An Existing health threat.

Gram-Negative-Bacteria – Release

25-5-2025

Westmead Hospital 1978

The 1992 U.V. photograph of Bacteria release

Thirty years has elapsed since the publication of the UV photograph showing the path of bacteria driven by flushing into the air, and the breathing intakes of seated WC pan users, in practice some users moved away a small distance, prior to flushing, however, many hospitals do not provide WC cover flaps as a standard, and if they did, the bacteria barrier value provided, is doubtful. As shown in the UAE 1982 Photograph, the bacteria cloud is significant, and the air displacement of the flushing input water significant.

It is noted at this point that 1000 bed Westmead Teaching Hospital is provided with a central storage flushing service water system. This flushing system could be disinfectant dosed. The flush valves have a minor modification, this allows fixing within the dimensions of a standard concrete building block, flanges are featured to simplify replacement, for later workshop servicing. In the original concept, rainwater collection and nominal straining and chlorination were an anticipated water, cost saving feature, that regrettably did not eventuate.

Most health aspects of the plumbing and drainage system were discussed with Ross Bonython the Architect, and on occasion with Bernie Amos the General Superintendent of the hospital who unfortunately passed away 9 May 2005.

The germicidal loaded bacteria release of bacteria from the typical bathroom ceramic toilet WC pan flushing has only been known since the University of Arab Emirates Photographs (dated 1992). Capture of this bacterium is feasible from both ceramic WC and the Bedside unit as featured on the cover of this paper

Toilet ventilation air **from high level is current common practice** and is probably assisting in the distribution of bacteria and infection over a broad area. A high proposition of this contaminated air **could be captured and removed**, from the bowl of the WC pan and UV irradiated to kill the bacteria. This could be achieved by a modified ducted WC pan seat and UV sterilisation. However, gaining some leverage to achieve such a test is the fundamental issue.

The following proposes.

The following proposition suggests UV Sterilization of foul air leaving WC Pans, located as near to the source as is practically possible. As a secondary consideration, also sanitary plumbing vent pipes a roof level discharge. Legionella bacteria are known to have a 25-metre travel zone.

About the author

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David (Dave) Creasey lives in Sydney and has four, now adult children. I was born in 1936 In the short reign of Edward 8 U.K .

In 1953. At seventeen I acquired a “First Class pass City and Guilds Intermediate for Plumbers work”. In year 4 at eighteen the Final City and Guilds First Class pass, also a City and Guilds Sanitary and Domestic Engineers Final First Class, an exam which embraced theory only . Later doing the Building Construction Civil Works and Architecture and the Higher National Certificate, this was interrupted in n 1957 ,when at 21. I was required to undertake two years National Service in the RAF , after this I married and completed the “Higher National Certificate for Public Health Engineering” at Willesden Technical College prior to leaving London and joining the Sydney office in December 1961 to Supervise the Plumbing Installation of the Reserve Bank of Australia.

In 2015 The Chartered Institute of Building Services Engineers - UK Head office confirmed that my qualifications were acceptable to them for membership, however at 80 years old I found it more interesting to write books (4). Which after some time, have started selling but regrettably these books do not include the following gram-negative infection probability source data.

From Google:-

In NSW public hospitals, at least 6,007 patients contracted COVID-19 in 2023, resulting in 297 deaths. This translates to an average of 115 infections and six deaths per week, in 2022-23, one or more hospital-acquired complications (H A Cs) were recorded in 115,000 public hospitalizations

