

SANITATION

Seminar points to long road to create safe sanitation for all

Matthew Hattingh reports on the latest sanitation-related research as presented at a seminar hosted by the Water Research Commission in celebration of World Toilet Day on 19 November last year.



You're done with the paperwork, zipped up and are good to go. But before you quit the cubicle, you might be alarmed to learn of research by a Durban sanitation fundi that identifies toilet door internal pull latches as the surface in a public bog most likely to bear nasty bugs.

And it's not only latches. Toilet seats, external door handles and wash hand basin tap handles, were also found to be "highly contaminated" with *E. coli* bacteria according to the research, presented at a World Toilet Day webinar hosted by the Water Research Commission (WRC). *E. coli* are commonly found in faecal matter and can cause diarrhoea and other illnesses.

But before you swear off public toilets for good, a little context and a few caveats...

Preshod Ramlal was sharing findings of his study of 23 community ablution blocks serving residents in two crowded Durban informal settlements – Kennedy Road (population 11 000) and Foreman Road (7 148). And he stressed that far from being "health hazards", as one Sunday newspaper put it, these ablution blocks mark a positive step on a long road to improving sanitation for the city's poor.

"There seems to be a misconception that water-flushing, shiny-white toilets protect all users," said Ramlal, noting that those seemingly pristine porcelain thrones weren't without their faults. When flushed, they launched pathogens (disease-causing organisms) into the air and from there onto bathroom surfaces. Or conversely, when contaminated hands touch these surfaces. Nevertheless, his research made it plain that key contact surfaces in community ablution blocks were frequently contaminated

and he warned that “almost everyone using these” risked infection over the course of a year.

Much needed to be done to improve matters. But indeed, the same held true across South Africa – a point other webinar speakers stressed, as they touched on related topics, including toilet troubles at cash-strapped state schools; the need for better sanitation management and maintenance; and the importance of securing the safety of the people who work with human waste.

The state of toilets at workplaces also got a look-in, with Nicky Naidoo, of Nema Consulting, briefing delegates on a recent survey. It found facilities to be largely clean and well maintained, but that most were culturally insensitive and failed to cater for the disabled. Women were underserved too.

But let’s return to Ramlal’s research and dip a little deeper into community ablutions blocks or CABs, to use the acronym adopted by the eThekweni municipality.

A senior environmental health practitioner with the municipality’s health department, Ramlal recalled how the city developed CABs in response to a continuing “mushrooming of informal settlements”. Back in 2003, when he joined the department, shackland residents enjoyed no formal access to water and sanitation. Most relied on homemade pit latrines, risking disease, while open defecation led to “excessive environmental pollution levels”.

CABs came on the scene after 2004, first as brick structures. But these took too long to build and suffered vandalism. The municipality later switched to using converted shipping containers and then modular or prefabricated designs. This cut installation and maintenance costs and, as a plus, meant CABs

could be relocated. Today, 1.2-million people live in eThekweni’s informal settlements, in 314 000 households, with 1 600 CABs serving the “vast majority”.

CABs provide toilets, urinals, wash hand basins, showers and sinks for laundry. Caretakers clean them up to four times a day.

Ramlal, who is busy completing a PhD and has published, or is awaiting publication, of a number of scholarly papers dealing with CABs and some of the nasties lurking in them, set out to:

- Determine what contaminants could be found on selected contacts surfaces in eThekweni CABs;
- Establish whether contact with contaminated surfaces might cause users and their communities to develop diarrhoeal infections; and
- Identify difficulties facing caretakers.

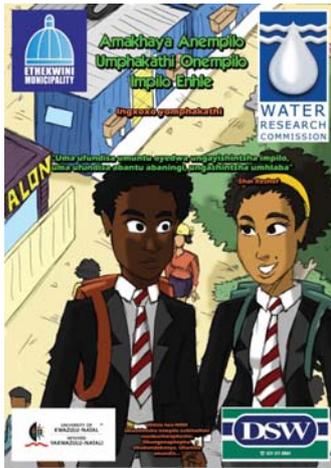
He used swab sampling, behavioural studies and surveys to gather data. Gene sampling, sequencing and cloning helped establish which kinds of disease-causing microorganisms were to be found, and in what quantities on four contact surfaces – toilet cubicle door internal pull latches; cistern handles; toilet seats; and wash hand basin taps. With baseline pathogen levels established, further investigations followed.

