Study reference number: 2008/08 MRZ/1

IMPROVE YOUR INFECTION CONTROL PROGRAM WITH AN ENVIRONMENTALLY FRIENDLY, MAINTENANCE FREE AND SCIENTIFICALLY PROVEN SOLUTION.

Study reference number: 2008/08 MRZ/1

How to improve an infection control program.

Suggested solution:

Toilet Friend Units as integrated part of Infection Control Programs are very efficient to reduce unpleasant odours and airborne bacteria & viruses, resulting in a hygienic, odour free environment, making cleaning more and more effective all the time.

But does the Toilet Friend Unit really WORK?

Aim of the study: to obtain scientific proof that there is a significant reduction in the spread of airborne bacteria.

Material for testing was supplied by Microchem Laboratories located in Dungarvan, Co Waterford, Ireland

Tests were analysed by Microchem Laboratories located in Dungarvan Co Waterford, Ireland, a leading independent test and research laboratory.

Study reference number: 2008/08 MRZ/1

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Study ref nr: 2008/08 MRZ/1

Contents:

Justification :

To confirm that the installation of the maintenance free, environmentally friendly, toilet friend units, effectively create a hygienic, odour free environment by preventing and reducing the spread of airborne bacteria and viruses, firstly from escaping from the toilet bowl and secondly in the aerosol after flushing of the toilet:

Table of contents:

Study ref nr: 2008/08 MRZ/1

Abstract:

The aim of the study was to prove without doubt that the environmentally friendly toilet friend units, that effectively prevents unpleasant toilet odours from escaping from the bowl when a toilet is used and flushed, also reduce the spread of airborne bacteria and viruses found in faeces.

Several studies conducted on the aerosol effect when a toilet is flushed, showed the spread of airborne bacteria and viruses and contamination of the toilet environment, even adjacent toilets as well.

Bacteria and viruses also cling to your clothes, towels, toothbrushes, shoes, floors, taps, walls etc. and you easily inhale and swallow them, resulting in the possibility of contracting different types of infections.

Several strains of different bacteria are spread through the faeces, one of them being Clostridium difficile and another Methicillin-Resistant Staphylococcus Aureus (MRSA). These two superbugs are a major cause of concern.

Conclusion: Proof was obtained that a reduction in the spread of bacteria was obtained when toilets that had a toilet friend unit installed, were used. Therefore, it can be claimed that the toilet friend units will successfully contribute in creating a more hygienic environment, automatically and maintenance free.

No hazardous air fresheners will be necessary anymore. Disinfecting and cleaning programs will be much more effective. With no contaminated filters or any disposable parts to replace, these units are an asset not recognised up to now. They were mainly used to eliminate foul and unpleasant odours resulting from the use of a toilet, not realising the real contribution in creating and enhancing a hygienic environment, especially over a period of time.

Every hospital, nursing home, surgery, household, pharmaceutical and other industries, restaurants, pubs, schools etc should install toilet friend units to help create and control environmentally friendly, hygienic environments, hassle free.

Study ref nr: 2008/08 MRZ/1

Introduction:

The aim of the study was to prove that the Toilet Friend units prevent and reduce the spread of airborne bacteria and viruses from leaving the toilet bowl after a toilet has been used and flushed. These units successfully eliminate unpleasant odours and therefore, assumingly, also airborne bacteria and viruses, by gently extracting them through the waste pipe where they belong.

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Tests were conducted to obtain proof for the consumptions made and a literature search was done to obtain proof for the following:

- Odour and relationship to bacteria
- Aerosol effect when a toilet is flushed and the consequential spread of bacteria
- Closing the lid of the toilet has little effect
- Cleaning and disinfecting not always successful
- The most contaminated areas
- Bacteria that can spread through faecal contamination and through the flush of a toilet.

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Various Pubmed (PMID) articles were published regarding faeces, bacteria and odour showing the relationship between odour and bacteria:

PMID 3662595: '*Diagnosis of rotavirus gastroenteritis by smell'* supported the suggestion that rotavirus stools have a characteristic smell.

PMID 9448181: '*Fecal hydrogen sulphide production in ulcerative colitis' ..'*H2S released by ulcerative colitis was elevated 3-4 fold at every measurement point comparing with normal faeces.'

PMID 535393: '*The isolation of urease-negative strains of Yersinia enterocolitica'.* The last sentence was of importance: 'An important characteristic was the smell of the culture, typical of all the indole-positive strains of Y. Enterocolitica'

PMID 17314143: '*Volatile organic compounds from feces and their potential for diagnosis of gastrointestinal disease.'* It was remarked in this article that 'patients and healthcare professionals have observed that faeces often smell abnormal during gastrointestinal disease' and also 'when compared to healthy donors, volatile patterns from faeces of patients with ulcerative colitis, C.difficile and C. Jejuni were each significantly different.'

PMID 11429513*: 'Gas production by faeces of infants'.* The conclusion was that this '*is strongly influenced by an infant's diet*. Of particular interest are differences in production of the highly toxic sulphur gases, H2S and CH3SH, because of the role that these gases may play in certain intestinal disorders of infants'

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Previous research and studies dealt with the unpleasant issue of unhygienic toilets areas as far back as 1956.

It has been proven that when a toilet is flushed airborne bacteria and viruses are spread through the room by way of the aerosol effect and leaving a contaminated area.

Cleaning and disinfecting are also problematic as some bacteria and viruses are resistant against the disinfectant chemicals used. If a disposable cleaning apparatus is not used, the contamination is only spread even further by using the same cleaning cloth, brush and the same rinsing water. The chemicals used to disinfect are also causing a health problem for some cleaners, specially irritating the respiratory tract, causing lung damage, asthma, allergies etc.

The following abstracts were published on the internet and contribute to the truth and reality of the statements made:

'A bacteriological investigation of the effectiveness of cleaning and disinfection procedures for toilet hygiene.'

Scott E; Bloomfield SF

Pubmed: ***PMID 2997099***

The last paragraph stated: '—although daily disinfection produced some reduction in contamination compared with daily cleaning, the reductions were less than that associated with the continuous release system and indicated the inadequacy of daily disinfection and/or cleaning for toilets where effective procedures are required'

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'Microbiological hazards of household toilets: droplet production and the fate of residual organisms'

Gerba CP, Wallis C, Melnick JL

Pubmed: ***PMID 169732***

Bacterial and viral aerosols as a result of flushing the toilet. *Dr. Charles Gerba (University of Arizona Microbiologist 1975)*

These 'studies have shown that water droplets in an invisible cloud travel six to eight feet out and up, so that the area of the bathroom (restroom) not directly adjacent the toilet are also contaminated' and that 'the bacterial mist has also been shown to stay in the air for at least two hours after each flush, thus maximising its chance to float around and spread.'