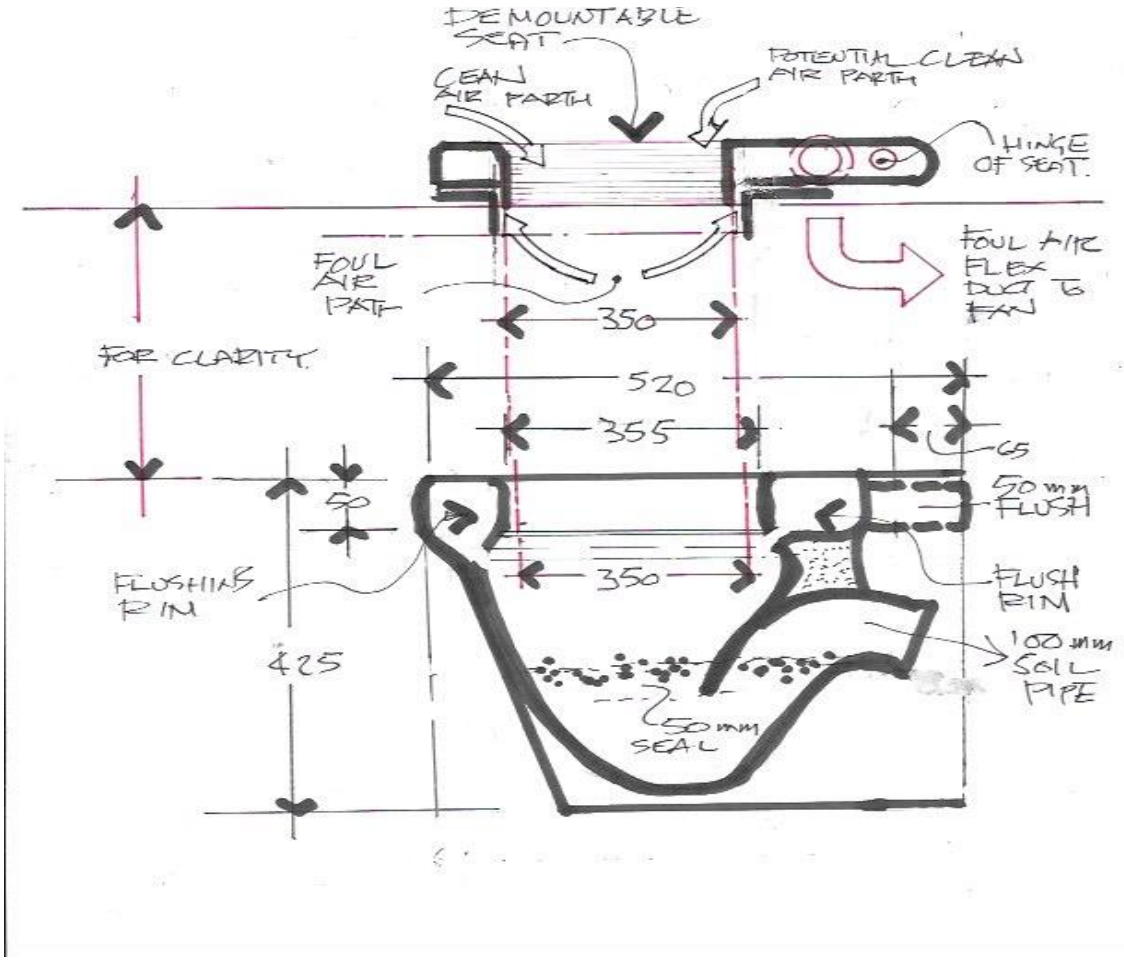
(2.0% of total) and 34,200 private hospitalizations (0.8%), according to the Australian Institute of Health and Welfare.

Gram Negative Bacteria exposed by UV photography .

