&E Director, SC Johnson Professional

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June 2019