To explore potential exposure points where users risked picking up diarrhoeal infections, eight different surfaces were swabbed for bacteria and *E. coli* concentration gauged. Samples were taken from toilet cistern handles and seats; internal and external toilet door pulls and latches; wash hand basin tap handles; shower tap handles; floor surfaces of toilet cubicles; and common floor-areas. To assess the probability of users falling ill, Ramlal measured *E. coli* concentrations on contact surfaces, the efficiency of it transferring to hands and from there to lips and mouths in sufficient doses.



SUSANA

Community ablution blocks, created inside shipping containers, are one of the sanitation solutions that the eThekweni Municipality has implemented.



The isiZulu version of a digital dialogue produced by the eThekweni municipality to share health and sanitation know-how and community ablution block dos and don'ts with residents of the city's informal settlements.

What did he find? *E. coli* concentrations on cistern handles ranged from about 3.5 to 7.5 log 10 CFU/cm², with a median value of about 5.5 and an upper quartile a little higher and a lower quartile a little lower.

Or, in layman's terms, when all the cistern handle samples were ranked from highest to lowest, the midpoint was about 10 to the power of 5.5 colony-forming units of bacteria for every square-centimetre of contact surface. And half of the cistern sample values fell within a narrow range – only a little more or a little less than 5.5 log 10 CFU/cm². The lowest concentration recorded among all the cistern handle samples was about 3.5 and the highest, about 7.5 log 10 CFU/cm². The median figure was a little lower for toilet seats than cistern handles, and for internal latches, slightly higher.

Based on these values, Ramlal calculated the risk of infection from the different surfaces based on how often they were touched. Taking the internal pull latch as an example, he calculated that almost three in every 100 people exposed may be infected if they touched it. Over the course of a year, with users touching the latch on average nearly twice a day, the probability was that everyone exposed would be infected.

And these being plague times, the study frequently found traces of SARS-CoV-2 on contact surfaces – most often on tap handles and cistern handles. "This goes to support the recommendation that washing of hands regularly could reduce risks of COVID-19 transmission," said Ramlal.

He calculated the risk of being infected with COVID-19 from the different surfaces, taking into account how often CAB users were exposed and whether the surface had been cleaned – which he found significantly reduced concentrations of infectious material.

In the case of toilet seats, Ramlal arrived at the following figures:

- One-time risk: About 2 out of a 10 000 people infected (uncleaned); 2 out of 1 million people (cleaned);
- Daily risks (2-3 uses): About 4 out of a 10 000 people (uncleaned); 6 out of 1 million people (cleaned); and

- Annual risks: About 6 out of a 100 people (uncleaned); 8 out of 10 000 people (cleaned).

He detected a host of other microorganisms in the samples, including rare potentially pathogenic bacterial species such as *Klebsiella michiganensis*; *Pluralibacter gergoviae*; *Kosakonia cowanii*; and *Raoultella ornithinolytica*. The presence of pathogens on contact surfaces "signifies infection within the populations that use the toilets", he noted. Turning to difficulties faced by caretakers, Ramlal highlighted blocked toilets; faeces on toilet surfaces and floors; and stagnant greywater outside CABs.

What should be done to reduce risk? Public education and awareness were needed, but COVID-19 had prevented face-to-face campaigning. So the municipality and the WRC launched a lively digital dialogue with informal settlement residents, which can easily be shared on smartphones. The dialogue, written by Ramlal, blends poster art and the spoken and written word (with English and isiZulu versions) to drive home messages about home hygiene, sanitation, waste disposal and CAB dos and don'ts.

In addition, he suggested direct interventions to reduce risks of infections at CABs. These included:

- Providing soap for handwashing;
- Supplying rubbish bins;
- Improving monitoring and rapid response to complaints; and
- Caretaker training.