The following it is an existing international issue, an alarming state of affairs, that since the 1992 discovery below. The following suggests the UV Sterilization of foul air leaving sanitary plumbing vent pipes, and WC pan bowl ventilation when flushed, to capture the air as UV photographed

The UAE University Photograph of WB pan flushing bacteria plume released / driven by the inflow of flushing water and no WC pan cover

Bacteria capture seat - sketch design prototype



There is a long history of investigations concluding that, if used properly, **Ultraviolet germicidal irradiation (UVGI)** can be safe and highly effective in disinfecting the air, thereby preventing transmission of a variety of airborne infections. (UVGI) is an established means of disinfection and can be used to prevent the spread of certain infectious diseases. Low-pressure mercury (Hg) discharge lamps are commonly used in UVGI applications and emit shortwave ultraviolet-C (UV-C, 100–280 nanometer [nm]) radiation, primarily at 254 nm. UV-C radiation kills or inactivates

microbes by damaging their deoxyribonucleic acid (DNA). Containment of bacteria at plumbing vent pipes must surely be a potential release point for pathogenic bacteria release.

Release from WC pan flushing is the first contact interface between the human anatomy and the plumbing system, the WC seat could be the interim bacteria release capture point, at least until a more considered system, such as a 100 mm vent connection to the WC bowl. The above drawing shows a WC pan extract ventilated seat, the proposition being that when the seat cover flap (Not shown) is raised by the WC pan user, a ventilation fan is activated to draw air through voids in the seat, the objective being the extraction of Gram-Negative -Bacteria, as is now known to be released from defecation. Downstream UV irradiation being introduced to kill active bacteria. Currently standard Health care practice does not vary from any other ventilation system and can be regarded as a potential carrier of contaminated bacteria as a contribution to Hospital acquired infections.

A Sudor vent

As an option? In theory the sanitary vent is providing replacement for the water volume leaving the system, the driving pressure is 75 mm water gauge. In theory there is no air out bound from sanitary vents. The vents are an obvious bacteria release point. Why not cap them with an air inlet path only? On my inspection of the recently constructed Royal North Shore Hospital I raised the issue that all roof vents (there is a mini forest) of germ laden pipes belching bacteria driven by wastewater discharges, to cascade like a germ waterfall from the flat roof catchment area.

My objection was overruled

Footnote:- The

Data download from Google

Various studies have shown that laminar flow surgery theatres have **greatly reduced levels of particles and bacteria in theatre air compared to turbulent systems** [5]. There surely exists a relationship between theatre air quality and post-op infection but it may be argued that when a level of air quality is achieved any further reductions in infection rates will be due to quality of aseptic technique [6]. This issue is not considered relevant to the proposal of diverting WC flushing driven bacteria infected air stream away from a short path to the WC seated user lungs which in current hospital bathroom design, exists **as a potential pre-operation germ hazard.**

Data originating from the following relates to **,post operation sepsis.** The deep-seated question may be? Bacteria have a time frame for growth, and a pre-operation infection may be relevant. The more pressing question is. Should all potential harmful bacteria habitats be eradicated?

Lidwell O.M., Lowbury E.J., Whyte W., Blowers R., Stanley S.J., Lowe D. Effect of ultraclean air in operating rooms on deep sepsis in the joint after total hip or knee replacement: Lidwell's prospective multicentre randomised control trial in 1982 involved sites both in the United Kingdom and Sweden and an excess of 8,000 patients undergoing knee or hip replacement surgery.

All patients were then followed up for between 2 to 3 years for evidence of joint sepsis. Overall, Lidwell found that the incidence of sepsis in the laminar air flow group was markedly reduced compared to the control group (0.6% compared to 1.5%). The incidence of sepsis was found to be further reduced when both an ultraclean environment and body exhaust suits were used.

Lidwell's study did not control for the use of antibiotic prophylaxis and its use in the various institutions in the study was widely variable. Lidwell estimated that a patient who did not receive prophylactic antibiotics was four times more likely to suffer from post-operative wound sepsis. Lidwell et al. concluded from the results of their trial that vertical laminar flow systems were superior to horizontal flow systems, and indeed turbulent air systems, with vertical laminar flow systems and exhaust suits being the most desirable set up to reduce post-operative wound sepsis.

