

Clothing, household linens, laundry and home hygiene

This fact sheet has been put together to provide background information and practical advice on what to do about the risk of spread of infection via clothing and household linens. This fact sheet has been produced for healthcare professionals, community workers and the media, and others who are looking for background understanding about infection risks associated with domestic laundry and/or are responsible for providing guidance to the public on how to launder clothing and household linens

Clothing, household linens and items such as cleaning cloths, like the any other surface in the home, can become contaminated with potentially harmful microbes (bacteria, viruses and fungi) during normal daily wear or use.¹ Although infection risks for clothing and household linens may be less than those associated with hands or other common hand touch surfaces, nevertheless these risks need to be appropriately managed in accordance with the level of risk. As well as making clothing etc visibly clean, home laundering should also be able to both:

- Reduce the risk of transmission of infectious illnesses amongst family members
- Reduce the “silent” spread of antibiotic resistant strains such as MRSA (resident skin carriers), or multidrug resistant Gram negative species (e.g. NDM-1, ESBL-producing strains which may be carried e.g within the bowel flora) amongst healthy family members

Activities or situations where clothing and household linens can spread microbes such that family members may become colonised or infected include:

- During wear, or use of items such as underwear, socks, bedlinens, towels etc which are contaminated with potentially harmful or antibiotic resistant strains
- When infected family members share items such as towels with other family members during normal daily activities.
- When members of sports teams share items such as towels
- Where contaminated and non-contaminated items are included in the same laundry cycle, contamination can pass from contaminated to uncontaminated items
- When contaminated clothing is handled before laundering or when inadequately laundered items are transferred/handled from the washer
- If there is a build up of microbes in the washing machine (e.g build up of biofilms) these may be deposited on the clothing etc during laundering
- If the laundry process fails to fully remove contamination and laundry remains damp for a period, there is the chance for growth of residual micro-organisms.



Reducing spread of germs between family members

In the home, the major sources of microbes which need to be controlled through good hygiene practices are infected or colonised family members, domestic pets and food (mainly raw food).

Infectious agents that have the potential to spread via clothing and other fabric items, including cleaning cloths, include enteric bacteria such as *Salmonella*, *Shigella*, *Campylobacter*, *E. coli* (including *E. coli* O157 and O104) and *C. difficile*, and enteric viral strains such as norovirus, rotavirus, adenovirus and astrovirus. It also includes respiratory (cold and flu) viruses such as rhinovirus and respiratory syncytial virus. Risks from skin pathogens are mainly associated with *Staphylococcus aureus* (including meticillin resistant *S. aureus*, MRSA), yeasts (such as *Candida albicans*) together with dermatophyte fungal strains such as *Trichophyton rubrum* (responsible for athlete's foot), and viral strains such as herpes. In developed countries *T. rubrum* accounts for 70% of all dermatophytoses (including athlete's foot) in humans and can be transmitted via socks.

Clothing and household linens such as towels, sheets etc that are most likely to become contaminated with pathogens from family members are those which come into direct contact with the body e.g. underwear, personal towels, bedlinen, facecloths, nappies. "Outer" clothing i.e. clothing not in direct contact with the body, is less likely to be a risk unless it becomes contaminated by e.g. vomit or faeces. Micro-organisms can be transferred from one family member to another, where family members share towels, for example.

Other "fabric items" which can spread germs around the home are cleaning cloths, dishcloths and tea towels. These, together with hands, and hand and food contact surfaces are considered by IFH to be the "high risk" routes for transmission of microbes in the home.² Cloths which are used during food preparation, or are used to clean the toilet or areas around the toilet are a particular risk as are cloths used to clean up material such as faeces or vomit, or surfaces associated with domestic animals. These items should ideally be decontaminated after each session of use, either by laundering or by other suitable means. For more information consult the IFH information and hygiene advice sheet "Look after the cleaning cloths in your home – and they will look after you".

How big is the risk for clothing and household linens?

From an analysis of the microbiological and epidemiological data, IFH has concluded that clothing and household linens etc are a risk factor for transmission of infection in home and everyday life settings during normal daily activities, although the lack of quantitative data directly linking contaminated clothing to infection in the domestic setting makes it difficult to assess the extent of the risk.¹

Although the microbiological data indicates that the "normal daily life" risks from clothing and household linens are somewhat less than those associated with hands, hand contact and food contact surfaces, and cleaning cloths which are seen as the key routes of transmission in the home, nevertheless it is concluded that these risks need to be appropriately managed through effective laundering practices.



