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The challenges of cholera at the 2017 Hajj pilgrimage

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In September, 2017, up to 2 million pilgrims from all continents will arrive in Saudi Arabia for the annual Hajj pilgrimage.[1] Living and worshipping together in crowded conditions will expose the pilgrims and the local Saudi Arabian community to a range of imported and local infections.[1] Over the past 5 years the Hajj has focused attention on new and re-emerging infectious diseases with epidemic potential such as the Middle East respiratory syndrome coronavirus (MERS-CoV), Zika virus, and pan-antibiotic-resistant bacteria—global health security threats that are ongoing and under active surveillance.[2] This year the explosive outbreak of cholera in Yemen,[3] from where many pilgrims originate, represents a serious risk to all pilgrims during the Hajj, and has the potential for global spread after the pilgrims return to their countries of origin. As of July 21, 2017, the

cholera epidemic in Yemen has affected an estimated 356 600 people and caused 1800 deaths, with 5000 new active cases reported every day.[4]

Cholera at the Hajj is not new.[5] During the 1821 Hajj, 20 000 pilgrims died as a result of the global cholera epidemic, which started in India in 1817 and spread across the world. Another cholera epidemic during the 1865 Hajj killed 15 000 of 90 000 pilgrims, and spread worldwide, including to the USA and Europe, with 200 000 deaths.[5] Dealing with infectious disease outbreaks and outbreak prevention at the Hajj has been a public health priority for Saudi Arabia because repeated endemic outbreaks of diarrhoeal diseases have occurred as a result of various pathogens prevalent in countries from which pilgrims originate. Since the 1865 outbreak, the Saudi Arabian health authorities have been well prepared to respond to an outbreak and have not had a major cholera outbreak, largely because of improvements to infrastructures for surveillance, rapid detection, and control through the Hajj Command and Control Centre.[1] They have ensured hygienic living conditions for pilgrims, and easy and free access to washing facilities, purified water, and health services.[1]

The latest overall cholera prevalence in Yemen has been estimated at 266 per 10 000 population.[6] In 2016, 19 500 Yemenis obtained a visa for the Hajj. If the attack rate is the same in a similar number of Yemeni pilgrims planning to attend the Hajj in 2017, up to roughly 582 cases of cholera can be expected. Notably, about 80% of individuals infected with *Vibrio cholerae* do not show symptoms and remain undetected, but are infectious. Thus, cholera poses substantial public health challenges for the 2017 Hajj. The ongoing cholera epidemic in Yemen calls for extreme caution and requires that particular attention is given to prevention, surveillance, and control measures. Advances in the development and assessment of new cholera vaccines provide hope for better control.[7] The WHO Strategic Advisory Group of Experts (SAGE) on immunisation[8] concluded at their meeting in April, 2017, that there is mounting evidence over the past 3 years that high coverage with oral cholera vaccine (OCV) results in a significant reduction of cholera transmission in various settings.

Three killed whole-cell OCVs have been prequalified by WHO—Dukoral (Valneva, Stockholm, Sweden), Shanchol (Shantha Biotechnics, Hyderabad, India), and Euvichol (EuBiologics, Seoul, South Korea). All three vaccines have good safety profiles and greater than 60% effectiveness against cholera disease for at least 3 years after two doses. In 2013, WHO formally established an OCV stockpile, which consists of Shanchol and Euvichol. Thus, mandating the cholera vaccine for pilgrims from Yemen, and those countries where cholera is endemic, might be prudent and requires practical and feasible recommendations.

WHO and Saudi Arabia should jointly commission a risk assessment to review the potential benefits, risks, costs, and practicalities of cholera vaccination and come up with feasible recommendations that should be operationally, clinically, financially, and politically sustainable. These recommendations should be included in the 2017 Saudi Arabian health requirements for pilgrims.[9] Furthermore, WHO guidelines on measures to prevent cholera and community awareness campaigns should be put into practice and strictly implemented. Proactive health education campaigns, implemented before, during, and after the Hajj, using leaflets and social media targeting all pilgrims and local Saudi Arabia populations, are required. These campaigns should include recommendations for basic hygienic toilet practice, including hand-washing after defecation and before handling food and eating, and health-seeking behaviour for those who develop symptoms. Meanwhile, the focus on cholera must not deter the Saudi Arabian authorities from remaining vigilant with regard to other epidemic-prone gastrointestinal and respiratory tract pathogens.[2]

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Corrections

Wang Y, Tian GB, Zhang R, et al. Prevalence, risk factors, outcomes, and molecular epidemiology of mcr-1*-positive Enterobacteriaceae in patients and healthy adults from China: an epidemiological and clinical study.* Lancet Infect Dis *2017; published online Jan 27. http://dx.doi.org/10.1016/S1473-3099(16)30527-8*—In the Findings of the Summary, the sixth sentence should have read 'Antibiotic use before hospital admission (p<0·0001) was associated with MCRPEC carriage in 35 patients compared with 378 patients with *mcr-1*-negative *E coli* colonisation, whereas living next to a farm was associated with *mcr-1*-negative *E coli* colonisation (p=0·03, univariate test)'. This correction has been made to the online version as of Feb 13, 2017.

