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Cholera Outbreak in an Informal Settlement at Shahpur Huts, Panchkula District, Haryana State, India, 2019

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Summary

In September 2019, after a reported death due to acute diarrheal disease in Shahpur village, Panchkula district, Haryana state, India, we conducted an outbreak investigation to identify the etiological agent, estimate the burden of disease, and make recommendations to prevent future outbreaks. The suspected cholera case was a resident of Shahpur huts, ≥1 year of age having ≥3 loose stools within a 24-h period between September 1 and 28, 2019 and a laboratory-confirmed cholera case, whose stool specimen tested positive for *Vibrio cholerae*. We identified 196 suspected cholera cases with a median age of 18 years (range: 1–65 years); 54% (106) being female. The overall attack rate was 8% (196/2,602), and the case fatality rate was 1% (2/196). Tested samples of water from tanks (n = 6), sewage effluent (n = 2), and 22% (4/18) of stool specimens collected from suspected cases were positive for *V. cholerae*. Strengthening surveillance, improving water, and sanitation systems are recommended to prevent future cholera outbreaks.

Keywords

Diarrhea; India; sanitation; *Vibrio cholera*

Cholera is an acute diarrheal disease (ADD) caused by the ingestion of food or water contaminated with *Vibrio cholerae*. Cholera is a major public health problem in many

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Conflicts of interest

There are no conflicts of interest.

developing countries, including India.[1] The World Health Organization (WHO) reported 499,447 cases of cholera and 2990 deaths in 2018, according to reports from 34 countries.[1] However, the cholera burden is estimated to be much higher. Only 5%–10% of cases and related deaths are officially reported because notification of cholera cases is no longer mandatory under the International Health Regulations (2005) and countries have limited capacity for epidemiological surveillance, outbreak investigation, and laboratory testing.[1–3] Cholera transmission is closely linked to contaminated water and a lack of or inadequate sanitation facilities. Typical at-risk areas include peri-urban slums and camps for internally displaced persons or refugees. In India, more than half of slums are not officially recognized by authorities, and residents lack access to basic services such as clean piped water and sanitation infrastructure.[4] The prevalence of ADD in the previous 2 weeks among children <5 years of age children was 9% nationally and 8% in Haryana state in the 2015–2016 National Family Health Survey.[5]

On September 10, 2019, the Integrated Disease Surveillance Programme (IDSP) received a report of a death due to ADD from Shahpur huts informal settlement, Kalka block, Panchkula district, Haryana. We conducted an outbreak investigation to identify the etiologic agent, estimate the burden of cholera in the community, and make recommendations to control and prevent future outbreaks.

We reviewed IDSP syndromic data for acute watery diarrhea (i.e., 3 or more loose or watery stools in the past 24 h) from August 5 to September 9, 2019 reported by Marawala Health Sub-centre, which serves Shahpur village and Shahpur huts informal settlement. We counted cases of acute watery diarrhea reported to IDSP for 2019 and the previous 3 years from 2016 to 2018. We calculated the mean number of cases per week over the previous 3 years and two standard deviations (SD) from the mean; the mean plus two SDs was considered the outbreak threshold.

We defined a suspected cholera case as a person ≥1 year of age with a history of three or more loose stools within a 24-h period between September 1 and 28, 2019 and who resided in Shahpur huts informal settlement. A laboratory-confirmed cholera case was defined as a suspected case with a stool specimen that tested positive for *V. cholerae*. We conducted a house-to-house case search of Shahpur huts on September 27–28, 2019. We used a standardized questionnaire to collect data on sociodemographics, symptoms, duration of illness, treatment, and outcomes. To identify suspected and laboratory-confirmed cases, we searched clinical and laboratory records of local public health facilities linked to the Kalka Community Health Centre, Panchkula District Hospital, and the referral Post Graduate Institute of Medical Education and Research (PGIMER) Hospital, Chandigarh, between September 1 and October 7, 2019. We collected stool specimens from cases with symptoms at the time of identification. Stool specimens were cultured for *V. cholerae* by the Civil Hospital Referral Laboratory, Panchkula, or Microbiology Department, PGIMER, Chandigarh. For cases admitted to PGIMER Hospital, rectal swabs were collected and tested for *V. cholerae* by culture.