These conclusions are drawn from an IFH review¹ of data showing how pathogens (or strains which may spread antibiotic resistance determinants) are transferred to clothing etc from a variety of sources during normal daily life, and the extent to which they can survive and spread from contaminated fabrics to hands and surfaces, such that we can become exposed to potentially infectious doses. The review also identified some 18 observational studies of cases, outbreaks of infection and self-reported infections in which clothing, etc was identified as a likely source of infection transmission. The most direct evidence of a link between inadequate domestic and community laundering and infection comes from a study of New York households which showed that, out of a wide range of hygiene practices studied, 2 specific “targeted” laundry practices, using a communal laundry and not using bleach in communal laundering, were associated with increased infection risk, whereas for all other cleaning practices which were assessed there was no evidence of association with infection risk.³ A further study showed that using hot water and using bleach for laundering was protective against infection.

It is important to recognise that infection risks associated with contaminated clothing etc are not constant, and can increase significantly under certain conditions. e.g. in healthcare situations. Risks of transmission via clothing etc are likely to increase in situations where a family member has diarrhoea or vomiting, or a skin or wound infection. It also increases in circumstances where a family member has reduced immunity to infection. People with reduced immunity now make up an increasing proportion of the population, currently up to 20%.⁴ The largest proportion is the elderly, many of whom have chronic ill health with associated with increased vulnerability to infection. In situations of increased risk the approach to hygiene is the same as for “normal” family members, the difference being that, if effective procedures are not used and/or these procedures are not rigorously applied there is higher infection risk.

In view of the current level of public health concern about infection risks associated with home and everyday life settings, particularly in relation to increasing healthcare now delivered at home to people who are infected or to vulnerable groups, there is growing awareness of the need to promote safe laundering of clothing and household linens as part of a multibarrier approach to home hygiene which also includes hand, food, respiratory and other hygiene practices in the home. This is also important as a strategy to reduce the spread of antibiotic resistant strains and reduce the need for antibiotic prescribing.

Reducing the “silent” spread of antibiotic resistant strains

Tackling antibiotic resistance is a global priority, and, in the last few years, there has been increasing awareness that hygiene measures are an important part of reducing spread of resistant strains.⁵ Currently, the focus is on resistant superbugs in hospitals, but it is now recognised that this is just as much a home and community problem. In the community, otherwise healthy people can become persistent skin carriers of MRSA, or faecal carriers of enterobacteria strains which can carry multi-antibiotic resistance factors (e.g NDM-1 or ESBL-producing strains). Because these people are perfectly healthy, the risks are not apparent until, for example, they are admitted to hospital, when they can become “self infected” with their own resistant organisms following a surgical procedure, and then spread it to other patients. It is thought that the major source of healthcare-associated infection is the patient’s own endogenous body flora. Sometimes these infections occur in the community, as



happened in 2005 when a young soldier acquired what should have been an easily treatable skin infection from a PVL-producing strain of MRSA, but subsequently died. As persistent nasal, skin or bowel carriage in the healthy population spreads “silently” across the world, the risks from resistant strains in both hospitals and the community increases. In the last few years a significant amount of new data has been published showing the extent to which “healthy” people in the community can carry resistant strains, and how person to person transmission can occur within the home.⁶

Transmission of *Staphylococcus aureus* and Methicillin resistant *Staphylococcus aureus* (MRSA) via clothing and linens

Staphylococcus aureus is an organism which is carried harmlessly in the nostrils, throat, and on the skin (particularly in areas such as the armpits and groin). About one third of the population constantly carry *S. aureus*, and one third carry it on a transient/short term basis. Usually the individual is unharmed by colonisation, but where the skin becomes damaged e.g. superficial wounds or abrasions or ulcers, or develops conditions such as psoriasis and eczema, the organism can cause infections such as boils. Occasionally a serious infection such as bacteraemia can result. *S. aureus* carriers constantly shed the organism from the skin's surface, most usually associated with skin scales. These organisms can become attached to clothing or household linens where they can survive for long periods of time, even in dry clothing, and can be transmitted to other family members.

