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Aldrig mer uttorkade och illaluktande golvbrunnar

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För 110 år sedan, 1907, drogs nedanstående slutsats! Därefter har det inte hänt så mycket

Conclusions.

The experiments show that :—

(1) Specific bacteria present in sewage may be ejected into the air of ventilation pipes, inspection chambers, drains, and sewers by (*a*) the bursting of bubbles at the surface of the sewage, (*b*) the separation of dried particles from the walls of pipes, chambers, and sewers, and probably by (*c*) the ejection of minute droplets from flowing sewage.

(2) A disconnecting trap undoubtedly prevents the passage of bacteria, present in the air of a sewer, into the house drainage system.

(3) An air inlet, even when provided with a mica valve, may be a source of danger when it is placed at or about the ground level.

1)

1) http://rspb.royalsocietypublishing.org/content/royprsb/79/531/255.full.pdf Sid 266

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2017 publicerades detta:

“The spread of disease via building environmental systems is, on the whole, little understood”. 2)

2) **Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig**
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5302810/

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Kan smitta spridas via golvbrunnar?

Enligt flera studier vi funnit är golvbrunnar och andra vattenlås, så kallade P-traps och U-traps, källor till smittspridning.

Detta är alarmerande, inte bara i sjukhusmiljö utan på många ställen där avloppsvattnet är kontaminerat på något vis.

SARS epidemin i Hong Kong, 2003, bröt ut i hemmiljö och man vet att uttorkade vattenlås var en bidragande orsak.

Även livsmedelsindustrin drabbas.

Det finns även belägg för att golvbrunnar som torkat ut utgör en extra stor risk för smittspridning.

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Konstaterande till följd av SARS-utbrottet i Hong Kong

Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig PMC5302810

The WHO conjecture stated that *“dry U-traps in bathroom floor drains provided a conduit for contaminated sewage droplets to enter households. A significant virus load had built up in the sewer system as an increasing number of SARS cases with diarrhoea excreted virus. Virus was aerosolized within the confines of very small bathrooms and may have been inhaled, ingested or transmitted indirectly by contact with fomites as the aerosol settled”.* 3)

3) WHO. Consensus document on the epidemiology of severe acute respiratory syndrome (SARS) Department of Communicable Disease Surveillance and Response, World Health Organization, 2003.

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The U-traps (particularly in floor gullies) were found to be depleted of water, thus having lost their sealing function and providing an open connection between the sanitary plumbing system and different apartments within the building. As the number of SARS cases increased, the sanitary plumbing system became a reservoir for the virus due to diarrheal excretion. The WHO hypothesis followed that the virus became aerosolized when discharged into the sanitary plumbing system which provided a conduit for virus-laden aerosols to enter apartments via depleted U-traps. This process was exacerbated by the naturally occurring airflows within the sanitary plumbing system and the negative pressures within bathrooms as a result of extract fans. The combination of these factors presented a pathway for pathogen transmission heretofore unexplored [2].

2) Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig PMC5302810

Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig (1/3)

On-site observations of defective trap seals

Observation data from previously completed on-site research carried out over many years were collated and suggest that **U-trap depletion is not uncommon**. Table 3 below shows examples of buildings where the Authors have observed depleted U-traps or have been involved in efforts to alleviate recurring problems in specific buildings (these efforts include re-design of ventilation and pressure alleviation systems, and replacement of water traps with waterless, sheath versions). Depleted U-traps have been found in buildings in many countries and in many different types of building. It is important to note that the majority of these buildings are high occupancy and that two of the buildings observed to suffer from depleted U-traps in the UK are hospitals. 2)

2) Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig PMC5302810

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Table 3. Observations of depleted U-traps within different locations and building types.

