Developing a Sustainable and Effective Approach to Hygiene and Infection Prevention in Home and Everyday Settings

Dr. Sally Bloomfield, London School of Hygiene and Tropical Medicine

A Webber Training Teleclass

Developing a sustainable and effective approach to hygiene and infection prevention in home and everyday life settings

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Hosted by Martin Kiernan
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Learning Objectives

The lecture will address

1. Why is home hygiene important – current trends in hygiene-related diseases
2. Developing a risk-based (targeted) approach to hygiene
3. Optimising the effectiveness of hygiene procedures – what are the challenges?
4. Sustainability – addressing the issues of environment, biocide resistance and the hygiene hypothesis.
5. Developing and promoting home hygiene – what do we need to do?

Why is home hygiene important?

- Infectious disease - heavy burden on health and healthcare
- Much preventable by good hygiene in homes and everyday lives
- Hygiene-related disease includes:
  - Gastrointestinal (food and non-food e.g norovirus)
    - UK - 17 million cases of IID pa, 1 in 4 people
    - - 3 million cases norovirus
    - US - 9.4 million episodes food borne infection
    - - 20 million cases norovirus
  - Respiratory infections
  - skin, wound and eye infections
  - Emerging infections – new agents/strains
    - Influenza "pandemic" strains
    - Antibiotic resistant strains are also a community problem – CA-MRSA, MDR G-ve strains

ID risk in the community is increasing

- Increasing "at risk" groups needing special care
  - Up to 1 in 5 people in the European community
  - Including - otherwise healthy - elderly, very young, pregnant mums etc,
  - underlying disease: HIV/AIDS
- Increasing healthcare at home
  - shorter hospital stays – post-surgical care
  - home-based treatments: chemotherapy, dialysis etc
  - Reduced health spending - but gains likely to be undermined by inadequate infection control at home
  - Much of the care is carried out by family members
  - food hygiene, respiratory hygiene are also important

The cycle of infection

- Healthcare workers now accept that reducing infection in healthcare settings cannot be achieved without also reducing circulation of pathogens (norovirus, MRSA etc) in the community.
- As standards of IC in healthcare settings improve, hygiene in home and everyday life settings exposed as weak link in the chain?

Costs of infectious diseases in the community

- Tends to be regarded as merely a "nuisance" – but
  - US foodborne illness costs $152 billion annually (total economic impact)
  - UK IID costs £740 million pa
  - UK HCA infection costs £1000 million pa
- IDs can act as co-factors in other diseases that manifest at a later date
  - cancer, chronic degenerative diseases
  - trigger for asthma.

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Changes demand new strategies

- Increasingly hygiene recognised as a cost effective strategy to reduce ID burden and address problem of antibiotic resistance
- To be effective and sustainable – must involve everybody – must be a shared responsibility
- Need strategies which
  - changes public attitudes, understanding and behaviour
  - provides clear codes of hygiene practice which deliver

The International Scientific Forum on Home Hygiene (IFH) www.ifh-homehygiene.org

- Established 1997 - not-for profit, non-government organisation.
- Need for body to speak from a scientific/medical viewpoint about hygiene in home and everyday life settings

Primary objectives:

- Raise awareness of the fundamental role of hygiene in preventing infectious disease
- Promote understanding of home hygiene practice
- Ensure home hygiene is based on the scientific evidence

IFH definition of "home hygiene"

The sum total of activities in the home aimed at preventing the spread of infectious disease including:

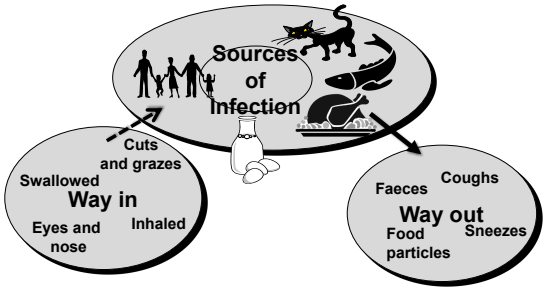
- food hygiene
- water at point of use (treatment, handling, storage) (HWTS)
- personal hygiene (particularly handwashing)
- general hygiene (surface hygiene, laundry)
- disposal of human and other waste
- situations where there is more risk (healthcare at home):
  - care of "at risk" groups (immune compromised)
  - infected people in the home

IFH targeted approach to hygiene

- IFH has developed a "new" approach to hygiene in the home and community - designed to
  - meet 21st century challenges
  - Support community hygiene promotion programmes.
- Known as "targeted hygiene".
- Based on risk management approaches - now the standard approach to control microbial risks in food and pharmaceuticals – and hospitals
  - means identifying critical points and targeting hygiene at these risk points
  - Based on fast growing microbiological evidence base

