

# **The hygiene hypothesis, old friends and their implications for child health and home hygiene**

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# The hygiene hypothesis – what does it mean - what are the implications for health?

- 1989 Strachan proposed - 20th century rise in allergic diseases related to lower incidence of infection in early childhood
- Also applies to range of other CIDs - T1D, MS, IBD etc
- Named “Hygiene Hypothesis”
- New knowledge indicates we have focusing:
  - on wrong types microbes and
  - far too narrow view of potential “hygiene-associated” causes i.e. home and personal cleanliness

# What sort of microbes do we need exposure to – when – and how?

Based on Strachan's original hypothesis

- Extensive epidemiological studies failed to find identify strong links to specific exposures
- Evidence for protective effect of specific infections (chickenpox, measles etc) weaker than previously thought.
  - no longer supports idea that children who have more colds/coughs less likely to develop allergies.

# The Old Friends Hypothesis

- Required microbial exposures are microbes we co-evolved with
- “Old Friends” include :
  - Microbiota of human & animal skin, gut, RT
  - Environmental saprophytes - indoor and outdoor environments
  - spp which need to be tolerated – HAV, helminths

# Importance of microbial diversity

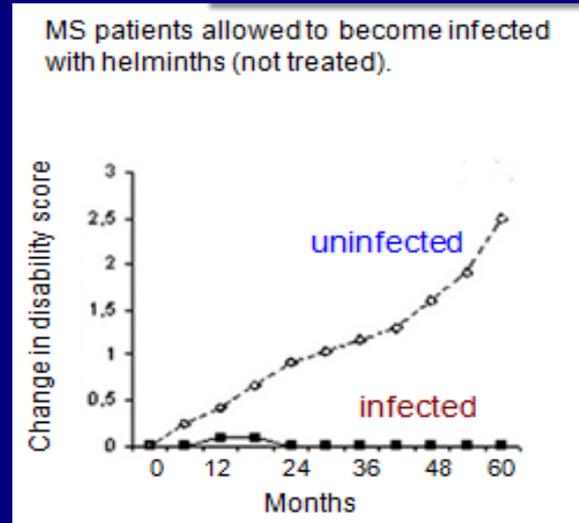
Exposure needs not confined to single species - can be met by one or more of diverse range - any species missing, role met by others?

Diversity and turnover of bacterial species is a requirement, rather than stable colonisation with one species.

# Do exposures need to be maintained during childhood and adult life?

- Most important – during pregnancy, first days or months - but - needs to be maintained for significant period e.g. Breastfeeding for 6 m
- Some evidence on-going exposure may be important

Treatment of adults with MS with helminth eggs showed arrest improvement of symptoms



# Why has this happened - and why now?

- Allergies/CIDs existed prior to 1800s - largely diseases of last 200 years
- Hay fever so rare in the late C19<sup>th</sup> - doctors struggled to find cases to study - now estimated 10 million in UK.
- Accumulated data
  - Increasing levels from the late 19<sup>th</sup> century
  - rapid rise from the 1970s

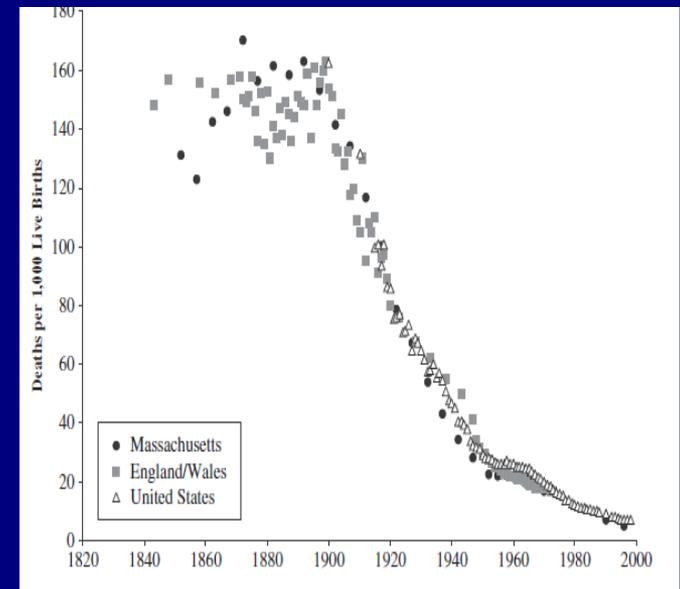
# What has changed in past 2 centuries to deprive us of requisite microbial exposure?

Obvious answer - sanitary/ hygiene revolution.

- improved water quality, sanitation,
- occurred gradually from 1800s but widespread coverage (toilets, chlorinated drinking water etc) did not occur until late 19<sup>th</sup> into C20<sup>th</sup>
- environmental clean-up - reduced exposure to human waste and animal excreta in city streets.
- Altered diet/foods (different or less microbial content)

# Temporal correlation suggests these factors involved

- OF hypothesis argues:
  - not for obvious reason i.e need for pathogen exposure
  - Vital protection from ID,
  - But inadvertently reduced/ altered exposure to “microbial “old friends”
- Microbial diversity hypotheses suggest
  - not one – but all of these factors are involved



The Health Revolution: Decline in Infant Mortality. Massachusetts: U.S. Bureau of Statistics of the United States Colonial Times to 1970, National Center for Health Statistics, Health U

# Could antibiotics be involved?

- Antibiotic usage - good temporal fit
  - Increasing antibiotics since 1950s
  - Steep rise in allergies from 1970s
- antibiotics may alter our interaction with microbes - reduced diversity of gut microbiota
- Evidence from epidemiological studies is conflicting
- Need to monitor?

