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The emergence of cholera in multiple countries amidst current COVID-19 pandemic: Situation and implications for public health and travel medicine

Cholera is an acute infection caused by *Vibrio cholerae*, mainly leading to secretory diarrhoea. Although most cases are asymptomatic, some patients might suffer from dehydration and electrolyte imbalance, and if not appropriately managed, these patients might die from shock. In addition, different risk factors might predispose to cholera outbreaks, including natural diseases, hot weather, contaminated water, and poor sanitation [1]. Recent reports from different worldwide countries have shown cholera outbreaks in their communities (Fig. 1).

According to the European Centre for Disease Prevention and Control (ECDC), around 30,629 worldwide cases of cholera, including 36 deaths, were reported by February 16, 2022. In addition, the number of suspected cases reached 262,955 by May 31, 2022, including 63 deaths (Fig. 1) [2]. However, the accurate numbers are expected to be higher than the announced ones due to the lack of proper reporting and surveillance [3]. Furthermore, the outbreaks occurred in different countries in Asia, Africa, and Europe. On the other hand, no cases were reported in the Americas in 2022, however is important to remember that in recent past decades this region has been also significantly affected by cholera [2,4–6].

In Africa, the outbreaks have been reported in many countries, including Cameroon, Nigeria, Ethiopia, Benin, Malawi, Zimbabwe, the Democratic Republic of Congo (DRC), South Sudan, Zambia, and Mozambique, Kenya, and Tanzania. In Cameroon, 7199 suspected cases (including 130 deaths) were reported in 15 districts as of May 2, 2022. In the DRC, 6166 suspected cases (including 89 deaths) were reported as of April 19, 2022, across 11 provinces, with an estimated CFR of 1.4%. A lower number of cases was reported in Nigeria (1861 cases, including 54 deaths) as of May 1, 2022, with an estimated CFR of 2.9%. The outbreak was reported in 16 states, with Taraba, Cross River, and Katsina accounting for most cases (72%). Moreover, it has been shown that younger individuals were at increased risk of being infected. A similar number of cases was also reported in Benin (1,705), with an estimated CFR of 1.2% (20 deaths), as of April 24, 2022.

A trend of cholera cases was also observed in Ethiopia, with a total number of cases and deaths of 674 and seven estimated on May 23, 2022, respectively (CFR: 1%) after the first case was reported on August 31, 2021. However, it should be noted that the intensity of cases declined within the past weeks, according to the WHO's Regional Office for Africa. Around 600 cases were reported in Malawi as of June 12, 2022, including 28 deaths. In Kenya, 319 suspected cases were estimated, including two confirmed cases and two deaths, with an estimated CFR of 0.6%, as of May 31, 2022. Lower numbers were estimated in Mozambique (suspected cases: 265, March 18, 2022), Tanzania (cases: 214, death: one, May 12, 2022), South Sudan (cases: 118), and Zambia (cases: 21 across three districts, May 12, 2022). No updates were available about the situation in Zimbabwe, Mozambique, Uganda, and Togo.

The highest number of cases was recorded in Bangladesh in Asia and globally, with an estimated 495,433, including 29 deaths, as of April 12, 2022. A considerable number was also reported in Pakistan (256,952), including three deaths, as of June 3, 2022. In Afghanistan, 6229 cases were reported across the country, including eight deaths, as of June 11, 2022. Cholera outbreaks were also reported in India (suspected cases: 100, March 9, 2022) and the Philippines (cases: 491, deaths: six, February 7, 2022). However, no recent updates could be obtained from these countries. In Iraq, 13 confirmed cases were reported on June 19, 2022, according to the Ministry of Health. However, the numbers are expected to be higher across the country as mass media reports mentioned that around 4000 cases of uncontrolled diarrhoea and vomiting were admitted within the past weeks. Finally, a recent outbreak was reported in Nepal, as four laboratory-confirmed cases were recorded on June 21, 2022. Globalization and travel may contribute with spreading as occurred years ago when imported cases from Nepal were the source of infection in the Haiti outbreak after the 2010 Earthquake in this Caribbean Island [7,8]. A single-source introduction of cholera from Nepal into Haiti followed by rapid, extensive, and continued clonal expansion. The phylogeographic patterns in both southern Asia and Haiti argue for the rapid dissemination of *V. cholerae* across the landscape necessitating real-time surveillance efforts to complement the whole-genome epidemiological analysis [8].

Furthermore, there are concerns about potential outbreaks in Europe. For example, some reports mentioned that isolated cholera cases were detected secondary to the damage to the sewage and water systems induced by the fighting in Mariupol, Ukraine, which has generated multiple health issues [9–11]. In addition, on June 6, the ECDC indicated *Vibrio* growth in the Baltic Sea, indicating the high risk of cholera outbreaks in countries lying on the sea. A case of an 81-year-old woman with non-cholera *Vibrio* on the Baltic sea coast was recorded in Germany, raising questions about whether these countries will suffer from a future cholera outbreak [12].

