

Isolation of bacteria of faecal origin on commuter's hands: a preliminary study.

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Introduction

Infectious intestinal diseases are amongst the biggest killers of children worldwide, latest estimates put deaths from diarrhoea at about 1.9 million per annum [1]. It has been suggested that hygiene promotion may be the most cost effective intervention for preventing infectious diseases in developing countries [2] and that handwashing in particular, if globally practiced, could save over a million lives [3]. In the UK it has been estimated that one in 5 people have an episode of diarrhoea every year [4]. A study in the North of England found that only 43% of mothers washed hands after changing a dirty nappy[5] and studies have found low rates of handwashing in public washrooms. Lack of adequate handwashing in the community may also be partially responsible for current problems associated with hospital acquired infections [6].

Whilst a number of studies have isolated bacteria on hands in hospitals, homes and in care settings, few have looked at fecal contamination on the hands of 'normal' adults. Our objective in this study was to provide a preliminary snapshot of contamination on hands of commuters to gauge the importance of hands as routes of transmission of bacteria of fecal origin in the broad UK population in six cities.

Methods

We took swabs from the hands of 409 commuters waiting at bus stops near London Euston, Birmingham New Street, Liverpool Lime Street, Cardiff Central and Newcastle Central Stations on weekday mornings between the 27th of August and the 17th of September 2008. Trained master's students approached people at the sites, explained the study and asked whether they would like to take part.

Hand swabs were taken and participants were also asked the following questions:

- Age, Sex, Occupation
- What mode of transport have you used this morning?
- Have you been into a hospital in the past week?
- Are you currently taking antibiotics?
- Have you washed your hands with soap this morning?

The samples were collected by wiping charcoal transport swabs containing 500 microlitres of Nutrient broth across the fingers of the volunteers. These were then sealed and returned to the laboratory within 8 hours. Upon arrival at the lab the swabs were placed into a glass Universal containing Purple MacConkey broth with a small glass inverted tube (to collect any gas produced). The Universals were then incubated at 44°C

for 24 hours and those which turned from purple to yellow and exhibited gas were deemed to be E coli. All Universals were then subbed onto two types of agar plate: 1) MacConkey agar No. 3 which contains crystal violet to inhibit Gram +ve cocci such as Staphylococci and Micrococci (normal skin flora) and Lactose to see if the organisms could ferment this to produce acid (pink colonies produced by a change in pH.) 2) Bile Aesculin agar upon which Enterococci appear as black colonies. Pink colonies of the former were then tested with a spot Indole reagent, a turquoise colour indicating E .coli. The identity of all the other colony types was resolved using an API 20 E biochemical strip predictor. Any black colonies on the Bile Aesculin were then tested with Streptococcal group D antisera where a positive result for Enterococci was confirmed by the appearance of agglutinating particles.

Ethical clearance was obtained from the Ethics Committee of the London School of Hygiene and Tropical Medicine.

Results

Overall 409 commuters agreed to take part in the study. 113 out of the 409 samples (28%) had faecal bacteria present.

Table 1 shows the organisms that were detected. Most common were Enterococcus in 22% of samples, followed by E.coli in 9%. Seven percent of samples were positive for several organisms.

Organism	N	Percent of samples positive
Enterococcus	88	22%
Ecoli	38	9%
Klebsiella	9	2%
Panteoa	3	0.7%
Enterobacter	2	0.5%
Citrobacter	2	0.5%
Multiple isolations	28	7%
Total positive	113/409	28%

Table 1. Organisms detected on hands.

Table 2 shows the rates of detection of any faecal organism by city and on male and female hands. A significant trend towards a larger percent positive with increasing northerly latitude was detected. Fig 1 shows that whilst rates of contamination on female hands did not vary greatly, male hands tended to be more contaminated the further north the city of investigation.

	Number positive/total	Percent with contaminated hands	Percent of males with contaminated hands	Percent of females with contaminated hands
London	13/100	13%	6%	21%
Cardiff	11/48	23%	15%	29%

Birmingham	21/86	24%	21%	26%
Liverpool	26/77	34%	36%	31%
Newcastle	43/98	44%	53%	30%
Overall	113/409	28%	27%	27%

Table 2. Rates of detection of fecal organisms by city and gender.