J Pediatr. 2013 Apr;162(4):832-838.e3. doi: 10.1016/j.jpeds.2012.09.049. Epub 2012 Nov 6.

## [Use of antibiotics during pregnancy increases the risk of asthma in early childhood.](#)

[Stensballe LG](#), [Simonsen J](#), [Jensen SM](#), [Bønnelykke K](#), [Bisgaard H](#).

Copenhagen Prospective Studies on Asthma in Childhood, Faculty of Health Sciences, University of Copenhagen, and The Danish Pediatric Asthma Center, Copenhagen University Hospital, Gentofte, Copenhagen, Denmark. [LGN@ssi.dk](mailto:LGN@ssi.dk)

### **Abstract**

#### **OBJECTIVES:**

To investigate the hypothesis that mother's use of antibiotics in pregnancy could influence asthma and eczema in early life.

# Is microbial exposure the only factor ?

- Increased risk of allergies/CIDs also depends on other factors :
  - diet (vitamin D deficiency), pollution, less physical activity, obesity,
  - socio-economic factors and stress,
- Genetic predisposition - key risk factor.

# Are we too clean for our own good?

- Role of home and personal hygiene small relative to other factors.
  - Clean-looking homes full of bacteria, viruses, fungi, etc.
  - Routine weekly cleaning - no sustained effect on microbe levels
- Cannot create “sterile” home - microbes constantly replaced via dust, air, body flora, pets, contaminated foods.

Key point may be:

- Microbial content of homes now DIFFERENT - but not because of “increased” cleanliness
  - e.g modern urban homes – interact c different environment cf rural homes prior to 1800s
  - helminths now relatively rare - up to 1950s 50% children infested with pinworm

# What about personal hygiene?

- Strachan suggested that “*higher standards of personal cleanliness*” could be an underlying cause
- Temporal correlation i.e increased bathing/showering, shampooing/bathing baby since 1950s
- Bathing and showering remove microbes from skin but rapidly replaced and no evidence that it includes OFs
- No evidence linking frequency of washing, showering or bathing to increased allergies risk.
- Need to monitor?

# How might we reverse the trends in allergies and other CIDs?

- Therapeutic approaches
- Using probiotic drinks or foods to reintroduce the key microbes to our bodies
- Progress requires better understanding which 'old friends' are truly friendly – and safe.

# Could Lifestyle changes re-establish our exposure to OFs?:

- For example
  - encouraging natural childbirth,
  - encouraging sustained breast feeding,
  - physical interaction between siblings,
  - more sport and other outdoor activities.
- Important to be cautious.
  - need clearer understanding before these approaches could be strongly advocated?

# Where have we got to?

- Reversing trends in CIDs
  - “The work is progressing very fast, but has a long way to go”
- Controlling infectious diseases
  - Good news! - allergies/CIDs not the price we have to pay for protection against IDs

# Why is hygiene in home and everyday life so important?

- Infectious disease circulating in the community - heavy burden on health and healthcare systems
- 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 (Tam et al 2011)
    - UK norovirus – 3 million – mostly non foodborne
  - Emerging infections – new agents/strains
    - Influenza “pandemic” strains
    - Antibiotic resistant strains are also a community problem – CA-MRSA, ESBL & NDM-1-producing strains

# Antibiotic resistance

Tackling antibiotic resistance is a global priority:

- involves home and community as well as hospitals
- Hygiene can reduce antibiotic prescribing - major underlying cause
- Infection control/hygiene now seen as central to strategies to reduce spread of drug-resistant infections
  - As spread of nasal/gut etc carriage in healthy population increases - risk of hospital and community infections increases.

# ID risk in the community is increasing?

- Increasing “at risk” groups needing special care
  - Up to 1 in 5 people in the European community
  - Include - otherwise healthy - elderly, pregnant mums etc, neonates require staged introduction to pathogens
  - underlying disease: HIV/AIDS
- Increasing healthcare at home
  - shorter hospital stays – post-surgical care
  - home-based treatments: chemotherapy, dialysis etc

# Can we have it both ways?

- If prevention of ID in children through good hygiene remains a cornerstone of public health

But

- if the ‘right kind’ of microbial exposure needs to be encouraged,
- How do we address both issues at the same time?
- How do we persuade people to develop lifestyles which reconnect with the “natural” environment whilst also protecting themselves and their children from ID?

# We need to unravel the confusion

“we have become too clean for our own good”.

- What do we really mean? – are we/they saying:
  - We need to encourage children to get dirty?
  - we need to relax hygiene standards?
    - children who have more infections are less likely to develop allergies

Are we too clean for our own good ?