Subsequent trials in comparison [7, 8] with better use of prophylactic antibiotic control did not demonstrate a significant difference in infection rates (traditional ventilation and Laminar flow), thus implying the use of prophylactic antibiotics as the single most prognostic factor in preventing infection after joint replacement [3].

In a paper examining the move of the Canisius Wilhelmina Ziekenhuis teaching hospital from its old site built in 1926 to a new facility built in 1992, the impact on post-operative infection rates that resulted from the move into modern laminar flow theatres was documented [9]. The authors found no change in the number of deep infections in joint replacement surgery after the move to modern facilities. Results for other forms of surgery were also included but again showed no difference in infection rates. Before and after the move to more modern facilities antibiotic prophylaxis was used where accepted and orthopaedic procedures were carried out in the theatres with the best ventilation at the old site.

The re-operation rates of 435 patients undergoing an Austin Moore Hemi arthroplasty in both laminar airflow and turbulent airflow theatres in a district general hospital highlighted important points [10]. The study followed earlier work in which the authors noticed that their total reoperation rate for Austin Moore prostheses and their reoperation rate due to infection were higher than reported in the literature

(11.4% and 4.5% respectively). In both cases prophylactic antibiotics and water impervious surgical gowns were used and cases were followed up for a minimum of 1 year and a maximum of 5 years. They found a statistically significant (p value = 0.00368) difference in the number of re-operations required due to post-operative sepsis in those patients who had been in non-laminar flow theatres (4% or 9/223) compared to those in laminar flow theatres (0% 0/212). While at the same time there was no statistically significant difference in rate of required re-operation due to non-infective factors (aseptic loosening and dislocation). Such a study would suggest that laminar flow systems are of significant benefit in joint replacement. However as already discussed the efficiency of laminar airflow systems is heavily based on both local theatre conditions and the positions and behaviour of the scrub team. Behaviour which may have been tightly controlled after the previous study indicated higher than expected infection rates although this does not explain the difference between the turbulent and laminar flow theatres. This was a small study carried out in a single hospital and while it provides encouraging evidence for the use of laminar flow theatres two recent studies examining the use of laminar flow theatres in joint replacement have examined data from much large number of cases and call into question the value of laminar flow ventilation.

A retrospective study performed in 2008 of the German nation nosocomial infections surveillance system, 'KISS' (Krankenhaus [hospital] infections surveillance system) using data provided by surgical departments of 99,230 operations carried out between 2000 and 2004 in 20 hospitals, compared the rates of surgical site infections in theatres with high efficiency particulate air filtered (vertical) laminar flow, HEPA turbulent air filtration and those without artificial filtration [11]. The study was not specifically focused on orthopaedic procedures, but it does provide data on the insertion of both hip and knee prosthesis. The study found that in the case of hip prosthesis theatres with vertical laminar flow devices there was a statistically significant increase in the number of surgical site infections compared to procedures carried out in turbulent air flow theatres (1.85% compared to 1.31% with a p value less than 0.001). There was also an increase in the number of surgical site infections in laminar flow theatres inserting knee prostheses, but this was not a statistically significant change (1.33% compared to 0.823% in turbulent air flow theatres). The detrimental effect of laminar flow theatres remained even after controlling for confounding factors such as both hospital and patient indicators of case severity. Due to the nature of the data collected it was not possible to ascertain whether or not

prophylactic antibiotics were used. However, as the authors point out the practice of using prophylactic antibiotics for such procedures is widespread with above 98% of patients undergoing the procedures examined receiving them. Therefore, it is unlikely that these results can be explained by differences in prophylactic antibody prescribing. While the age, gender and ASA score of the patient were also reported by the survey other possible risks for surgical site infection such as obesity and smoking habits were not.