Fighting the cholera outbreak requires the integration of worldwide efforts to provide better treatment and interventional approaches [13]. Moreover, special attention should be given to vulnerable groups of populations. For example, in India, heat waves and dryness were reported and are associated with the cholera outbreak across these countries [14]. Therefore, healthcare authorities should adopt campaigns to increase awareness of these populations' risks and interventions against the outbreak and provide adequate water and food

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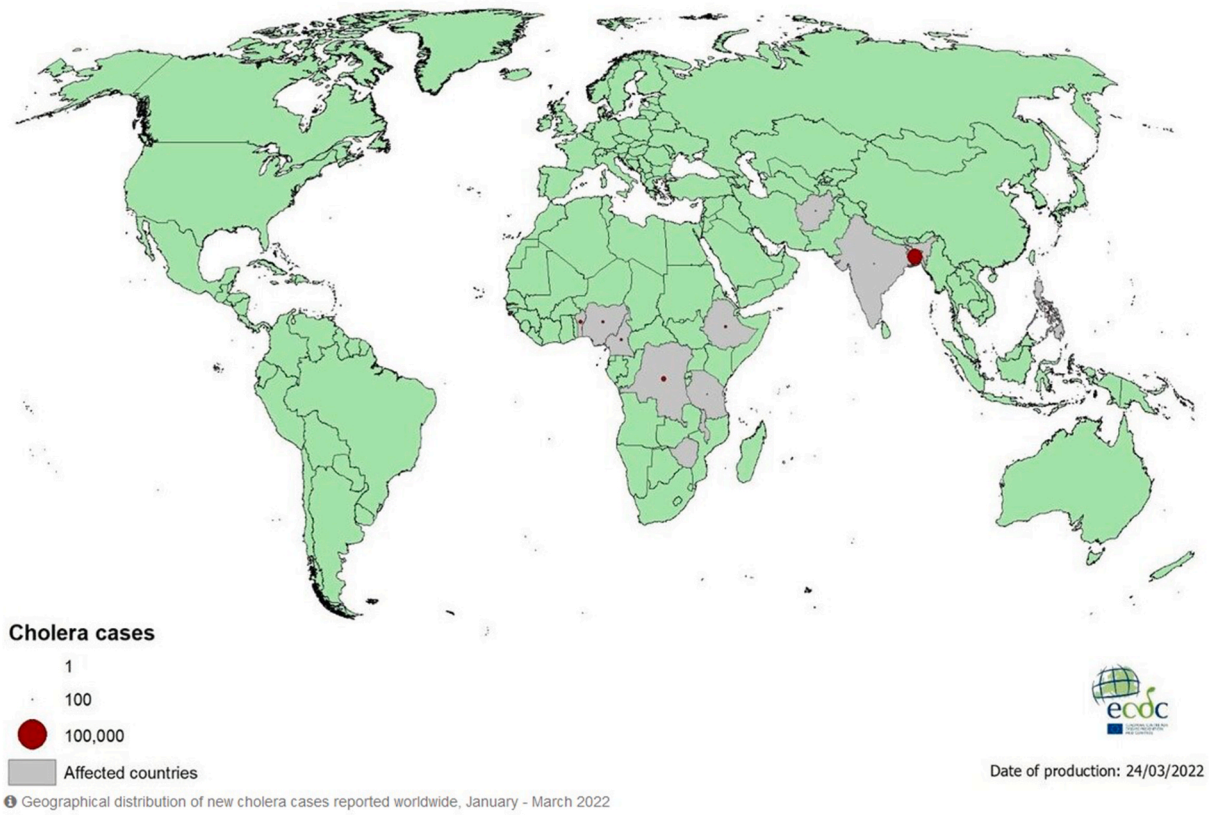


Fig. 1. Geographical distribution of new cholera cases reported worldwide, January–March 2022. From: ECDC (https://www.ecdc.europa.eu/en/all-topics-z/cholera/surveillance-and-disease-data/cholera-monthly).

supply to the most vulnerable groups. Moreover, in Afghanistan, reports show that the outbreak resulted from the country's deadliest earthquake in two decades [15]. Therefore, emergency measures should target clean food and water supply in regions with extreme heat waves. Evidence shows that different approaches have been initiated in response to these outbreaks. For instance, according to the WHO's Regional Office for Africa, vaccination campaigns were implemented in the DRC's highly affected regions. The application of these vaccines can be effective in reducing the incidence of cholera in these countries.

Cholera transmission through borders was suggested in Iraq-Iran and Cameroon-Nigeria [15,16]. Therefore, to avoid contamination, travellers to endemic areas should stick to hygiene measures. Likewise, healthcare authorities should also maintain the sanitation of transported products. Moreover, traveller vaccination is only recommended for travellers at high risk of exposure [17–19]. Furthermore, healthcare officials should benefit from previous restriction measures during the COVID-19 pandemic that was effectively used to relieve the intensity of the outbreak. That would help with various aspects, including the sustainability and uptake of response measures and innovating the most cost-effective approaches in resources and vaccine mobilization and utilization [20]. Cholera vaccines are still to be improved and more used worldwide [21].

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