Clean home  
could give a  
tot asthma

Is our cleanliness  
zeal making us ill?

Too clean for our own good?

Hygiene  
is killing  
us, says  
Conran

Childhood  
is poisoned  
by the  
germ of fear

Clean children  
run a higher  
risk of asthma

SOME DIRT EVERY DAY  
KEEPS DOCTOR AWAY

Dirt could be good for you

**How dirt can protect  
you against cancer**

## 'Inevitable' flu pandemic will kill 75,000 Britons and 50 million worldwide, warn Lords

By TAMARA COHEN

Last updated at 8:26 AM on 21st July 2008

## Mother catches MRSA from newborn son after doctors failed to tell her he had it

By JAYA NARAIN

Last updated at 21:31 16 October 2007

## Deadly E.coli outbreak has peaked, says German health minister

By DAILY MAIL REPORTER

Last updated at 9:13 AM on 9th June 2011

News > UK news

## Girl's E coli death 'due to sewage' by prize beach

## Is your supermarket chicken poisoning you?

By TOM RAWSTORNE

Last updated at 10:05 AM on 8th February 2011

## Babies delivered by Caesarean section at higher risk of asthma and allergies

- Example of “getting more dirty” to protect children from allergies?



Parents Who Suck on Their Infants' Pacifiers May Protect Their Children Against Developing Allergy

- 3x less likely to suffer from eczema at 1.5 years of age,
- No increase in upper respiratory infections .

# We have to change our attitudes and understanding?

- Need to distinguish cleanliness (absence of dirt, social acceptability, freshness) from infection prevention practices.
- ID avoidance not about how clean our homes look/how often we shower,
- Its what we do at times when it matters to stop spread of germs:
  - ALWAYS washing hands
    - after toilet & handling raw foods
    - before handling ready to eat foods.
    - After changing babies nappy
  - Rigorous food hygiene in the kitchen
  - Good respiratory hygiene (catch it, bin it, kill it)
  - Following the hygiene rules when caring for pets.

# IFH targeted approach to hygiene

- Getting people to know the critical points in the chain of infection transmission and using hygiene measures at these points to prevent ongoing spread of pathogens.

“superhighways” for spreading pathogens around the home are:

- hands
- hand and food contact surfaces,
- cleaning cloths/cleaning equipment.

also

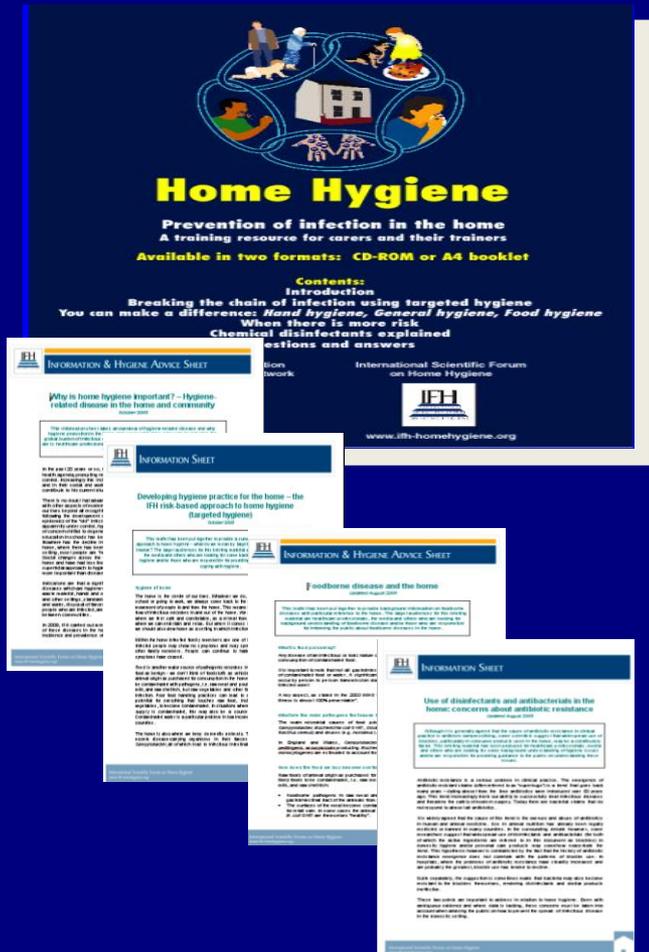
- surfaces in contact with body: baths/  
hand basins etc
- clothing and household linens



Minimises infection risks, whilst maximising opportunities for exposure to Old Friends

# IFH communications strategy

- IFH communication materials :
  - Scientific Reviews
  - Guidelines and training materials
  - Plain language “fact/advice” sheets
- All available to download from [www.ifh-homehygiene.org](http://www.ifh-homehygiene.org)
- sign up for IFH news sheet



# The hygiene hypothesis and its implications for home hygiene, lifestyle and public health

- 2012 IFH report
- Summary of findings/conclusions
- IFH website - [www.ifh-homehygiene.org](http://www.ifh-homehygiene.org)
- Summary also in hard copy
- Thanks to Prof Graham Rook and Dr Stanwell-Smith