An extractor ceiling fan will initially aid in spreading the bacteria, because by extracting the air upwards through the room, bacteria will have ample time to cling to various surfaces, to your clothes and will even reduce the time before you inhale and swallow the bacteria and viruses and you could easily contract a cough, cold, diarrhoea etc. in this manner!

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www.serendip.com

Dr Philip Tierno, Director-Clinical Microbiology and Diagnostic Immunology at NY University:

'*The greatest aerosol dispersal occurs not during the initial moments of the flush, but rather once most of the water has already left the bowl'*

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'Dirty Business' www.jrscience.com

'There are 120 viruses in faeces, so when a toilet is flushed, water particles with more than 25000 virus particles and 60000 bacteria are ejected from the toilet bowl and can settle on any surface as far as six feet away from the toilet. These particles will last several hours and have the potential, especially in public toilets, to cause disease. These water particles can contain bacteria like salmonella, E.Coli or streptococcus pyrogenes...'

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'The potential spread of infection caused by aerosol contamination of surfaces after flushing a domestic toilet'

Barker J, Jones M V

Pubmed: ***PMID 16033465****. Journal Applied Microbiology 2005; 99(2) 339-47*

'Significance and impact of the study: Many individuals may be unaware of the risk of air-borne dissemination of microbes when flushing the toilet and the consequent surface contamination that may spread infection within the household, via direct surface-to-hand-to-mouth contact. Some enteric viruses could persist in the air after toilet flushing and infection may be acquired after inhalation and swallowing'

'Infectious gastroenteritis is caused by a variety of microorganisms which have the potential to contaminate surfaces in toilets and bathrooms, because they are excreted in large numbers during episodes of acute diarrhoea. Flushing the toilet is known to produce aerosols that are capable of causing surface contamination within the toilet and bathroom.'

Darlow and Bale 1959; Bound and Atkinson 1966; Newsom 1972; Gerba et al 1975

'Many enteric pathogens are spread by the faecal-oral route and it has been suggested that the fallout of droplets containing faecal material, after flushing the toilet, is an important infection hazard within the bathroom.'

Hutchinson 1956; Darlow and Bale 1959; Gerba et al 1975.

'Viruses are a significant cause of gastroenteritis worldwide and virtually all children aged 3-5 years acquire a rotavirus infection. Individuals with acute diarrhoea may shed >1010 infectious rotavirus particles per ml of faeces (*Hart and Cunliffe 1999*) and toilet flushing could spread aerosols containing the virus onto surfaces in the bathroom. In the UK, over the last decade the reported incidence of norovirus has increased considerably and it is estimated that at least 3 million cases occur annually (*Evans et al. 1998; Wheeler et al. 1999*). The virus produces a rapid onset of diarrhoea and vomiting in both adults and children and large numbers of infectious virus particles are found in both vomit and faeces. The infective dose of both norovirus and rotavirus is presumed to be as low as 10–100 virus particles (*LeBaron et al. 1990*) which undoubtedly contributes to their high infectivity, spreading mainly through contact with infected individuals and virus-contaminated environmental fomites. Norovirus outbreaks can be difficult to control because the virus spreads rapidly in closed environments often resulting in secondary attack rates of >50% (*Caul 1994*).'

'Closing the toilet lid had little effect in reducing the number of bacteria released into the air which was c. 1000 CFU m3 after the first flush (data not shown). Although splashes would probably have been contained by closing the lid, there was a gap of 15 mm between the top of the porcelain rim and the seat, and also a gap between the seat and the lid of 12 mm which would allow aerosols to escape into the room. Conversely, *Darlow and Bale (1959*) found that closing the lid reduced the aerosol concentration by a ratio of 1 : 2 but their measurements were performed using a wash-down toilet and an impinger air sampler. In contrast, *Bound and Atkinson (1966*) found that closing the lid did not significantly reduce the bacterial count in the air from a

wash-down toilet seeded with E. coli using a slit sampler positioned at seat level.'

(Pure Flush in the USA has a video demonstrating that to close a toilet lid does not prevent the aerosol effect when flushing a toilet. See the website: www.pureflush.com)

'The highest level of surface contamination was closest to the aerosol source, at the toilet seat level, however, the marker organisms were also found on the cistern and on a shelf, 41 and 83 cm above the toilet seat respectively. The particles captured by the settle plates were likely have been >20 lm because these are known to settle within a relatively short period compared with smaller-sized particles which can remain suspended for several hours (*Chatigny et al. 1979*). Our results support earlier studies (*Darlow and Bale 1959; Gerba et al. 1975) that* there is a risk that pathogens contaminating bathroom surfaces could spread to other family members. Organisms may be picked up by the clean hands of an uninfected person and cause infection, either by direct transfer from surface-to-hand-to-mouth, or transfer by handling ready-to-eat foods (*Barker et al. 2004*). The number of bacteria/ viruses found in the toilet or on surrounding surfaces must be compared with the infectious dose. Although bacteria may multiply if they contaminate food and reach levels required for infection, clearly this does not happen with viruses. Nevertheless, many faecal–oral pathogens such as norovirus, rotavirus, Campylobacter and E. coli 0157 have infective doses as low as 10–100 micro-organisms (*Dupont et al. 1972; LeBaron et al. 1990; Tauxe 1992; Caul 1994; Griffin et al. 1994; McDonnell et al. 1995*) and we speculate that surface-to-hand-to-mouth transfer could occur with the levels of contamination that we found on the surfaces surrounding the toilet. '

'The possibility that aerosols containing enteric pathogens could cause infection after being swallowed following deposition in the nose or pharynx was suggested by *Darlow and Bale (1959*) Recent epidemiological studies have provided convincing evidence to support this hypothesis. The likelihood of air-borne transmission of norovirus was demonstrated in an outbreak at a restaurant where no food source was implicated but analysis of the attack rate showed an inverse correlation with the distance from a person who had vomited (*Marks et al. 2000*). In infected persons up to 1011 g) 1 of virus particles have been detected in stools during viral gastroenteritis and with an average stool weighing 100 g the toilet bowl could contain 1013 virus particles. If there is a 2-log reduction in loading after an initial flush, the bowl water could still contain 1011 virus particles. Multiple trips to the toilet during diarrhoea are likely to result in large numbers of pathogens persisting in the toilet, both on the porcelain surfaces and in the bowl water. Our studies have shown that such contamination is likely to result in continuing air-borne spread on subsequent flushes. It would not be unreasonable to suggest that the persistence of enteric viruses within the air could be a potential infection risk via inhalation and swallowing. Airborne contamination could help to explain the high level of secondary spread of norovirus, within closed communities.'