Of particular concern are the new “community” strains of MRSA (CA-MRSA). Experience in the USA suggests that these strains are transmissible within families, but also in community settings such as prisons, schools and sport teams. Skin-to-skin contact (including intact unabraded skin) and indirect contact with contaminated objects such as towels, sheets and sports equipment seem to represent the mode of transmission. This means that care of sports clothing and equipment is important to prevent the spread of this organism. Sports clothing and equipment such as towels should be laundered after each use.

A review of the evidence indicates that clothing and household linens are a risk factor for spread of *S. aureus* (including MRSA and PVL-producing MRSA strains), and that effectiveness of laundry processes may be an important factor in defining the rate of community spread of these strains.¹

For more information about *S. aureus* and MRSA consult the IFH fact/hygiene advice sheet “Methicillin Resistant *Staphylococcus aureus* (MRSA) and the home”.

What about *Clostridium difficile*?

Whether, or to what extent, underclothing might be a vehicle for spread of *C. difficile* in the community is not known. A UK study suggests that only about 1 in 5 of *C. difficile* infections are spread between patients in hospital.⁷ There is growing awareness that community-acquired *C. difficile* is important and there are data indicating transmission to humans from animals. Studies suggest carriage rates for *C. difficile* in the healthy adult community of up to 3% with higher colonisation rates in the over 65 age group.^{8,9}



How does laundering reduce germ levels on clothing?

During laundering, temperature, together with the action of water and detergent work together to reduce microbial contamination levels on fabrics:

Physical removal.

During the main cycle, dirt and microbes are detached from the fabric and suspended into the wash water. These are then “washed away” during the rinse and spin cycles. This mechanism is often referred to as dilution.

Thermal inactivation.

In addition to physical removal, micro-organisms can be killed by heat. Thermal inactivation increases as the temperature is increased.

Chemical inactivation.

During laundering, some chemical inactivation of microbes by the surfactants and activated oxygen-based bleach used in detergents contributes to the hygiene effectiveness of laundering (see more details below). Adding hypochlorite bleach in the washing process also achieves inactivation of microbes.

A number of other components can also contribute including:

- Where laundry is dried, added microbicidal effect can be achieved particularly from exposure to sunlight.
- Drying in a tumble drier can further reduce microbial load.
- Where clothes and linens are ironed, particularly where they are ironed damp, heat and steam penetrating the fabric causes reductions of microbial load.
- Microbial contamination is further reduced if clothes are stored dry.

Data on the hygiene effectiveness of laundering is given in a 2013 IFH review.¹⁰

Formulation of laundry detergents

Laundry detergents contain a mix of ingredients including surfactants, builders, optical brighteners, perfume etc. In common usage, "detergent" refers to mixtures of chemical compounds including alkylbenzenesulfonates, which are similar to soap but are less affected by hard water. The cleaning action of laundry detergents arises primarily from the action of the surfactants and other ingredients, which are designed to maximise release and suspension of dirt and microbes into the wash liquid, together with enzymes and/or an activated oxygen-based bleach which digest and remove stains. These are then rinsed away during the rinse and spin cycles.

Although activated oxygen bleach is included in many powder detergents to digest and remove stains, it also produces some chemical inactivation of bacteria, fungi and viruses. Surfactants also exert some chemical inactivation action against certain species although the extent of their action is not known. The extent of inactivation will depend on the concentration, wash temperature, pH, level of soiling etc.

Examples of the most common activated oxygen bleaches used in laundry detergents are persalts (now commonly percarbonate) plus activators such as tetraacetythylenediamine (TAED) which generate peracetic acid in situ. The rate and extent of release of active oxygen and thus the microbicidal action decreases



as the wash temperature decreases, but bleach activator manufacturers claim that effective action can be delivered even at temperatures down to 20°C.