Targeted hygiene: the chain of infection

Targeted hygiene: the chain of infection



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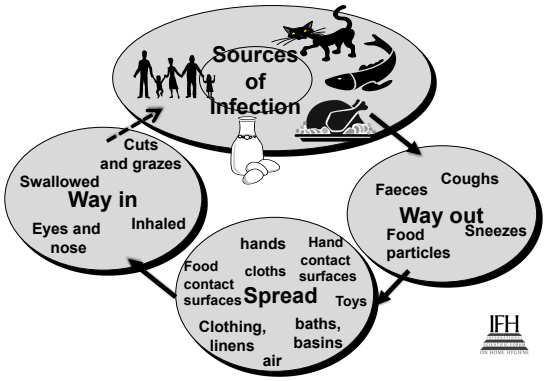


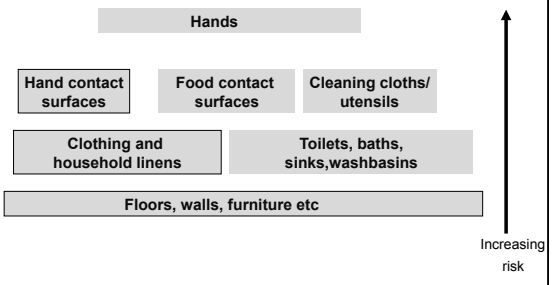
Developing a "targeted" approach to home hygiene

- Critical control points identified by assessing microbiological data for each site or surface to determine:
  - Is it likely to be contaminated with pathogens/germs?
  - Are the pathogens likely to be spread from the site or surfaces such that family members become exposed?
- If the answer to both questions is yes, then there is a need for hygienic cleaning to reduce the risk of spread

Risk approach to hygiene in the domestic setting

Site(s)	Chance of pathogens being present	Risk of spread of pathogens
• Reservoirs (Toilets, U-tubes, etc)	Highest	generally low
• Reservoir/disseminators (wet cloths & cleaning utensils)	Highest	Constant
• Hands	Sometimes	Constant
• Hand, food, water contact surfaces	Sometimes	Constant
• Clothing, household linens	Sometimes	sometimes
• Floors, walls, etc	Low	Occasional

Identifying critical points



Evidence base for targeted hygiene

- Based on integration of :
  - Microbiological data; clinical intervention studies, case control studies
- How big is the risk?
- What is health impact of promotion of a given hygiene practice?
- How can we assess this without intervention study data
- Hand hygiene Intervention studies - reductions:
  - up to 50% or > - diarrhoeal disease
  - up to 20% or > - respiratory disease
- Ranking risks relative to hands - based on micro data
  - suggests hand & food contact surfaces, clothing, household linens etc must contribute to infection transmission
- But how much?

Targeted hygiene: breaking the chain of infection

means "hygienic cleaning" to eliminate pathogens from critical sites before they can spread further

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What do we mean by "hygienically clean"

"a level of germs which is not harmful to health"

But

- infectious dose varies:
  - viruses: 1-100 particles
  - bacteria: may be 10 --> as high as 10^6
  - Salmonella: amplified following transfer to food
- Depends on susceptibility - may be lower for "at risk" groups
- Without precise data - seems reasonable that :
  - where there is significant risk of pathogen spread (i.e for critical control points)
  - aim should be to get rid of as many germs as possible

What methods are available for "hygiene cleaning"

Detergent/soap-based hygienic cleaning - mechanical removal

- To be effective as a hygiene measure it must be applied in conjunction with a thorough rinsing process - to wash germs away from the surface
- wiping a surface is not sufficient

Inactivation *in situ*

- In some cases a product or process which inactivates/ kills pathogens in situ is required
  - microbiocidal hygiene product (disinfectant, antibacterial, alcohol hand sanitizers)
  - heat (e.g boiling or >60°C)

Combined removal and kill sometimes used

- laundry - removal, heat and bleach kill
- dishwashing - removal, heat

Preparing a meal with a chicken contaminated with Salmonella or Campylobacter

	Percentage of sites contaminated with Salmonella and/or Campylobacter		
No of participants in each group = 20	After Meal Preparation	After Cleaning with Soap and Water	After cleaning with soap and water + hypochlorite disinfectant
Chopping board	60%	15%	0
Utensils	5%	25%	5%
Hands	35%	20%	0
Dishcloth	25%	25%	5%
Sink Surround	30%	30%	0
Sink Rim	10%	15%	5%
Taps, Fridge, Cupboard, Oven and Kitchen Door, Condiments	9%	8%	1%
TOTAL	17.3%	15.3%	2.3%

Cogan, Bloomfield and Humphries, Letters in Appl.Microbiology 1999, 29,354-358

Risks associated with preparation of a meal using a chicken contaminated with Salmonella or Campylobacter

