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New environmental reservoir of CPE in hospitals

The incidence of multidrug-resistant carbapenemase-producing Enterobacteriaceae (CPE) is steadily increasing, and maximal infection control and prevention strategies should be implemented to limit their spread in health-care settings.[1] WHO guidelines, published in 2017, recommend hand hygiene compliance, screening, contact precautions, environmental disinfection, and educational sessions to prevent the transmission of CPE, and surveillance cultures of the environment are advised to be undertaken with caution.[2] Drains, sinks, and faucets have been identified as vehicles for the transmission of bacteria, mainly *Acinetobacter baumannii* and *Pseudomonas aeruginosa*.[3,4] Based on expert opinion, environmental cultures are most appropriate for analysis if these organisms are involved.[2] To our knowledge, we describe the first detection of CPE in toilet bowls and traps and subsequent hospital-associated transmission of *Citrobacter freundii* producing OXA-48 to four patients in one ward. We also outline the subsequent surveillance and infection control measures undertaken to contain the outbreak.

In a 71-year-old woman, who at the time of infection had recently undergone a pancreatic-oduodenectomy procedure, culture of post-operative wounds and a subsequent rectal swab yielded a *C freundii* producing OXA-48. The second patient, an 87-year-old woman residing in the same two-person room as the first patient, also screened positively for *C freundii* OXA-48 infection. Both patients were not known to be carrying, or at risk of carrying, a CPE. These first cases of *C freundii* OXA-48 in a CPE-negative hospital were unexpected. Weekly rectal screening of all patients residing in the ward for 2 weeks following the identification of the first two infections revealed no other CPE-positive cases.

1 month after discharge of both patients, a 90-year-old man was admitted to the same index room and his urine sample tested positive for *C freundii* OXA-48; the other patient concurrently residing in the same room tested negative for CPE. Our CPE outbreak protocol was initiated and thorough sampling of all high-touch surfaces, medical tools, and toilet water was done. 50 mL of water from the toilet bowl was concentrated through the membrane filter technique, with subsequent culture of the 0·22 µm membrane (Millipore, Merck, Billerica, MA, USA) on a CPE selective agar (Oxoid Oxoid Ltd. Thermo Fisher Scientific, Cambridge, UK). Of the sampled environmental cultures, only the toilet water was found to be positive for *C freundii* OXA-48, with a confluent culture on the membrane. Despite the removal of toilet brushes and daily toilet disinfection, with a final concentration of 5000 ppm chlorine, for 3 consecutive days, the *C freundii* persisted to the same extent. After 3 days of daily pre-cleaning with biguanide/quaternary ammonium (Hexanios, Anios, Lille, France) for 15 mins, followed by disinfection with 2500 ppm peracetic acid for 30 mins, *C freundii* OXA-48 in toilet bowls and traps was succesfully eradicated. Room disinfection was done with 5000 ppm chlorine. All toilet bowls and traps of the ward were screened for CPE. Nine rooms that shared the common waste plumbing tested positive for *C freundii* OXA-48. 15 patients residing in these rooms were subsequently screened for CPE by rectal swab, and one additional patient tested positive for *C freundii* OXA-48. All toilets in the adjacent rooms were cleaned and disinfected with the same procedure on a weekly basis. Follow-up CPE screening of patients and cultures of the toilets remained negative 1 year after the outbreak on this ward.

In conclusion toilet bowls and traps in a hospital environment are a possible source of CPE, which pose a risk for hospital-acquired infections and propagation of outbreaks. Besides patient CPE screening, environmental sampling might allow earlier detection of unexpected reservoirs. Periodic disinfection with peracetic acid was effective in terminating the reported outbreak. The original source of the *C freundii* OXA-48 remains unknown, but because Enterobacteriaceae are predominantly of human origin in hospitals, future guidelines should also consider the disinfection of toilet, sink, and shower drainage systems in CPE isolation rooms. Efforts to redesign waste water drainage systems, toilets, showers, and sinks to minimise the risk of transmission from colonised water reservoirs should be initiated urgently.

We declare no competing interests.

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Echinococcosis in Pakistan: a call for research

We read with interest the Article by Francesca Tamarozzi and colleagues,[1] which identified cystic echinococcosis research gaps in rural endemic areas and called for the collection of additional epidemiological data in these regions. Cystic echinococcosis is an endemic disease in central Asia, with about 58% of the population at risk, including residents of Afghanistan, Iran, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Tajikistan, Turkmenistan, Uzbekistan, and western China.[2] We also read with interest the letter by Men-Bao Qian and Xiao-Nong Zhou[3] highlighting the establishment and outcomes of the Belt and Road Network for the Elimination and Control of Echinococcosis and Cysticercosis. The network includes 13 endemic Asian countries but, unfortunately, does not include Pakistan. Although Pakistan is considered part of this endemic region, only scarce data are available.[4] To better understand the local transmission and effects of cystic echinococcosis in Pakistan, additional epidemiological data are essential. These data can then help guide control and prevention strategies in a country where under-regulated livestock slaughtering and the presence of free-roaming dogs help support parasite transmission.

Initial diagnosis of cystic echinococcosis is based primarily on diagnostic imaging (ultrasound or CT). Between July 2 and July 27, 2018, research personnel from Pakistan took part in a training programme focused on ultrasound screening for cystic echinococcosis, which was held at the WHO Collaborating Centre for Clinical Management of Cystic Echinococcosis at the University of Pavia, Italy, and funded by the Higher Education Commission, Pakistan. Cross-sectional surveys using community abdominal ultrasound screening are greatly needed to provide additional data for evaluation of the socioeconomic burden of the disease in Pakistan. At present, the only available data are from a few hospital-based studies that probably represent just a fraction of the national cases.[4] Between 1990 and 2018, 15 retrospective surveys and 19 case reports describing 1611 cases of cystic echinococcosis in Pakistan were published. The absence of a surveillance system to identify, or a national database to record, cystic echinococcosis cases has resulted in a substantial data gap for Pakistan. Although not formally assessed, cystic echinococcosis probably has a substantial economic effect on the local health sector, and preliminary studies in livestock suggest that the frequency of infection in intermediate hosts might be increasing (Ahmed H, unpublished).

In China, large-scale community studies have been done for echinococcosis, because western China is considered highly endemic for both cystic echinococcosis and alveolar echinococcosis. These studies have involved members of the international research community, with expertise in medicine, epidemiology, diagnostic imaging, ecology, veterinary medicine, geography, and other disciplines. If Pakistan is to build the capacity to perform research and implement control for cystic echinococcosis, international collaborations are required, such as inclusion in the newly formed Belt and Road Network for the Elimination and Control of Echinococcosis and Cysticercosis.

In Pakistan, cystic echinococcosis is neglected by the health authorities, largely due to a scarcity of data on the number of cases and the monetary and non-monetary effects that these cases are having on the country. This is a call to the national and international research communities and to WHO to take notice of the threat of cystic echinococcosis in Pakistan and to help devise a strategy to address this neglected but important public health problem.

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