Location	Building type	No. of floors	U-trap location	Partially depleted	Fully depleted	Likely cause
UK	Hospital	5	Bathroom	√		Evaporation/ under use
UK	Hospital	5	Plant room		√	Evaporation/ under use
UK	University campus	5	Plant room		√	Evaporation/ under use
UK	Office building	8	Basement		√	Evaporation/ under use
Ireland	Residential	1	Bathroom		√	Evaporation/ under use
USA	Hotel	10	Bathroom		√	Pressure transients
China	Office building	7	Public toilets	ID		Pressure transients
Hong Kong	Residential	50	Bathroom		√	Evaporation/ under use
UK	Hospital	7	Wards		√	Unknown

ID = Intermittent depletion.

doi:10.1371/journal.pone.0171556.t003

Gormley M, Aspray TJ, Kelly DA, Rodriguez-Gil C (2017) Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig. PLOS ONE 12(2): e0171556. https://doi.org/10.1371/journal.pone.0171556
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0171556

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Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig (2/3)
Discussion

The experiments prove that pathogens can be transmitted from one part of a building to another on sanitary plumbing system airstreams.

The U-trap is designed to provide a physical barrier between the sanitary plumbing system and building in order to prevent cross-transmission of airstreams. However, it is vulnerable to particular environmental and system conditions that make it susceptible to depletion. Table 4 details the hazards that influence the risk of U-trap depletion. 2)

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Table 4. Hazards of water trap seal depletion.

Hazard	Risk to U-trap	Cause
Under-use	Evaporation	Vacant/under-utilised building
High ambient temperature	Increased rate of evaporation	Local climate
		Internal heat gains
		Poor design or construction
		Over-loaded system
Excessive system	Self- siphonage or	Tall building *(> 30 storeys)*
pressure transients	induced-siphonage	External air pressures
		(wind shear/sewer surcharge)
		Chimney effect

doi:10.1371/journal.pone.0171556.t004

Gormley M, Aspray TJ, Kelly DA, Rodriguez-Gil C (2017) Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig. PLOS ONE 12(2): e0171556. https://doi.org/10.1371/journal.pone.0171556
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0171556

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Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig Discussion.

If an appliance is under-used then the water seal within the U-trap can simply evaporate over time. The rate of evaporation under normal ambient conditions in the UK has been found to be in the region of 3 mm per week. 4) A 50 mm water seal would, therefore, fail after a period of 17 weeks of non-use. Increased rates of evaporation occur due to higher ambient temperatures. Anecdotal evidence gathered by the authors has found that the water within a 50 mm floor gulley trap located *within a boiler room evaporated completely within a 24 hour period.* 2)

4) Wise AFE and Swaffield JA. Water, sanitary and waste services for buildings, 4th Edition, Longman Scientific and Technical, 1995, London

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The water seal is also vulnerable to fluctuations in air pressure that can propagate throughout the system as pressure transients.

Excessive negative pressures generated by discharging appliances or adjacent appliances, can lead to trap depletion by self-siphonage or induced-siphonage, respectively. The propagation of excessive positive pressures within the system can be large enough to completely displace the water seal into the appliance [5, 6, 7] leaving the trap either wholly or partially depleted. In some cases, even though the trap is not noticeably depleted, ***positive pressures can push air from the sanitary plumbing system through the water seal as air bubbles and into the building***. [2]

5) Swaffield JA, Campbell DP and Gormley M. Pressure Transient Control Part I—Criteria for Transient Analysis and Control Building Services Engineering Research and Technology, 2005;26 (2) 99–114. PubMed/NCBI

6) Swaffield JA, Campbell DP, and Gormley M. Pressure Transient Control Part II—simulation and design of a positive surge protection device for building drainage networks, Building Services Engineering Research and Technology, 2005; 26 (3):195–212. PubMed/NCBI

7) Gormley M. (2007) Air pressure transient generation as a result of falling solids in building drainage stacks: definition, mechanisms and modelling. Building Services Engineering Research & Technology, 2007; 28 (1): 55–70. PubMed/NCBI

Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig Discussion.