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'Method for detecting viruses in aerosols'

Wallis C, Melnick JL, Rao VC, Sox TE.

*Pubmed**: PMID 3004329**. Applied Environmental Microbiology 1985*

They developed a method to detect the quantity of viruses in a person's daily stool. Of interest was that poliovirus was the model. Poliovirus-containing faecal material from two of four infants who had recently received oral polio vaccine also yielded the poliovirus in the aerosols.

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'*Microbial agents associated with waterborne diseases'*

Leclerc H; Schwartzbrod L; Dei-Cas E.

*Pubmed: **PMID 12546197***

'Many classes of pathogens excreted in faeces are able to initiate waterborne infections. There are bacterial pathogens, including enteric and aquatic bacteria, enteric viruses, and enteric protozoa, which are strongly resistant in the water environment and to most disinfectants. The infection dose of viral and protozoan agents is lower than bacteria, in the range of one to ten infectious units or oocysts.

More and more numerous reports show that Helicobacter pylori DNA can be amplified from faeces samples of infected patients, which strongly suggests faecal-to-oral transmission'

www.cleanseats.com.au/articles.html

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Persistance of Nosocomial Pathogens requires proper environmental cleaning.

www.infectioncontroltoday.com

In this article it was shown that most gram positive bacteria, (Enterococcus sppp, Staphylococcus aureus (including methicillin-resistant) or Streptococcus pyogenes, survive for months on dry surfaces. Many gram-negative species (Actinobacter spp. Escherichia coli, Kliebsiella spp' pseudomonas aeruginosa, Serratia marcescens, or shigella spp, can survive for months. Mycobacteria, including Mycobacterium tuberculosis and spore forming bacteria including Clostridium difficile, can also survive for months on surfaces.

'Viruses from the gastrointestinal tract, such as astrovirus, poliovirus or rotavirus, persist for approximately 2 months.'

The important last remark was 'the number and types of microorganisms present on environmental surfaces are influenced by the number of people in the environment, the amount of activity, the amount of moisture, the presence of material capable of supporting bacterial growth, *the rate at which organisms suspended in the air are removed,* and the type of surface and orientation (horizontal or vertical)'.

The toilet friend unit prevents airborne bacteria and viruses from escaping the toilet bowl, thus fulfilling the criteria of removing organisms suspended in the air (even before they leave the bowl.)

Infection Control Today Magazine:

'Surface sanitation in healthcare: Why your disinfection system may be letting you down'

Valerie Williamson (Kimberly- Clark Professional)

08/01/2007

In this article one of the criteria mentioned that influence the number and types of microorganisms present on environmental surfaces is:

'Rate at which organisms suspended in air are removed'

The article also 'further cautions against returning a cloth to the bucket of disinfectant once it has been used to wipe surfaces as this may promote increased environmental contamination and microbial spread'

Ventilation systems and ceiling extractor fans will not be ideal as they will 'improve' the air flow and enhance the spread of the bacteria to contaminate surrounding surfaces.

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Microbes in the washroom. (Sani-seat toilet seats.)

'The micro-organisms of concern in the washrooms and the toilets would be those arising from faecal contamination. Human faeces are loaded with a multiplicity of microbial flora. More than 100 distinct types of micro-organisms occur regularly in the normal faecal flora. There are an estimated 100 000 000 000 bacteria /gram of faeces! Among these; the presence of a group of bacteria called the 'Coliform bacilli- especially Escherichia coli is a sure indicator of faecal contamination.

In addition to these there are others with the potential to cause disease.(pathogenic).

Some such pathogenic microbes which get excreted include:

-Salmonella (typhoid)

-Shigella (baciliary dysentery)

-Vibrios (cholera)

-Entamoeba histolytica (amoebic dysentery)

-Gardia lambia (diarrhoeal disease- Gardiasis)

-Enterobius vermicularis (pin worm)

-Hepatitis A & E (Juandice)

-Rotaviruses and other viruses causing diarrhoea'

www.saniseat.com

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'Survival of Salmonella in bathrooms and toilets in domestic homes following salmonellosis'

Barker J; Bloomfield SF.

Pubmed: ***PMID 10945790***

'Salmonella enteritidis persisted in one toilet for 4 weeks after the diarrhoea had stopped, despite the use of cleaning fluids. Salmonellas were not isolated from normally dry areas such as, the toilet seat, the flush handle and door handle. Toilet seeding experiments were set up with Salmonella enteritidis PT4 to mimic environmental conditions associated with acute diarrhoea. Flushing the toilet resulted in contamination of the toilet seat and the toilet seat lid. In one out of three seedings, Salmonella bacteria were also isolated from an air sample taken immediately after flushing, indicating that airborne spread of the organism could contaminate surfaces in the bathroom. In the seeded toilet Salmonella bacteria were isolated from the biofilm in the toilet bowl below the waterline for up to 50 d after seeding, and also on one occasion from the bowl water. The results suggest that during diarrhoeal illness, there is considerable risk of spread of Salmonella infection to other family members via the environment, including contaminated hands and surfaces in the toilet area.'

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Toilet Flush May Have Spread SARS
Hong Kong study calls for better look at airborne transmission
(Pure Flush: www.pureflush.com)

'WEDNESDAY, April 21 (HealthDayNews) -- A new study suggests that severe acute respiratory syndrome (SARS) may have been spread through the simple act of flushing a toilet instead of being passed directly from person to person.'

'Even with all the research that has been conducted on SARS in the past year, some mystery still remains as to how the virus can be transmitted.'

Two articles appearing in the April 22 issue of the New England Journal of Medicine explore the possibility of airborne and laboratory transmissions. Both scenarios point to new public health measures that should be taken to contain the disease.