The principal components of all cleaning products must be listed on the pack by law and not all laundry detergents contain activated oxygen bleach components. If a laundry product contains a bleach system, “oxygen-based bleaching agent” will be listed as one of the ingredients on the pack. If it is not listed, it means that the product does not contain an activated oxygen bleach. As a rule of thumb, powders and tablets normally contain an activated oxygen bleach, but liquids, and products used for “coloureds” do not:

	Powder / Tablets					Liquids				
	Bio		Non-bio		Colour	Bio		Non-bio		Colour
'bleach'	+	+	+	+	-	-	-	-	-	-
Enzymes	+	+	-	-	+/-	+	+	-	-	+/-

For more information go to:

http://uk.cleanright.eu/index.php?option=com_content&task=view&id=112&Itemid=143&Itemid_fourth=130

Low temperature laundering

Whilst laundry hygiene is important, equally it is important to consider sustainability issues i.e the environmental impact of higher temperature laundering, use of detergents and other chemicals, and the need to conserve water. In recent years the household soap and detergents industry has made a significant investment in developing laundry products that perform (i.e deliver clean clothing) at low temperatures. The energy consumption required to heat the water in a washing machine contributes by far the largest proportion of the environmental impact of laundering. In order to save energy, increasingly over the past few years, home laundering has been carried out at lower temperatures (30-40°C).

The desire to wear and use clothing etc which is clean, is deeply rooted part of our culture in terms of nurturing our families, feeling good about ourselves and so on. From a public health perspective however, it is important that the process of laundering is also effective in managing risks associated with potentially harmful microbes, bearing in mind that visibly clean and hygienically clean are not necessarily the same thing. Although laundry processes should be able to deliver clean fabrics with the minimum use of water, power and chemicals, it is equally important that laundered clothing and household linens do not represent a risk in terms of transmitting potentially harmful microorganisms.

The guidance given in this document is based on the principle that, if we are to minimise energy consumption associated with household laundering whilst at the same time managing infection risks, the items that make up the weekly wash need to be segregated into categories, with relatively more stringent laundering requirements specified for higher risk categories.



Standardising laundry temperatures and other laundering conditions

In 2013 IFH carried out a review of the data on the hygiene effectiveness of laundering at various temperatures, under varying conditions.¹⁰ A key finding was the lack of standardisation and control within studies, and the variability in test conditions (wash cycle time, number of rinses etc) between studies. The consequent variability in the data (i.e the reduction in contamination on fabrics) obtained, in turn makes it extremely difficult to propose guidelines for laundering with any confidence, based on currently available data. As a result there is significant variability in the recommendations for hygienic laundering of clothing etc in healthcare and domestic situations given by different agencies.¹¹⁻¹⁶

A particular concern is recent data^{17,18} suggesting that, although guidance can be given about preferred laundering temperatures, in reality modern washing machines do not reach the temperature specified on the machine controls. The data also showed the differing extents to which temperature declines during the wash cycle. These data suggest that, for programmes set at 60°C, the maximum temperature reached ranged from around 46-53°C, whilst for programmes set at 40°C, the maximum temperature was around 35-39°C. For programmes set at 30°C, the maximum temperature was about 28-29°C. A 2013 WHICH report showed that around two thirds of UK domestic washing machines set to 60°C did not actually reach the prescribed temperature.¹⁹

Uniforms of healthcare workers

In the UK, US and elsewhere, healthcare workers frequently launder their uniforms at home. Microbiological evidence shows the extent to which their clothing can become contaminated by contact with infected patients indicating the importance of effective laundry hygiene at home.¹ A UK questionnaire study of nurses working in 3 hospitals indicated that 31% of nurses did not use the hospital laundry whilst a US survey of nursing staff indicated that 26% home-laundered their scrubs.

Uniforms of healthcare workers should be laundered separately from other laundry items. They should be handled and washed or laundered using a process which eliminates the risk of spread of infection in the home.

Guidance on machine laundering of clothing and household linens

The following guidance is primarily intended for reference use by hygiene professionals/infection control practitioners, community workers, the professional and consumer media etc who need to give advice to their patients, or to the public in general. Because of the need to launder different categories of clothing at different temperatures according to level of risk, and the need to take account of the heat and bleach sensitivities of different fabrics, these guidelines are somewhat complex. For communication with consumers/patients, the information needs to be interpreted and simplified to meet the specific needs of the individual patient or public group, and transmitted through leaflets and/or one to one communication etc.



As a rule of thumb:

For higher risk items		Launder at 60°C or more with an active oxygen bleach-containing detergent
For lower risk items	For items which come into close and persistent contact with the body	Launder at 30-40°C with an active oxygen bleach-containing detergent
	For items not in close and persistent contact with the body	Laundering at 30°C with all/any formulated detergent should be sufficient

As discussed in more detail above, the lack of consistent data on the hygiene effectiveness of laundering at various temperatures, under varying conditions makes it extremely difficult to propose guidelines for home laundering for consumers with confidence, based on currently available data. A particular concern is data suggesting that in reality modern washing machines do not reach the temperature specified on the machine controls.