Recent research on the isolation of Bio aerosols in hospital building drainage systems using Polymerase Chain Reaction techniques is reported also, confirming that the network is a pathogen reservoir and conducive to the production of aerosolised pathogen-laden air streams. Physical observations of **empty fixture trap seals** in a number of building drainage networks confirms there is potential for cross-transmission of aerosolised pathogens via the building drainage network and a potential threat to the health of inhabitants. 8)

8) Gormley, M., Swaffield, J.A., Sleigh, P.A. and Noakes, C.J. 2011. An assessment of, and response to, potential cross-contamination routes to defective appliance water trap seals in building drainage systems. Building Services Engineering Research and Technology, 1(1), 1- 15

Pathogen cross-transmission via building sanitary plumbing systems in a full scale pilot test-rig

While research into the potential mechanisms of the SARS transmission at Amoy Gardens proved that there was an airflow path between the sanitary plumbing system and different parts of the building when the U-trap had no water seal [7,8], it was only hypothesized that pathogens could be transmitted within these airflows and could deliver an infective exposure dose. This paper sets out to test the WHO hypothesis by qualitatively and quantitatively tracking the transmission of a model organism chosen to represent pathogens generally within the airflows of a full scale pilot test-rig representing a two storey sanitary plumbing system designed to current European standards [9]. The data gained from the pilot test-rig is supplemented with on-site observational data of sanitary plumbing defects collected over many years by the Authors to identify the risk factors of transmission. [2]

7) Hung HCK, Chan DWT, Law LKC, Chan EHW and Wong ESW. Industrial experience and research into the causes of SARS virus transmission in a high-rie residential housing estate in Hong Kong, Building Services Engineering Research and Technology,2006; 27(2): 91–102.

8) Gormley M, Swaffield JA, Sleigh PA and Noakes CJ. An assessment of, and response to, potential cross contamination routes due to defective appliance water trap seals in building drainage systems. Building Services Engineering Research and Technology, 2012; 33: 203–222.

9) British Standards Institution. BS EN 12056–2 Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation. 2000: British Standards Institute.

Drainage systems, an occluded source of sanitation related outbreaks

Results

Often the cause of sanitation related outbreaks is due to inadequate sanitation and maintenance. However, in general these infections probably go unnoticed.

Conclusion

Drainage systems and its maintenance, if neglected, could pose a threat in both community and healthcare causing infections as well as emergence of multi-resistant bacteria that could cause unpredictable clinical manifestations. 10)

10) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4342212/

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Drainage systems, an occluded source of sanitation related outbreaks

Sanitation is in general inadequate in rural areas and in developing countries 11, 12) while regarded as safe in the developed countries in the community as well as in healthcare. However, it is not sufficient to have access to water and modern drainage systems unless adequate sanitation is maintained. Quality assurance maintenance work is implemented in pharmaceutical and food industry in order to reduce the risk of exposure to the hazards (e.g. pathogens causing clinical manifestations) in the disposals. However, in the community or in healthcare, sanitation is not prioritized and often forgotten 13), despite that wastewater disposal contains increased level of human microbes and that there are several reports implicating drains as a source of infection (Table 1).

11) OECD: **Evaluation Insights Rural Water and Sanitation.** In 2012. http://www.oecd.org/dac/evaluation/Evaluation%20insights%20WASH%20final%20draft.pdf

12) Carr R. Excreta-Related Infections and the Role of Sanitation in the Control of Transmission. In: Fewtrell L, Bartrma J, editors. Water Qual Guidel Stand Heal WHO. London: IWA Publishing; 2001. pp. 89–113.