Training was a theme picked up by a number of the speakers at the webinar. Jeanette Neethling, of consultants Partners in Development (PID), listed training, tools, protocols and enforcement as key ingredients in better sanitation worker safety. Neethling spoke about PID's work to improve health and safety around pit latrine emptying and touched on sanitation management at rural schools.



Photo supplied

Partners in Development's work with the Sani Squad, a sanitation business in Snathing, near Pietermaritzburg, provides a useful example of how simple, but effective equipment combined with training and good management can help make pit latrine emptying safer.

She agreed with Jay Bhagwan, the WRC's executive manager for water use and waste management, who in his welcoming remarks to delegates said: "Technology is not automatic and eternal, it needs operation and maintenance and it needs servicing." Neethling stressed that any toilet waste technology would only succeed if applied in concert with improved management and user behaviour. Operations and maintenance were "often the forgotten aspect of sanitation".

"Very few South African municipalities are actively planning for pit emptying, but many VIP toilets constructed across the country since 2001 have reached their capacity," she said. Users of pit and ventilated improved pit (VIP) latrines, the workers who emptied and maintained these, and the wider environment were increasingly exposed to pathogen-carrying faecal sludge.

Too often sanitation systems failed to separate people from their excrement, she said, citing a 2016 WRC project (**No. K5/2134**). The project, led by Bobbie Louton of Partners in Development, found that, "In many cases workers did not take the measures available to them to reduce exposure, indicating that either their knowledge of disease transmission or their attitude towards their own health or that of householders did not support safe work practice."

Louton's team visited 10 Durban homes to study how pit latrines were emptied and to collect sludge and stool samples. They found helminth eggs in nine of 10 pits and at 10 of 10 homes, concluding that all pits should be assumed to contain helminth eggs or similar pathogens. The eggs are laid by parasitic worms that can infest the human gut, absorbing nutrients and causing disease. Louton found that pit emptying introduced pathogenic faecal matter into homes, putting householders, sludge handlers and the public at risk.

Neethling touched on some of the reasons for this, sharing photographs of workers handling sludge and then touching household surfaces with dirty gloves; spilling sludge; climbing into pits for want of proper tools; and using household taps to clean up.



Long-handled spades help Sani Squad workers keep sludge at more than arm's length.



Photo supplied

Sani Squad workers use a Pitvaq mobile pit emptying machine to avoid contact with faecal sludge. Groundsheets catch spills, protecting householders and the environment.

How might matters be remedied? She recommended:

- Training so workers better understand disease transmission and how to reduce risk;
- Better safety equipment, tools and facilities;
- Protocols, for example, to deal with inevitable spills; and
- Enforcing protocols and good practice.

How did this play out in the field? Neethling shared lessons from Partners in Development's work with the Sani Squad, a sanitation business that operates in Snathing, near Pietermaritzburg, emptying pits and septic tanks.

They used a Pitvaq pit emptying machine (developed by PID thanks to WRC research) and other tools, including long-handled spades, groundsheet and sludge drums with lids, to limit worker contact with sludge and to minimise spills. Training, multiple uniforms and personal protective equipment helped further.

Back at their depot after work, dedicated clean and dirty change rooms and cheap-and-cheerful shower facilities help staff clean up properly.

Drawing on her work with schools, Neethling told delegates that, as with pit emptying, protocols and detailed guidebooks had been produced (including by Partners in Development and available from the WRC). These helped schools and cleaners with the why's, what's, who's and how's of sanitation.

But she noted schools often lacked capacity and funds. Training of staff was vital, but the reality was many schools simply did not have cleaners. They needed materials and equipment and must be monitored and supported in their work as part of a team effort. She stressed that unless new infrastructure was accompanied by effective management programmes it was likely to fail.

Third-party monitoring and accountability were of great value when it comes to maintenance, particularly for those who aren't "purely motivated by the goodness of keeping toilets clean". "We believe the Department of Education has that role to fill."