Although it could be argued that there is no clear epidemiological data showing to what extent clothing etc contributes to transmission of potentially harmful organisms, or that lowering of laundry temperatures constitutes a health risk to consumers, there is extensive microbiological and epidemiological data demonstrating some level of health hazard.¹ In view of all these considerations, IFH has concluded that that laundry guidance should follow a precautionary approach, which incorporates a margin of safety against the current lack of standardisation and control which means that typically some household cycles deliver significantly lower hygiene effectiveness than others.

The following guidance has been formulated to give consumers the best and most appropriate guidance based on current knowledge, taking account of both environmental issues and the need to protect consumer health. If we could understand more about the infection risks, the factors which contribute to the hygiene effectiveness of laundering, and how to better control domestic machine laundering parameters such as temperature in order to deliver hygiene effectiveness, hopefully, in the longer term, it should be possible to recommend a less precautionary (i.e less stringent) level of guidance, thereby further increasing the sustainability of the laundry process.

Categorization of laundry items according to level of risk

The following guidance is based on the principle that, in order to minimise overall energy consumption associated with household laundering whilst at the same time managing infection risks, the items that make up the weekly wash need to be segregated into categories according to level of risk, and relatively more stringent laundering requirements specified for higher risk categories. It is recommended that clothing, household linens etc. should be divided into the following categories:



Category A. Higher risk items

Category A1

Specific items of clothing, household linens etc. where there is considered to be a higher risk that they may have become contaminated with pathogens or antibiotic resistant strains during normal daily use or wear including:

- Uniforms of healthcare workers and clothing of other workers who are likely to come into contact with pathogens, which are laundered at home e.g. restaurant, laboratory and sewage workers, veterinarians, farmers, etc.
- Clothing of family members giving care to infected family members
- Clothing etc. which is heavily soiled e.g. with faeces or vomit, or body fluids (including re-usable babies' nappies)
- Sports clothing, particularly high-contact sports such as rugby football, American football, martial arts, etc.
- Cloths, towels etc used in the kitchen during food preparation, in the nursery and in the toilet area.
- Clothing of patients in hospitals, which is taken home by the family for laundering
- Clothes of patients with chronic wounds (up to 1 - 2 % of every old people will have chronic wounds which can be heavily contaminated with *Staphylococcus aureus* and *Pseudomonas aeruginosa*).
- Clothing of family members with skin diseases such as dermatitis, who may be heavy shedders of e.g. *S. aureus*
- Fabric items associated with domestic pets e.g. pet blankets

Category A2

All items of clothing, household linens etc. used or worn in situations where there is higher infection risk:

- because someone in the home is infected - e.g. shedding bacterial pathogens in faeces, or fungal pathogens, such as in athletes foot, from their skin, or *Candida* from mucous membranes
- because there is someone in the home who is particularly vulnerable to infection e.g. undergoing cancer chemotherapy, HIV/AIDS etc.

Category B. Lower risk items

Category B1

Those items of normal daily wear which come into direct, significant and persistent contact with body surfaces during normal daily wear (see endnote i) This includes:

- underclothing (including socks, vests, bras, pants), sweat shirts, towels, bed linens, face cloths and other personal items

Category B2

Those items of normal daily wear outer clothing which do not have extensive and persistent contact with body surfaces. This is considered to apply to items such as:

- jackets, sweaters, skirts, trousers, soft furnishings, table linens etc.



Where category B items are being used or worn in “risk” situations as described for Category A2 above (i.e where a family member is infected, or at increased risk of infection) they should be considered as category A and laundered as per instructions for laundering of Category A.

Guidance for laundering of Category A and Category B items

The following conditions for laundering are recommended:

Before wash

Never put wet items in the laundry basket

Separate laundry so you don't "mix germs":

- Do not mix potentially soiled (towels, linens, underclothing) with low risk clothing (shirts, trousers, socks)
- Do not mix "food with other" i.e. do not mix tea towels and dishcloths with other items

Laundering of Category A items.