Yang S, Wu J, Ding C, et al. Epidemiological features of and changes in incidence of infectious diseases in China in the first decade after the SARS outbreak: an observational trend study. Lancet Infect Dis *2017; published online April 12. http://dx.doi.org/10.1016/S1473-3099(17)30227-X*—In this Article, a description of the colour scale used in figures 1 and 3 had been mistakenly omitted from the figure legends. This correction has been made to the online version as of April 19, 2017.

Van Boeckel TP, Gandra S, Ashok A, et al. Global antibiotic consumption 2000 to 2010: an analysis of national pharmaceutical sales data. Lancet Infect Dis *2014; **14:** 742–50*—In this Article, a coding error resulted in an inaccurately high rate of reported antibiotic sales in Australia, New Zealand, Hong Kong, Malaysia, Singapore, and South Korea. In the first sentence of the results in the Summary and the main text, the increase in consumption of antibiotic drugs has been changed from "36% (from 54 083 964 813 standard units to 73 620 748 816 standard units)" to "35% (from 52 057 163 835 standard units to 70 440 786 553 standard units)". This percentage has also been changed in the second sentence of the Discussion. Figures 1, 2, and 4 have been corrected to reflect the new data. In the third sentence of the results in the main text, the absolute increases in consumption from 2000 and 2010 have been changed for cephalosporins (from $8·4 \times 10^9$ to $8·1 \times 10^9$ standard units) and broad-spectrum penicillins (from $5·8 \times 10^9$ to $6·1 \times 10^9$ standard units). In the fourth sentence, the relative increases have been corrected for monobactams, glycopeptides, cephalosporins, and fluoroquinolones. In the fourth sentence of the second paragraph of the Results, the following text has been removed: " with two exceptions: consumption increased substantially in Australia (from 25 in 2000 to 87 units per person in 2010) and New Zealand (from 26 in 2000 to 70 units per person in 2010) and we noted a continuous increase of antibiotic consumption". In the sixth sentence in this paragraph, the following text has been removed "In 2010, the high-income Asian countries and regions (Hong Kong, Malaysia, Singapore, and South Korea) all ranked within the top eight consumers of antibiotics per person." In this paragraph, the percentage increase in global antibiotic consumption between 2000 and 2010 attributable to BRICS countries has been changed from 76% to 79%. In the fifth sentence of the discussion, the word very has been changed to moderately to read "We also noted moderately-high antibiotic consumption per person in Australia and New Zealand". The following sentences have been removed since they no longer reflect the data: "National campaigns have been implemented to reduce inappropriate use of antibiotics for upper respiratory tract infections. When started in 2000, these campaigns led to a decrease in number of antibiotic prescriptions for upper respiratory tract infections, and so the reason for continued high antibiotic use during 2000–10 is not clear. However, NAUSP data for consumption in hospitals indicate decreasing use of antibiotics in 2011 and 2012. For New Zealand, a recent study investigated nationwide antibiotic use in the community for a 7 year period (2005–12). Antibiotic consumption rate per person was high compared with many European countries and continued to rise an average of 6% per year, consistent with our study findings. We were unable to find nationwide hospital antibiotic consumption information, but one hospital study observed lower consumption compared with many European countries. As with Australia, a national campaign in New Zealand was associated with a decrease in antibiotic prescriptions for upper respiratory tract infections among children; however, the reason for high consumption is unclear." The third table in the appendix has been updated with new data and a new version of the appendix has been uploaded online. These changes have been made to the online version as of May 3, 2017.

GBD Diarrhoeal Diseases Collaborators. Estimates of global, regional, and national morbidity, mortality, and aetiologies of diarrhoeal diseases: a systematic analysis for the Global Burden of Disease Study 2015. Lancet Infect Dis *2017; published online June 1. http://dx.doi.org/10.1016/S1473-3099(17)30276-1*—In this Article, the equation to correct the proportion estimates for exposure misclassification due to diagnostic error has been corrected in the fourth paragraph of the Aetiology section and on appendix p 14. These corrections have been made to the online version as of June 14, 2017.

Charlier C, Perrodeau É, Leclercq A, et al. Clinical features and prognostic factors of listeriosis: the MONALISA national prospective cohort study. Lancet Infect Dis *2017; **17:** 510–19*—A member of the MONALISA study group was incorrectly listed in the appendix. Nicolas Vodovar should have read Dominique Vodovar. This correction has been made to the online version as of July 17, 2017.

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