"Airborne spread of a concentrated source of virus can infect many persons within a short period of time," Dr. Tak-sun Ignatius Yu, lead author of one of the studies and an associate professor of community and family medicine at the Chinese University of Hong Kong, said. "Future prevention and protection against SARS should take into consideration the possibility [that] airborne transmission avoidance of close contacts alone may not be adequate. **The prevention of aerosolization of the virus source should take priority."**

'Severe acute respiratory syndrome associated coronavirus is detected in intestinal tissues of fatal cases'

Shi X; Gong E; Gao D; Zhang B; Zheng J; Gao Z; Zhong Y; Zou W; Wu B; Fang W; Liao S; Wang S; Kie Z; Lu M; Hou L; Zhong H; Shao H; Li N; Liu C; Pei F; Yang J; Wang Y; Han Z; Shi X; Zhang Q; You J; Zhu X; Gu J

Pubmed ***PMID 15654797***

'Conclusion: In addition to the lungs, the gastrointestinal tract is another target of SARS-CoV infection, as the intestinal epithelial cells and mucosal lymphoid tissue are infected. The findings provide possible explanations for the gastrointestinal symptoms and the presence of virus in the stool of SARS patients.'

'*Organ distribution of severe acute respiratory syndrome (SARS) associated coronavirus (SARS-CoV) in SARS patients: implications for pathogenesis and virus transmission pathways.'*

Ding Y; He L; Zhang Q; Huang Z; Che X; Hou J; Wang H; Shen H; Qiu L; Li Z; Geng J; Cai J; Han H; Li X; Kang W; Weng D; Liang P; Jiang S

Pubmed: ***PMID 15141376*** *(copyright 2004 Pathological Society of Great Britain and Ireland. Published by John Wiley & Sons. Ltd)*

'In addition to viral spread through a respiratory route, SARS-Co V in the intestinal tract, kidney and sweat glands may be excreted via faeces, urine and sweat, thereby leading to virus transmission.'

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Five spontaneous deaths associated with Clostridium difficile in a colony of cotton-top tamarins (Saguinus Oedipus)

Rolland RM; Chalifoux LV; Snook SS; Ausman LM; Johnson LD

Pubmed: ***PMID 9355088***

'The proximity of the cases raises the possibility of environmental contamination by resistant C.difficile spores or faecal spread of the organisms as reported in hospitals, day-care centres and nurseries.'

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Infection Control Today Magazine:

06/2004 Clinical Update

Clostridium difficile Toxin:

Diagnosis, Treatment and Prevention of Disease.

Marcia Hardick, RN BS, CGRN

'There have been no reports of C.difficile transmissions via medical instrumentation or food, or from food preparation areas in hospitals. There are, however, reported cases of transmission from the use of blood pressure cuffs, toilets, bedside commodes, electronic rectal thermometers, bed rails, call buttons, and improper gloving or glove removal techniques.'

'Nosocomial epidemiology and transmission of Clostridium difficile infection'

Grúnewald T, Frenzel S; Decker M; Lindner B; Sultzer R; von Eichel-Streiber Cl Ruf BR

Pubmed: ***PMID 11381634***

'Though, environmental samples in general had a low positivity, toilet chairs were contaminated in 15.4% and may be a potential source of transmission.'

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Biomed Central Infectious Diseases.

Aerial dissemination of Clostridium difficile spores.

Katherine Roberts; Caroline F Smith; Anna M Snelling; Kevin G Kerr; Kathleen R Banfield; P Andrew Sleigh; Clive B Beggs.

Under discussion the following were stated: 'Previous work has found surfaces within bathrooms and toilets to be among the most contaminated areas within hospitals, which is not surprising given that C.difficile colonises the colon.'

Under conclusion the following: 'The study produced evidence of sporadic aerial dissemination of spores of a clone of C.difficile, a finding which may help to explain why C.difficile associated diarrhoea (CDAD) is so persistent within hospitals and difficult to eradicate.' And 'if airborne dissemination is a contributory factor to environmental contamination, then the use of negatively-pressurised isolation rooms and improved ward ventilation systems may help to reduce the spread of CDAD in healthcare facilities and these interventions warrant urgent evaluation.

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Possible risk for re-colonization with methicillin-resistant Staphylococcus aureus (MRSA) by faecal transmission

Klotz M, Zimmermann S, Opper S, Heeg K, Mutters R.

Pubmed: ***PMID: 16217924***

The authors conclude: 'We show here that colonization of the gastrointestinal tract with MRSA apparently could play an important role in spreading MRSA via faecal contamination. Hence, we suggest that stool colonization with MRSA could be the source of a so far unrecognized transmission of MRSA within individual

patients and within the population. Therefore, our findings imply a modification in the hygienic strategies for handling decontamination and therapy of MRSA patients.'

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Molecular characterization of the transmission between the colonization of methicillin-resistant Staphylococcus aureus to human and environmental contamination in geriatric long-term care wards.

Asoh N, Masaki H, Watanabe H, Watanabe K, Mitsusima H, Matsumoto K, Oishi K, Nagatake T

Pubmed: ***PMID: 15704661***

The authors investigated the differences between MRSA types which colonize in humans and in the environment. They isolated and cultured 25 strains from the respiratory tract, 4 strains from faeces and 11 strains from decubitus ulcers. Fifty-seven strains were from the patients' environment.

'CONCLUSION: Our results demonstrated that MRSA from patients can contaminate the environment, whereas MRSA from the environment might be potentially transmitted to patients via health care workers under unsatisfactory infection control.'

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Widespread environmental contamination associated with patients with diarrhea and methicillin-resistant Staphylococcus aureus colonization of the gastrointestinal tract.

Boyce JM, Havill NL, Otter JA, Adams NM.

Pubmed: ***PMID: 17828690***

This study was done to show the environmental contamination by patients with diarrhoea and MRSA.

'Patients colonized with methicillin-resistant Staphylococcus aureus (MRSA) may contaminate their immediate environment with this organism. The items most commonly contaminated were bedside rails, blood pressure cuffs, television remote controls, and toilet seats.'

'CONCLUSIONS: Patients who have diarrhoeal stools and heavy gastrointestinal colonization with MRSA are associated with significantly greater environmental MRSA contamination than patients without MRSA in their stool, and they are likely to be the source of that contamination.'

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Significance of airborne transmission of methicillin-resistant Staphylococcus aureus in an otolaryngology-head and neck surgery unit.

Shiomori T, Miyamoto H, Makishima K.

Pubmed: ***PMID: 11405862***

The aim of this study was to proof that MRSA is airborne and can easily be spread in this way.