It is recommended that these items should always be machine laundered at 60°C or more, using an active oxygen bleach-based laundry product (see endnotes ii and iii). The hygienic effectiveness of laundering under these conditions depends on ensuring that:

- the machine is not overloaded i.e. is loaded according to instructions
- the correct dosage of detergent is added according to pack instructions,
- the machine, load and wash water is heated to, and reaches 60°C, prior to commencement of the cycle (see endnote iv).
- a standard wash cycle is used (i.e avoid a “quick wash”, “water saving” or other “eco” cycles)
- the load is subjected to at least 2, preferably 3 rinse and spin cycles

Notes:

1. Laundering at 60°C should be possible for most Category A1 items because of the types of fabrics which are used.
 - For some items, particularly in Category A2 (delicates, coloureds or woollens), it may not be possible to wash at these temperatures and/or to use a bleach-based detergent. For these items the following is recommended:
 - Carry out a prewash by soaking clothes in cold water with non oxygen bleach-based detergent. Drain off as much wash liquid as possible and if possible wring out. Then wash at 30-40°C according to instructions on the care label.
 - The hygiene effectiveness of the process may be increased by using an antimicrobial prewash product or hygienic rinse aid according to manufacturer's instructions and claims guidance on efficacy (i.e its efficacy against bacteria and/or viruses and/or fungi etc.)
 - For items which are not sensitive to bleach, chlorine bleach (1 cup of household bleach diluted to 2 pints water) may be added to the final rinse cycle to give an additional level of hygiene assurance



- In some cases it may be advisable to use a professional laundering service in order to achieve adequate hygiene.

2. Segregation of laundry

Although the evidence suggests that laundering of items at 60°C with an activated oxygen bleach-based detergent is sufficient to prevent transmission of any pathogens between different items within the same wash load, because of the “risk status” of these items it is advised that Category A items are segregated into separate loads e.g.

- Launder items used around food, e.g. tea towels and dishcloths, separately from other items.
- Launder items from a known infected person, or items visibly/heavily soiled with blood, faeces or potentially infected body fluids separately from items for other family members
- Uniforms of healthcare and other designated workers should be laundered separately from other laundry items.

3. Hygienic quality assurance of these items can be further increased (i.e. the margin of safety) by:

- Drying in sunlight
- Tumble drying at 40°C or more, for 20 minutes or more (see endnote v).
- Ironing – particularly steam ironing

4. Where a family member is known to be infected with *Clostridium difficile*, laundering of soiled items at 60°C with an activated oxygen bleach-based detergent is not sufficient. Local infection control teams should be consulted to determine the most suitable means to ensure decontamination.

5. Heavily soiled items. As stated above, it is advised that items soiled with blood, vomit, etc. should be laundered at 60°C with an activated oxygen bleach-based detergent. By contrast items heavily soiled with food material (unless it is uncooked raw foods such as raw meat or chicken), mud etc. may appear very dirty but are not necessarily contaminated with high levels of pathogens. However it may be necessary to launder these items at 60°C with an activated oxygen bleach-based detergent in order to achieve the desired level of visible cleanliness

6. Additional guidance:

- Wear disposable latex gloves when handling laundry if it is visibly soiled.
- Remove residual solid material with a tissue and placing it in the toilet before laundering or washing.
- Sluicing (hand-washing dirty linen before putting it in the washing machine) is not recommended as this can create aerosols that may contain pathogens.
- Wash hands after handling soiled laundry.
- Dry laundry as soon as possible after washing.

7. House dust mites. House dust mites which can cause allergies can build up in all types of household textiles. Laundering at 60°C with an activated oxygen bleach-based detergent is recommended to reduce the risk.



Laundering of Category B items

Category B1 items

It is recommended that these items should be machine laundered at 30-40°C, using an activated oxygen bleach-based laundry product (see endnotes ii and iii). The hygienic effectiveness of laundering under these conditions depends on ensuring that:

- the machine is not overloaded i.e. is loaded according to instructions
- the correct dosage of detergent is added according to pack instructions,
- the machine, load and wash water is heated to, and reaches 30 or 40°C, prior to commencement of the cycle (see endnote iv)
- a standard wash cycle is used (i.e avoid a “quick wash”, “water saving” or other “eco” cycles)
- the load is subjected to at least 2, preferably 3 rinse and spin cycles

Category B2 items

For **category B2** items, which are considered as “lower risk” (i.e. excluding in situations where family members are infected, or at increased risk of infection), although laundering at 30°C with a non activated oxygen bleach-based detergent is considered to deliver limited decontamination, this is considered satisfactory for these items.