Percentage of sites contaminated with Salmonella or Campylobacter (total number of sites sampled)			
	After food prep. Before Cleaning	After food prep. & After cleaning c. soap and water	After food prep. & after cleaning c. soap and water + rinsing
Hands, chop board, Cloth,	63% (120)	23% (120)	12.5% (120)

Cumulative % frequency occurrence of viable counts on hands, board, cloths after food preparation, before cleaning			
	>1000	>100	>10
Salmonella	3.3	8.3	33.3
Campylobacter	33	50	73.3

Cogan, Humphrey and Bloomfield 2002 JAM 2002;92:885-892

Contaminated foodstuffs as a source of infection in the home

Prevalence in raw chickens

- UK: Salmonella 5%, Campylobacter 30%;
- Up to 1 in 30 homes every day?

Survival

- 4 - 24hrs on surfaces

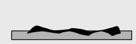
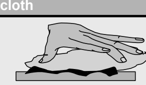
Infectious dose

- *Salmonella*: 10^2 to 10^6cfu - risk amplified by transfer to food or wet cloths
- *Campylobacter*: 100-500cfu

Outcome

- UK 600,000 cases pa *Campylobacter*; 38,000 *Salmonella*,
- 40% at home

Effectiveness of hygiene procedures in eliminating norovirus from surfaces (N = 14)

Inoculate c. Norovirus in faecal suspension	Wipe c. clean cloth ↓ - sample surface & cloth	Use cloth to wipe another clean surface ↓ Sample surface, cloth, hands
		
Clean x 1	100% +ve	100% +ve
Clean x 2	100% +ve	100% +ve
Clean and disinfect c. bleach	0% +ve	0% +ve

Surfaces sampled using RTP-PCR

Barker, Vipond and Bloomfield, J. Hospital Infection 2004;58:42-9

Infected family members as a source of norovirus infection in the home

Virus shedding

- Vomiting incident may produce 30 million norovirus particles,

Survival

- hours --> days on surfaces

Infectious dose

- norovirus 6-10 particles

Outcome

- UK -->3 million cases pa, mostly person to person
- US -→ 20 million cases on norovirus pa

Hygiene for the 21st Century

- Hygiene in our homes and everyday life is **NOT**
  - about getting rid of the germs that "lurk" in our homes
  - about trying to create a sterile home
  - unfocussed "once weekly deep down clean"
  - adding biocides to cleaning & other products to give "a bit of extra hygiene"

Hygiene for the 21st Century

Need a scientific approach based on principles of risk assessment and management i.e which means applying

- an effective "hygienic cleaning procedure"
- at critical control points
  - hands,
  - high frequency touch surfaces
  - food contact surfaces
  - clothing and household linens (including uniforms of healthcare workers)
- at the right time

In order to break the chain of transmission of infection

The importance of effective "hygienic cleaning procedures"

- we need to develop and use the "best"/most appropriate procedures
- CEN tests enable us to evaluate and compare performance of disinfectants in a standardised manner
- By contrast – little data on detergent-based hygienic cleaning processes
- Now have range of lab models and panel tests - why are we not using them

What do we need to know about the efficacy of "hygienic cleaning" - using in use models?

- How effective is detergent-based cleaning on contaminated surfaces?
- What does/might a disinfectant cleaner add?
  - Does it just give a false sense of security
- How does the level of soiling affect the efficacy of disinfectants - in households?
- What part does the cleaning cloth play?
- What cues do people use to judge whether a food surface is "hygienically clean"?
  - To what extent do consumers understand the difference between clean and hygienically clean?

How effective is an effective hygienic cleaning procedure?

- Normally assessed as 1, 2, 3, or more log reduction
- What is the impact of increased efficacy on infection rates?

Application of Quantitative Microbial Risk Assessment to hand hygiene.

- **Infection risks from hand-to-mouth contact after handling raw beef contaminated with *E. coli* O157**
- **US population 100 million - 10% contact H-->M per year**

Intervention	Log reduction on hands	No of infections per year	Median risk reduction
No handwashing	0	0.7	
HW e. soap	0.7	0.014	98% (cf no HW)
Use of electric hand dryer	4.3	0.00005	99.9286% (cf HW)

QMRA data shows health benefit from an increased log reduction may be insignificant for an individual, but translate into a significant decrease in disease burden in national population.