'To quantitatively investigate the existence of airborne methicillin-resistant Staphylococcus aureus (MRSA) in a hospital environment and to perform phenotyping and genotyping of MRSA isolates to study MRSA epidemiology

CONCLUSIONS: Methicillin-resistant S aureus was recirculated among the patients, the air, and the inamimate environments, especially when there was movement in the rooms. Airborne MRSA may play a role in MRSA colonization in the nasal cavity or in respiratory tract MRSA infections. Measures should be taken to prevent the spread of airborne MRSA to control nosocomial MRSA infection in hospitals.'

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Detection of methicillin-resistant Staphylococcus aureus (MRSA)--relation between respiratory tract and gastro-intestinal tract

Ito Y, Tanaka M, Shimazaki M, Nakamura T, Kimura Y, Shima H, Kato N, Watanabe K.
Pubmed: ***PMID: 9128004***

'The study was conducted to elucidate the possibility of hospital infection of methicillin-resistant Staphylococcus aureaus (MRSA) through faeces
These findings suggest the possible role of faeces in hospital infection with MRSA'

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Conclusion:

The toilet friend units will greatly contribute to create a hygienic environment and must form part of every medical institution's infection control program, as well as in normal households, hospitality sector, industries, restaurants, working environments etc. All households where a member contracted Hepatitis, gastroenteritis, MRSA etc should definitely consider to install a toilet friend unit to help protect the spreading to other members of the household.

Advantages of the units are:

- They are maintenance free. There are no contaminated filters to replace that actually form a health hazard by the time they must be replaced.
- The units work automatically and are working either permanently or can be controlled by a sensor light for areas where there is a lessened traffic flow. The units switch off automatically after 4-5 minutes and will switch on again with movement in the area.
- Epidemic episodes of the famous 'winter vomiting bug' and diarrhoea may be reduced, saving money.
- Environmentally friendly product. No need to use hazardous air fresheners and to dispose of empty aerosol cans anymore. Thus creating a hygienic, safe and odour free environment automatically.
- Economical to run. They do not use more electricity than €1 per month..

Study ref nr: 2008/08 MRZ/1

Materials and methods used:

Due to the fact that the toilet friend units are maintenance free, testing was not that straight forward. The units don't have any filters or 'trapping' devices to eliminate odours and bacteria that could be tested. The gentle suction effect can be demonstrated by placing a plastic bag over the toilet, but this does not proof the reduction of bacteria. The fact that unpleasant odours are successfully being removed, also implicates the removal of bacteria, but must be scientifically proven as well.

After a discussion with the head of the UCD School of Biomolecular & Biomedical Science of the Microbiology Department at UCD, it was decided to test the units while operating normally. The difference in the bacteria count between a normally operating unit and a test where the quantity of bacteria being eliminated could be shown, would determine the effectiveness.

Explanation: When someone wants to use the toilet, the unit will work automatically from the time the person approaches the toilet, while the toilet is in use and flushed, and for 4.5 -5min after the person has left the room.

One of the operating units was therefore dismantled and the extractor pipe was mounted above a settle plate. Another settle plate was placed on the floor where a unit was operating normally and one settle plate where there was no unit installed. These settle plates were left in place for 5 minutes, thus for the duration of the normal operating time of the unit.

The main purpose of the testing was to show the number of bacteria being removed from the environment when the toilet friend units are used.

Airborne bacteria and viruses can linger in the air for two up to six hours and settle plates were left for 2h30 in certain tests to be more effective.

TSA settle plates were supplied by Microchem Laboratories, Dungarvan , Co Waterford, Ireland.

The tests were conducted in a normal environment in two institutions during daily use as usual and at a private household.

No seeding of the toilets or any special performance was done before the tests were conducted. No special cleaning and disinfection were done; only the usual daily cleaning of the toilets was performed.

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Test A 3:

A settle plate was placed on the floor of the room where there was no toilet friend unit operating and left for 2h30.

Test A 4:

A settle plate was place on the floor in another toilet with a toilet friend unit operating normally and left for 2h30.

Test A 3-4 & 5-6

Toilet used for test	Position of plate	Details of test & duration
Patient	Floor	A3. With unit off (2h30)
Staff	Floor	A4. With unit on (2h30)

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Test B3 & 4:

Test B3:

The toilet friend unit was disconnected and the extractor pipe was connected to a settle plate just before a patient wanted to use the facility. The settle plate was removed 5 min after the patient left the toilet and the extractor pipe was connected to the waste pipe again.

Test B4:

A settle plate was place on the floor as near as possible to the place where the extractor pipe is connected to the waste pipe. See diagram* for more clarity.

This settle plate was put in position when the patient was ready to use the toilet and removed 5min after the patient left the room.

Test B. 3-4

Toilet used for test	Position of plate	Details of test & duration
Patient	Mounted to fan outlet	B. 3 (unit on)
Staff	Floor	B. 4 (unit **on**)

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Test C1-3 & 4-6

Settle plates were placed on the floor, on the lid of the cistern and at seat level for 30min after the toilet was used and flushed.

Tests C 1-3 were conducted with no toilet friend unit working.

Tests C 4-6 were conducted with a normal operating toilet friend unit.

Test C. 1-3

Toilet used for test	Position of plate	Details of test & duration
Staff	Floor	C1. With unit switched **off** (30 min after flush)
Staff	Seat level	C2. With unit switched **off** (30 min after flush)
Staff	Cistern	C3. With unit switched **off** (30 min after flush)

Test C. 4-6

Toilet used for test	Position of plate	Details of test & duration
Staff	Floor	C6. With unit switched **on**(30 min after flush)
Staff	Seat level	C5. With unit switched **on**(30 min after flush)
Staff	Cistern	C4. With unit switched **on**(30 min after flush)

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Test D 1 & 2

Test D1.

An air extractor pipe was connected to a settle plate and air was extracted above the toilet for 5 min after flushing the toilet with no toilet friend working.

Test D2:

The same test was performed again with a new settle plate and with the toilet friend unit operating normally.

This test will not be very reliable as the two extractor fans are counteracting each others efficacy.

The test will be more reliable if an air sample gun was used, but no gun was available. A toilet friend extractor pipe was modified and connected to the settle plates before conducting the tests.

The suction effect of the toilet friend unit is best shown as in the show room demonstrations, by pulling a black plastic dustbin bag over the seat and watching the gentle extraction taking place.