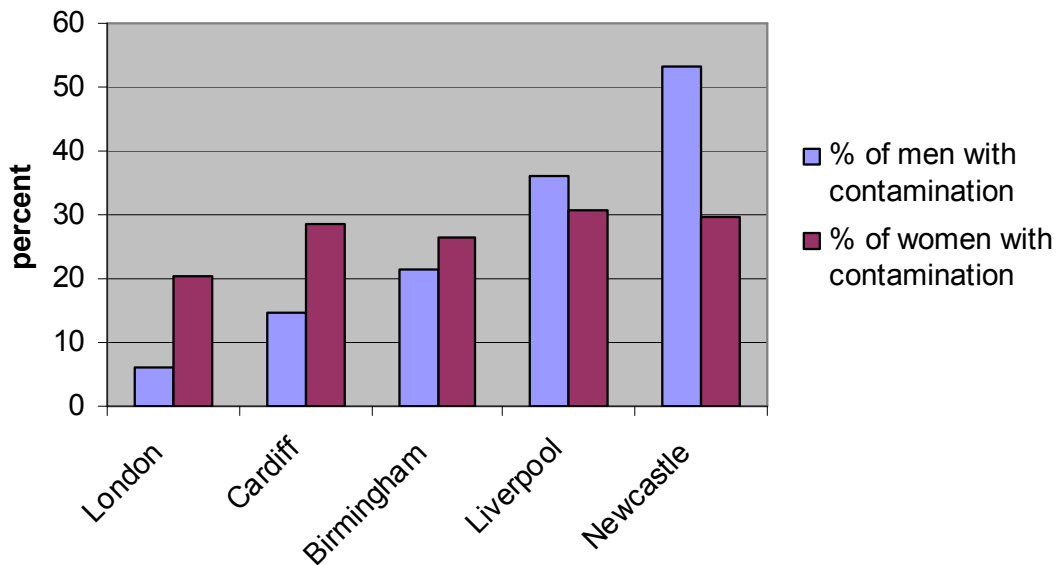


Fig 1. Rates of contamination of hands of men and women in sampled cities.

Table 3 summarises rates of hand contamination by population group. Rates of contamination did not vary significantly by age, by use of antibiotics, by whether they had visited a hospital or whether they claimed to have washed their hands with soap that morning. People who had used the bus had higher rates of hand contamination than those who had used the train and those whose occupations were manual rather than professional, student, retired or unemployed tended to have cleaner hands than average.

Variable	Category	Rate positive	Percent positive
Age	<30 vs >30	53/189 vs 52/214	28% vs 24%
Occupation	Manual vs other	4/26 vs 88/247**	15% vs 36%
Mode of transport	Train vs bus*	15/92 vs 71/249**	16% vs 29%
Hospital visit this week	Yes vs no	12/42 vs 95/361	29% vs 26%
Antibiotics	Yes vs no	5/19 vs 103/385	26% vs 27%
Washed hands with soap	Yes vs no	96/368 vs 12/41	26% vs 29%

Table 3 Rates of hand contamination by group

*excludes those who used both

** significant to $p < 0.05$

Discussion

This study did not attempt to quantify the number of bacteria that were found on hands, hence hands could be reported as positive with only one or very few bacteria. Nevertheless, we were surprised by the very high rates of detection of bacteria of faecal origin on hands. Though the presence of such bacteria is probably not a health hazard in itself, it is indicative of a failure of hygiene, and more specifically a failure to wash hands after contact with faecal material or surfaces where faecal material is present. Were pathogens to be present in excreta they could then use this route of transmission to find and infect new hosts.

We were also surprised to note the clear and significant geographic trend with lower isolation rates in Southern cities gradually rising to higher rates the further north the samples were taken. This trend was due largely to a significant increase in detection of fecal bacteria on the hands of males, but not females, with increasing latitude. We can see no obvious reason for this. Commuters in some cities may have had longer journeys from home, and hence had longer for bacteria to die off. Sampling was carried out by different individuals in some cases on different days and may have been less thorough in some cities than others, and train and bus cleaning regimes may have varied for city to city. Climatic conditions may also have varied. However, there is no reason to expect that any of these factors would have varied in a systematic way in males so as to produce the pattern observed. We therefore propose further investigation of the hypothesis that hands are washed more often or more thoroughly in the South of the UK relative to the North, and that male and female handwashing rates differ geographically.

References

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