Haas et al 2002

Targeted hygiene and sustainability

Targeted Hygiene and Sustainability

- Protecting health by preventing infection intrinsically more sustainable approach than treatment.
- Hygiene measures must themselves be sustainable
- Issues need to be assessed and managed:
  - Environmental impact & human safety
  - "we have become too clean for our own good"
  - Continuous exposure to low level micro-biocides may induce antimicrobial "resistance"

Hygiene hypothesis

- Exposure to microbes (particularly early childhood) may be important in protecting against allergic diseases (asthma, hay fever etc)

But

- we do not know what sort of exposure, and why this exposure is now lacking
- Increasingly unlikely that we need to suffer "infections" to achieve this.
- Evidence now points to "old friends"

Biocides and antibiotic resistance

- EU SCENIHR 2009 report:
  - "evidence **does** indicate that use of certain types of biocidal products in various settings **may** contribute to increased occurrence of antibiotic resistance"
- But:
  - evidence is lab-based
  - no evidence that biocide use has contributed to antibiotic resistance in clinical practice
- Both IFH and SCENIHR reports stress:
  - important role of biocides
  - but – appropriate, prudent - targeted - use.

Antibiotic resistance is also a community problem

- Establishment of TATFAR - Transatlantic Task Force on Antimicrobial Resistance
- Three component strategy/working groups:
  - Appropriate antibiotic prescribing
  - Developing new antimicrobial drugs
  - Prevention of hospital and community-acquired drug resistant infection
- Prevention through hygiene
  - reduces the need for antibiotic prescribing
  - Reduces spread of resistant strains such as MRSA, NDM-1s etc - the silent epidemic

Targeted hygiene and sustainability

- Targeted hygiene provides a framework for building sustainability into hygiene

Because:

- Through targeted hygiene and prudent and focussed use of hygiene products and processes, it intrinsically
  - minimises environmental impacts
  - minimises risks of antibiotic resistance through low level biocide exposure.
  - sustains “normal” exposure to microbial flora of environment - may be important to build balanced immune system.

Laundry Hygiene

- Low temp laundry cycles being introduced without regard to their hygiene effectiveness

Disinfection of laundry samples inoculated with *S. aureus* in the main cycle machine washing programmes.

Pre-wash	Temperature	Washing agent	Mean Log 10 Reduction Factor	Cross contamination to sterile cloth sample included in cycle
No	80°C	Premium detergent (contain a bleaching agent based on oxygen)*	[illegible]	No
No	60°C		[illegible]	No
No	40°C		3.03	No
No	30°C		3.07	No
Yes	30°C		[illegible]	No
No	60°C	Liquid colour detergent (no bleaching action)	4.22	no
Yes	60°C		[illegible]	Yes
No	30°C		≤1	Yes
Yes	30°C		≤1	Yes

* percarbonate + activators

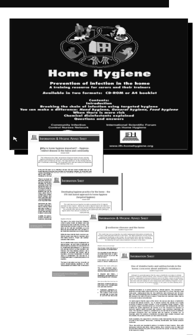
Infection risks associated with clothing etc

- Increasing evidence that clothing and linens (e.g towels and bed linen) are important risk factors for spread e.g of MRSA
- German homes where there is a carrier - MRSA isolated from laundered items
- US homes - MRSA isolated high frequently touch surfaces (including wiping cloths and dishtowels) in 9 out of 35 homes.
- In US, 50% of MRSA isolates are community-acquired strains

Promoting hygiene practice in the home and community - putting theory into practice

IFH communications strategy

- IFH communication materials :
  - Scientific reviews
  - Guidelines and training materials
    - Home Hygiene Training Resource produced in collaboration with IPS
  - Plain language “fact/advice” sheets



Major needs are:

- Need for an integrated approach
  - Health, food, education agencies, health professionals etc need to work together to develop approach which looks at hygiene from point of view of the family
  - need a lead agency to co-ordinate hygiene in home and everyday life”
- Need to take a more balanced view
  - Microbiologists, immunologists, environmentalists need to agree approach which respects need for disease prevention as well as environmental protection etc
- Develop hygiene promotion programmes
  - Hygiene seen as part of healthy living
  - Hygiene education in schools

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Hygiene education in schools

- EU-funded e-Bug project
- (www.e-bug.eu)
- Teaching pack for primary and secondary schools
- Aim – ensure all children in Europe leave school with basic understanding of hygiene and antibiotic resistance – chain of infection, hand, respiratory and food hygiene
- Translated into 27 European languages

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IFH

Coming Soon

07 March	***(FREE … WHO Teleclass - Europe)*** **Achievements in Improving Injection Safety Worldwide** Speaker: Prof. Chuck Gerba, University of Arizona Sponsor: World Health Organization First Global Patient Safety Challenge
22 March	**Hand Hygiene: New Frontiers in Messaging and Measurement** Speaker: Dr. Katherine Ellingson, Centers for Disease Control Sponsor: Diversey Inc.
29 March	**Water and Infection Control** Speaker: Andrew Streifel, University of Minnesota
5 April	**Standardized Training for Environmental Cleaning in Healthcare** Speaker: Grace Volkening, Brenda Smith, Nora Boyd, Public Health Ontario Sponsor: Virox Technologies Inc

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