Test D 1-2

Toilet used for test	Position of plate	Details of test & duration
Staff	Mounted to fan outlet (Modified)	D1. With TF unit **off** (5 min after flush)
Staff	Mounted to fan outlet (Modified)	D2. With TF unit **on** (5 min after flush)

****

Test E 1 - 2:

Test E2: A settle plate was placed on the floor for 5 min after the toilet has been used, with no toilet friend unit operating

Test E1: A settle plate was placed on the floor for 5 min after the toilet has been used in a toilet with an operating unit

Toilet used for test	Position of plate	Details of test & duration
Private household	Floor	E2. With TF unit **off** (5 min after flush)
Private household	Floor	E1. With TF unit **on** (5 min after flush)

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Study ref nr: 2008/08 MRZ/1

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Study ref nr: 2008/08 MRZ/1

Results and discussion:

Tests were conducted during normal daily work routine and no special effects were created.

Tests were analysed by Microchem Laboratories located in Dungarvan, Co Waterford in Ireland, a leading independent test and research laboratory.

The settle plates were incubated and cultured by Microchem Laboratories

Microchem provided the results with bacteria count as well.

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Tests conducted on 05/08/2008 at a normal operating Day Hospital in Co Cork.

Test A 3 & 4 & 6.

Toilet used for test	Position of plate	Details of test & duration	Result
Patient	Floor	A3. With unit off (3h00)	>500 Cfu ****SPOILT
Staff	Floor	A4. With unit on (3h00)	>500 Cfu ****SPOILT

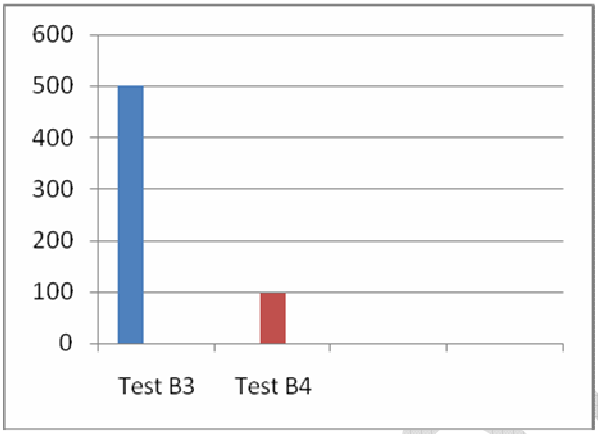
Test A3 was spoilt, because a patient threw the settle plate in the dustbin, although it was recovered immediately and covered with the lid.

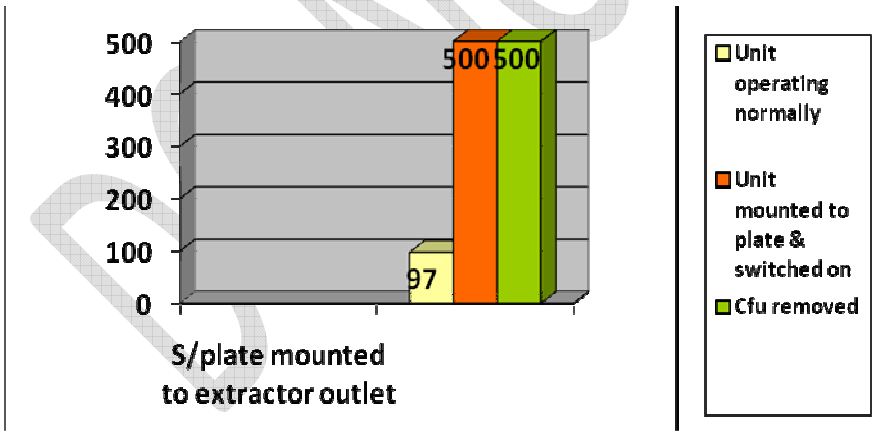
Test A4 was also spoilt because the settle plate was not removed before the toilet friend extractor pipe was dismantled to perform Test B3, with the result that when test B3 was done, the area was contaminated by blowing extracted air out over the settle plate and into the room, contaminating plate Test A4.

****

Test B 3-4

Toilet used for test	Position of plate	Details of test & duration	Result
Patient	Mounted to fan outlet	B.3 (unit on)	>500 Cfu (stopped count at 500 cfu)
Staff	Floor	B. 4 (unit **on**)	97 Cfu





The result showed that >500Cfu were removed through the wastepipe when the toilet friend unit was operating normally and the air was blown over the settle plate and not removed through the waste pipe as in test B4. With the toilet friend working normally only 97Cfu were detected on the settle plate in comparison with the >500Cfu detected in Test B3

This result showed that *at least* 80% of airborne bacteria are removed through the extractor pipe out into the waste pipe. This is not 100% accurate as the bacteria were not counted above 500 Cfu.

According to literature articles the number of bacteria can be between 1000 CFU m(-3), 1370 CFU m(-3) for serratia, (*The potential spread of infection caused by aerosol contamination of surfaces after flushing a domestic toilet. Barker J' Jones MV Pubmed PMID 16033465*), up to 600 000 bacteria and 25000 virus particles in a single flush (*Dirty Business* www.jrscience.com). The percentage of bacteria removed based on these facts, would have been 90%, 93% up to 99.98% theoretically.

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Tests conducted on 05/08/2008 @ Toilet Friend Office

Test C. 1-3

Toilet used for test	Position of plate	Details of test & duration	Result
Staff	Floor	C1. With unit switched **off** (30 min after flush)	55 Cfu
Staff	Seat level	C2. With unit switched **off** (30 min after flush)	57 Cfu
Staff	Cistern	C3. With unit switched **off** (30 min after flush)	62 Cfu

In this facility a toilet friend unit was installed since day 1 and the toilet does not have the same traffic flow as in the day hospital. The environment is more hygienic, but nevertheless a good comparison was possible.

On top of the cistern the highest bacteria count was detected, confirming the aerosol effect when the toilet is flushed.