13) Bartram J, Cairncross S. Hygiene, sanitation, and water: forgotten foundations of health. PLoS Med. 2010;7:e1000367. doi: 10.1371/journal.pmed.1000367. [PMC free article] [PubMed] [Cross Ref]

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Table 1

Reports implicating drains as the source of outbreaks

Microorganism	Reservoir	Location	References
SARS	Dry U-traps	Community, Amoy Garden, Hong Kong	WHO [8]
Multidrug resistant *Pseudomonas aeruginosa*	Faulty drains	Hospital-wide and medical unit, England	Breathnach *et al*. [7]
Carbapenem resistant Enterobacteriaceae	Sink drains	ICU, Melbourne, Australia	Kotsanas *et al.* [9]
Several different fungi	Drains in bathrooms Drains in kitchen sinks	Community, Osaka, Japan	Hamada *et al.* [10]
Pseudomonas aeruginosa	Sink drains Whirlpool drains	ICU at Burn hospital, Cincinnati, OH	Edmonds *et al*. [11]
Pseudomonas aeruginosa	Sink drains	Medical-Surgical ICU, Chicago, IL	Levin *et al.* [12]
Pseudomonas aeruginosa	Toilets	Out patients, Tübingen, Germany	Döring *et al.* [13]
Fusarium spp.	Plumbing drains	131 buildings from 8 states, US	Short *et al.* [6]
extended-spectrum beta-lactamase-producing (ESBL) Enterobacteriaceae	Sink drains	Cardiac-Surgical ICU, France	Kac *et al*. [14]
Pseudomonas aeruginosa	Sink drains	Hematology unit, Lund, Sweden	Dagens Nyheter [15]
ESBL *Klebsiella pneumoniae*	Sink drains	Neurosurgical ICU, Uppsala, Sweden	Starlander *et al*. [5]
Klebsiella pneumonia Carbapenem resistant	Sink drains	ICU, Sørlandet, Norway	Tofteland *et al.* [16]
Pseudomonas aeruginosa	Drains	ICU, Edinburgh, UK	Gillespie *et al.* [17]
ESBL Enterobacteriaceae	Sink drains	ICU, Tours, France	Roux *et al.* [18]
Carbapenem-resistant *P. aeruginosa*	Unsealed drain	Urology ward, Barcelona, Spain	Peña *et al.* [19]
P. aeruginosa with unusual antibiogram	Drains	Neurosurgery ICU, Clichy, France	Bert *et al.* [20]
ESBL *Klebsiella oxytoca*	Sink drains	Hospital, Toronto, Canada	Lowe *et al.* [21]
Foot Mouth Disease virus	Leaking drains	Community, Pirbright, UK	HSE [22]
P. aeruginosa	Grooved drainage design	Haemotology, Singapore	Ling and How [23]
Carbapenem resistant *Klebsiella oxytoca*	Drainpipes, traps	ICU, Spain	Vergeres -Lopez *et al.* [24]

Slutsats

Uttorkade golvbrunnar och andra vattenlås är ett problem och smittspridning sker via avloppsnät

Problem

1. Hindra flödet av luftburen smitta från pumpgropen upp i lokalerna
2. Minska förekomsten av smittämnen i avloppsnätet
3. Minska förekomsten av bakterier i det stående vattnet i vattenlås

Lösning

1. Rengör golvbrunnar och vattenlås noggrant.
2. Installera golvbrunnspåfyllare i lokaler där vattenlås tenderarar att torka ut.
3. Tillsätta ett bakteriedödande medel i behållaren för att upprätthålla en bakteriehämmande miljö i vattenlåsets vatten.

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Covid-19

Att Covid-19 smitta finns i avloppsvattnet har påvisats och vilken påverkan har detta för smittspridningen? Flera studier har gjorts och görs bl a. dessa.

COVID-19: mitigating transmission via wastewater plumbing systems

Forskning: Coronaviruspatienter kan vara symptomfria i över tre veckor

- Vi har hjälpt fastighetsägare att slippa uttorkade golvbrunnar sedan 2011 - enkelt, underhållsfritt och prisvärt

https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(20)30112-1/fulltext

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Safe Drain
Technologies Sweden AB