Notes:

1. Although laundering at 30-40°C with an oxygen bleach-based detergent may be possible for many/most Category B1 items, for some items, particularly delicates or coloreds, it may not be possible to wash at these temperatures and/or to use a bleach-based detergent. For these items the following is recommended:

- Carry out a prewash by soaking clothes in cold water with non oxygen bleach-based detergent. Drain off as much wash liquid as possible and if possible wring out. If it is not feasible to launder at the specified temperature/detergent, items should be washed according to instructions on the care label.
- The hygiene effectiveness of the process may be increased by use an antimicrobial prewash product or hygienic rinse aid according to manufacturer’s instructions and claims guidance (i.e. on efficacy against bacteria and/or viruses and/or fungi etc.)

2. Segregation of laundry - Evidence suggests that laundering of items at 30-40°C may be insufficient to prevent transmission of any pathogens between different items within the same wash load. It is thus advised that Category B1 and B2 items are segregated into separate loads and laundered separately.

3. Hygienic quality assurance of these items is further increased by:

- Drying in sunlight
- Tumble drying at 40°C or more, for 20 mins or more (see endnote v)
- Ironing – particularly steam ironing



Further Guidelines for all laundry

- Wash hands after handling soiled laundry.
- Dry laundry as soon as possible after washing. Don't leave it damp for long periods, e.g. in the washing machine overnight, because any remaining microbes may multiply quite rapidly. In particular, although these are not harmful, this particularly includes microbe which impart unpleasant odours to the textiles
- In large houses or apartment buildings, laundry facilities are shared by all residents/householders thereby increasing the risk of transfer considerably. If using shared laundry facilities, e.g. a laundrette, always use a bleach-based product and launder at 40-60°C.

Care of the washing machine

Particularly for washing machines which are only run at 30-40°C with a non AOB detergent, bacterial and fungal biofilms will build up in the machine. Although, as yet there is no evidence that these species are harmful to health in the domestic setting (although a 2013 infection outbreak in low birth neonates associated with this source has been reported in a hospital), these microbes can be transferred in large numbers to the clothes etc. They can also impart strong and unpleasant odours to the textiles. The washing machine should be cared for as follows:

- Keep your washing machine clean - including rubber lining which should preferably be cleaned with a weak bleach solution (1 cup of household bleach to 2 pints water)
- Rinse and scrub detergent box weekly - if need be use boiling water
- Open the door and the detergent box when the washing machine not in use to enable inner surfaces of the washing machine to dry.
- Once a week or every fifth cycle, use a high temperature wash, or alternatively a chemical disinfectant on an empty cycle, to clean the interior of the machine the machine and prevent the development of odours which are not necessarily harmful, but unacceptable. In order to reduce this build up, the machine should be run with the program with not only the highest wash temperature as specified in the documentation; but also the highest detergent level and the longest washing time. This is because research has shown that at a normal low suds level the 'hot' water will not heat and clean the inner of the machine sufficiently.

Endnotes

i. It is not possible to compile an exhaustive/definitive list of which items fall in this category and which fall in category B1. It is left to health worker/consumer interpretation, bearing in mind that, in some cases it could lead to some small increase in risk

ii. During laundering, chemical inactivation of microbes on fabrics can be achieved using various bleach components. Normally oxygen bleaches (persalts) with a low temperature activator are used or, as is common in some countries, chlorine-based bleaching agents are added to the wash load. If a laundry detergent contains activated oxygen bleach this should be stated in the ingredients on back of pack. For more details consult the section above on formulation of laundry detergents.



- iii. An alternative process may be used provided it can be demonstrated through scientifically valid in vivo method, that it delivers an equivalent level of effectiveness against bacteria fungi and viruses.
- iv. It should be noted that, in some countries e.g. USA water at the given temperature is added to the machine prior to adding the clothing. This means that the temperature of the load during the wash cycle is likely to be well below this initial temperature throughout the wash cycle
- v. Tumble drying is not recommended as a measure to achieve hygiene due to its poor sustainability

References/Evidence base

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