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Test conducted on 06/08/2008 @ Toilet Friend Office

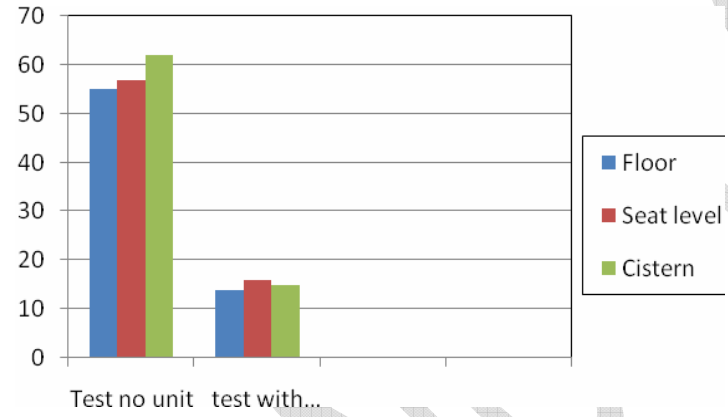
Test C. 4-6

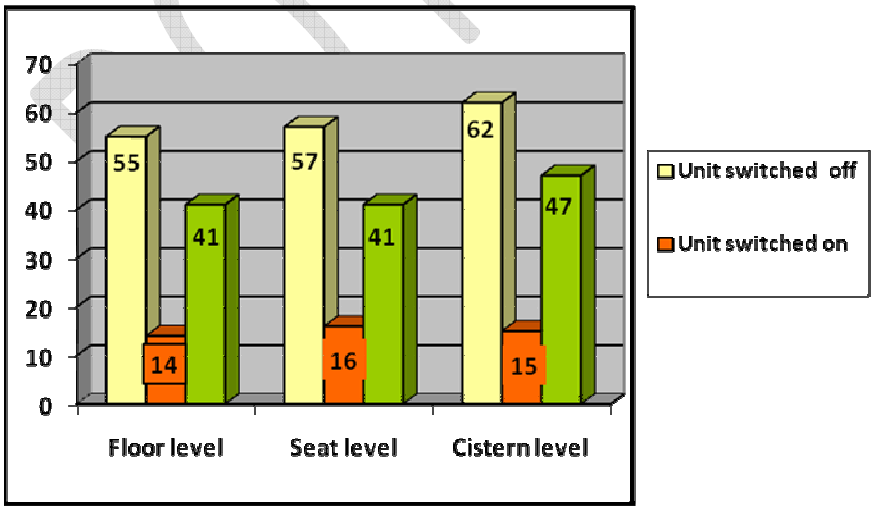
Toilet used for test	Position of plate	Details of test & duration	Result
Staff	Floor	C6. With unit switched **on**(30 min after flush)	14 Cfu
Staff	Seat level	C5. With unit switched **on**(30 min after flush)	16 Cfu
Staff	Cistern	C4. With unit switched **on**(30 min after flush)	15 Cfu

Comparison:

Position of plate	With unit switched off Settle plate count	With unit switched on Settle plate count	% difference More hygienic effect with the toilet friend unit operating
Floor	55 Cfu	14 Cfu	75%
Seat level	57 Cfu	16 Cfu	72%
Cistern	62 Cfu	15 Cfu	76%

CFU





We can confirm that even in this clean, hygienic environment at least 72%- 76% more airborne bacteria are removed through the waste pipe, when the toilet friend unit is working in comparison with the unit not operating.

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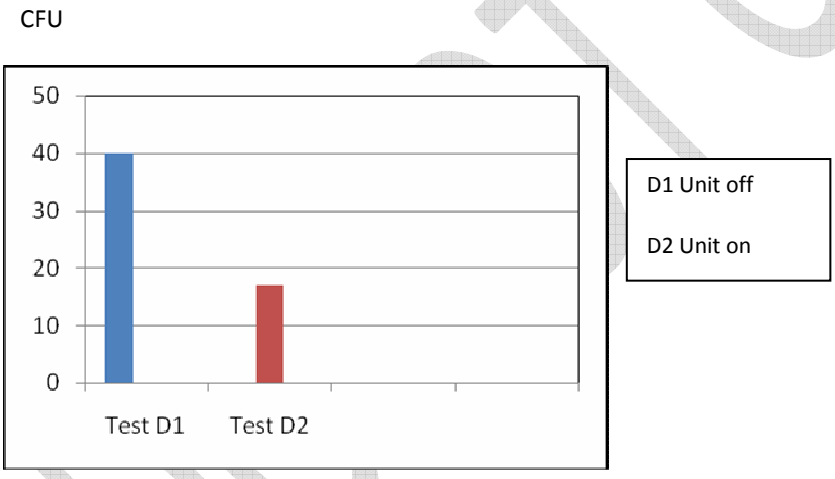
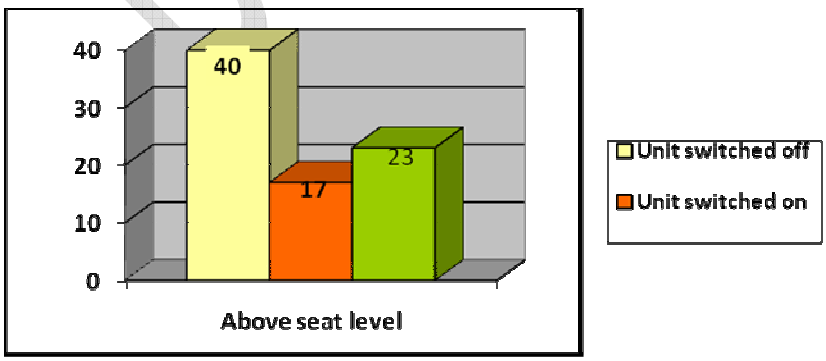
Tests conducted on 07/08/2008 @ Toilet Friend Office

Test D 1-2

Toilet used for test	Position of plate Extractor pipe above toilet	Details of test & duration	Result
Staff	Mounted to fan outlet (Modified)	D1. With unit **off** (5 min after flush)	40 Cfu
Staff	Mounted to fan outlet (Modified)	D2. With unit **on** (5 min after flush	17 Cfu





The result of these tests shows the difference in suction and removing of the aerosol effect when flushing a toilet. An extractor pipe was held above the toilet and was sucking air for 5min after the toilet was flushed. In one test the toilet friend unit was operating normally in comparison with the other test where the unit was not working. The two extractor pipes used were actually counteracting each other's suction action in test D2.

The test will be more reliable if an air sample gun was used, but no gun was available. Although not a very reliable test, a positive difference of 58% was still noted.

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Test E 1 & 2:

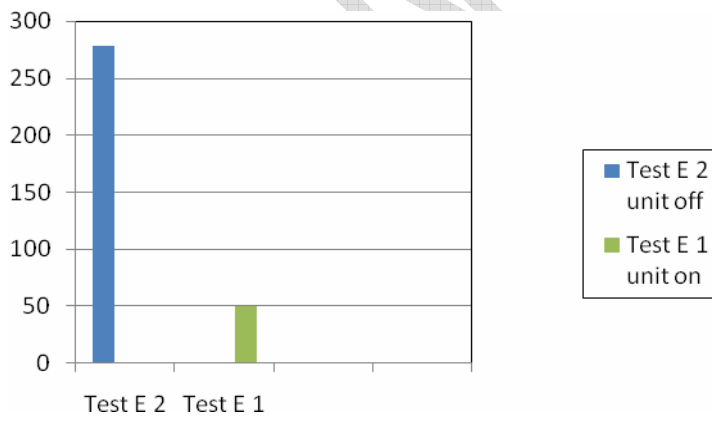
Tests conducted at normal operating private household.