A more recently published paper [12] using retrospective data from between the years 1999 and 2008 and 88,311 cases recorded on the New Zealand joint registry (51,485 primary total hip replacements and 36,826 primary total knee replacements). The joint registry collects information on all revisions performed as well as the reasons they were undertaken it also documents whether the initial procedure was undertaken in a laminar flow theatre as well as if space suits were used. The study provided more evidence that laminar flow theatres may indeed have a detrimental effect on post-operative infection rates. The paper compared rates of early revision (defined as within 6 months of the original procedure) for deep infection in both total hip and knee replacements preformed in laminar flow theatres or not and in space suits or not. Like the study of German hospitals, the New Zealand paper found statistically significant increased rates of required revision needed in the laminar flow cases.

However, unlike the German study there was significance in both the total hip and knee replacements. With total hip replacements performed in a laminar flow theatre needing revision 0.148% of the times compared with a rate of 0.061% of those performed in a turbulent airflow theatre (p value <0.003). Similar results were seen in total knee replacements with 0.243% of those in a laminar flow theatre requiring early revision compared to 0.098% in a turbulent air flow theatre (p value <0.001). The study was also able to compare the rate of revisions in surgeons who had more than 50 operations in both environments of which there were 43. Of those surgeons there was a 0.110% rate of infection in the laminar flow theatre compared with a 0.028% in the conventional theatre (p value <0.03). The study also showed an increase in infection in operations that used space suits over those that don't despite the fact that space suits have been proven to reduce the bacterial burden in the operating theatre air much like laminar flow systems.

McGovern et al. (2011) [13] looked at the effects of forced-air warming and theatre lighting on laminar flow using helium soap bubbles. They demonstrated that forced air warming resulted in contamination depending on the height of the anaesthetic screen and recommend using conductive warming. They also demonstrated turbulent air circulation under the shadow of lights.

CONCLUSION

While it is true that laminar-flow systems have proven to reduce the bacterial and particulate contamination of the air it does not appear that they have a significant impact in reducing the rates of infection in joint replacements and indeed there is evidence to suggest the opposite is true.

Due to the extensive evidence gathered in the past 10 years it no longer seems possible to recommend the use of laminar flow ventilation in total joint replacement. Further work is needed to look at the effect of patient warming and theatre lighting on laminar flow and, in turn, infection. It appears more prudent than ever to ensure we comply with methods established to reduce the rate of potential pre-operative infection such as described and prophylactic antibiotics and maintaining 'normothermia' in the anaesthetised patient.

DISCUSSION

Total joint replacement is an increasingly successful operation with more procedures being performed than ever before. If laminar flow theatres had an impact in lowering the rate of sepsis after joint replacement an argument could be made that even if the reduction in risk was only slight the cost would be justified due to the devastating consequences it could prevent, especially as the cost of laminar flow systems continues to fall. However, from recent large studies there seems to be a detrimental impact from the use of laminar flow ventilation systems which runs contrary to the established evidence on their reduction in bacterial contamination of operating room air.

Note D Creasey:- Whilst the foregoing data from recent large studies seems to imply a detrimental impact from the use of laminar flow ventilation systems in the operating theatre environment, which seems to be contrary to the other established evidence on their reduction in bacterial contamination of operating room air.

Comment :-

Data from Google leaves considerable doubt that a system of laminar flow air catchment in an operating theatre has significant impact on infection rates. However, the proposition of extract ventilation and UV Irradiation of excreta release gases at all hospital WC pans (Particularly those shared) and Bed pans is the proposition being offered by this paper.

This paper **is not focused on operating theatres**, it is focused on bacteria capture eradication from human excreta adjacent to the point of release from human anatomy in all hospital and health care toilet environments, as standard ventilation procedure, at WC pans and bedpans.

Acquired hospital infections are a growing problem.

The question is, **what does it take to motivate such a simple test?**

The Patient bed adjacent tip up WC Pan designed for Westmead Hospital by D Creasey & Associates Pty Ltd and approved by Sydney Water. Extract Ventilation bacteria capture from this type of WC pan would be a simple modification. An air ducted quick removable Pan seat and cover as a routine sterilizable item.