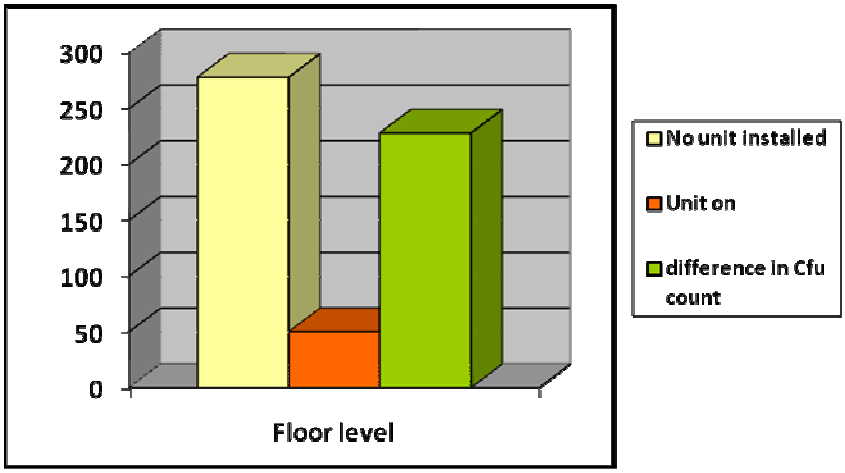
Test E: to determine Cfu count in the following conditions.

Position of plate	With unit switched off Settle plate count Test E2	With unit switched on Settle plate count Test E 1	% difference More hygienic effect with the toilet friend unit operating
Floor	278 Cfu	50 Cfu	82%

Test E2: Conducted with no T F unit installed in toilet for 5 minutes after flush.

Test E 1: Conducted with T F unit installed and operating for 5 minutes after flush.





We conducted these tests in a normal environment and the result was a reduction of 82% in the bacteria count.

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Study ref nr: 2008/08 MRZ/1

Conclusion:

It was claimed the toilet friend units prevent airborne bacteria and viruses from even escaping the toilet bowl and reduces the spread of these bacteria, based on the fact that bacteria has a distinct odour and the fact that the toilet friend units successfully remove unpleasant odours. The aim of the study was to proof that the toilet friend units while operating, eliminate odours and reduce and prevent the spread of airborne bacteria and viruses.

The following were proven and used as part of the study:

- The odour of faeces due to bacteria was proven by doing a literature search using words as odour, faeces, toilet etc.
- Testimonials of institutions where toilet friend units were installed are available, confirming the effective removal of unpleasant odours.
- The aerosol effect when a toilet is flushed and the spread of bacteria contaminating the room and even adjacent rooms were also proven.
- Some strains of bacteria that can be spread through faeces were proven.
- The fact that the cleaning and disinfecting of toilets are not always effective, were also proven.
- Microbiological tests conducted in a day hospital in Co Cork, at the premises of Toilet Friend Ireland and a private household, confirming the reduction in the spread of bacteria.

Test were done in a normal operating day hospital, without making use of special seeding of toilets or extra disinfecting of the areas to give significant, but maybe unreal comparative results.

Even although this was the first tests to be done, satisfactorily results were obtained to proof the airborne bacteria and viruses removal effect of the operating toilet friend units. Because of the difficulty in performing testing, the best proof was to show the bacteria being extracted away through the waste pipe in comparison with a normal operating unit and where no unit was installed.

(The units don't have any filters or any disposable parts that could be tested. The extracting effect can be shown by pulling a plastic bag over the seat and watch the gentle extracting effect, but this also does not prove the reduction in bacteria.)

After a period of time the environment will be overall more hygienic, due to the fact that as part of the daily cleaning and disinfecting program, the units successfully reduce the spread of bacteria and as a result reduce contamination of the vicinity more effectively.

We can with confidence strongly recommend that toilet friend units must form part of the infection control program of each healthcare institution worldwide. Also part of normal households, restaurants, pubs, hotels, guest houses, shopping centres, universities etc. No more need for potentially harmful air fresheners and empty cans that must be disposed off afterwards.

As mentioned before, the units are maintenance free. No filters are used to trap the bacteria, because these filters will be heavily contaminated after some period of usage and will have a diminished effect at that stage as well. Also the contaminated filters will have to be disposed of safely.

The units are also more effective than ceiling extractor fans to reduce the spread of bacteria and eliminate odours, because the ceiling extractor fans extract the foul air upwards through the room, enhancing the spread of the airborne bacteria and viruses and leaving ample time for them to adhere to surfaces.

The toilet friend units are economical to run and do not use more power than €1 per month.

The units switch on automatically when someone approaches the toilet and begin to operate even before the toilet is used and flushed to optimise the effect. The units switch off automatically again 4-5 min after the person has left the toilet area. For urinals and heavy traffic areas units can be installed that run permanently if required.

Everyone can contribute to improve the environment effortlessly by installing a toilet friend unit.

Note:

Testimonials are available from highly satisfied clients.

These include hospitals, nursing homes, day care centres, private homes etc. in Ireland.

For more information on the product and installations, please contact the company at:

Toilet Friend Ireland Ltd
Unit 6 Youghal Business Park
Parkmountain
Youghal
Co Cork
Tel: +353 24 20525
Fax: +353 24 20523
Email: info@toiletfriend.ie
www.toiletfriend.ie

Study ref nr: 2008/08 MRZ/1

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    11/01 REV2007_07 FORM# 000133

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    Each year, at least 100,000 people who go into hospital gets an infection there.

    MRSA is one example of this.

    What is MRSA?

MRSA is resistant to antibiotics

BBC News Thursday, 24 February 2005, 11:25 GMT

47. ***MRSA and C diff***

    Dartford and Gravesham

    NHS UK

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This leaflet explains about MRSA, how it is passed on and how it can be treated. It also explains about things we are doing at Great Ormond Street Hospital to reduce the chance of it spreading. (NHS-Trust UK)

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