We conducted an environmental survey to assess the water distribution and sanitation systems in Shahpur village and Shahpur huts informal settlement. Shahpur huts informal

settlement was segregated from Shahpur village and comprised of approximately 700 unauthorized huts occupied by migratory laborers and families. The huts were grouped into three areas based on elevation and designated as upper, middle, and lower. Therefore, upper huts were on the highest ground and lower huts on the lowest ground. We collected samples of drinking water from the tube wells, common tanks, and from huts of suspected cases. We also collected sewage samples from the effluents of public toilets. Water and sewage samples were sent to the Ramgarh Public Health Laboratory and PGIMER, Chandigarh, for bacterial analysis and culture and following the recommended methods the tests were performed.

The investigation was a public health response to an outbreak as part of the India Epidemic Intelligence Service Program, undertaken with the purpose to identify the source of spread for immediate control of the outbreak and intended for benefit of the community at large. Ethical approval is not applicable as part of public health response. The investigation did not involve any human laboratory sample collection for research purposes and there were no invasive investigations or medical interventions/experiments. All Government of India ethical principles and guidelines were adopted during the outbreak response: the investigation was aimed at achieving public good (beneficence) and collective welfare (solidarity); no harm was done to any individual (nonmaleficence); fair, honest, and transparent (accountability and transparency); and participants' data were de-identified before analysis (confidentiality).

The number of acute watery diarrhea cases reported to IDSP for week 37 of 2019 exceeded the mean plus two SDs thresholds from the previous 3 years to confirm an outbreak. As shown on the epidemic curve, the suspected cholera cases started on September 5, 2019 [Figure 1]. The first case was reported on September 10, 2019, and only sporadic cases were reported after September 14, 2019.

A total of 562 huts, with a population of 2602, were occupied at the time of the investigation. We identified 196 suspected cholera cases. The overall attack rate was 8% (196/2602), and the case fatality rate was 1% (2/196). The median age of suspected cholera cases was 18 years (range: 1–65 years), and females accounted for 54% (106) cases. By age group, the attack rates were highest among adolescents aged 11–20 years at 14% (64/442) and children aged 1–10 years at 12% (61/497). Most (79%, 155) suspected cholera cases lived in the upper huts. When stratified by hut location, the highest attack rate was among people in upper huts at 16% (155/992) compared to attack rates of 5% (31/664) and 1% (10/946) among people in middle and lower huts, respectively. All suspected cases from upper huts reported symptom onset dates between September 7 and 14, 2019. In the lower huts, nine cases (90%) occurred between September 21 and 27 2019. Commonly reported symptoms besides diarrhea were vomiting (48%, 95/196), abdominal pain (15%, 29/196), and fever (12%, 24/196). No suspected case reported bloody stool. Among cases, 80% (156) received antibiotics, 69% (135) received oral rehydration salts, 32% (63) received intravenous fluids, and 10% (19) were hospitalized. Of the 18 (9%) stool samples collected from suspected cases, four (22%) were positive for *V. cholerae*.

The environmental investigation showed that Shahpur village had piped water supplied by the public health engineering department; no suspected cholera cases were reported from Shahpur village proper. For Shahpur huts informal settlement, water was supplied to the community through four large cement tanks each with a tap [Figure 2]. One tank served the upper huts, one tank served the middle huts, and two tanks served the lower huts. These four common tanks were open without lids or caps. The four tanks received water supplied from two tube wells, which were nearly 200 feet deep. Of the 22 drinking water samples sent for analysis, public health laboratory reports were received for eight (36%), and all samples were reported as "not potable" due to high bacteria counts. Water samples were taken from the common water tank ($n = 1$) that served the upper huts, the common water tank ($n = 1$) that served the middle huts, and upper huts ($n = 4$) with suspected cases; all six were positive for *V. cholerae*. The two sewage samples collected in the upper huts area were also positive for *V. cholerae*.

We identified a laboratory-confirmed cholera outbreak in an informal settlement of huts located near Shahpur village, Panchkula, Haryana, in September 2019. Cholera cases were concentrated in the upper huts area, and the outbreak was probably from consuming *V. cholerae*-contaminated water in the common tanks. The water supply from both tube wells was stopped for 3 days on September 12, 2019. All four common water tanks were chlorinated and covered, and health workers distributed chlorine tablets to every hut. In the interim, the public health engineering department supplied water to the Shahpur huts community. Cases declined following the implementation of these measures. Cholera outbreaks are stopped with two intervention strategies: water and sanitation improvements and cholera vaccination.[6] Studies have shown the substantial costs related to building and maintaining piped water distribution and sanitation systems and ongoing quality control.[6] In a low-resource setting like India, with a huge migrant labor workforce and limited water and sanitation infrastructure, the use of the cholera vaccine could be a cost-effective measure to prevent cholera outbreaks and reduce the burden in at-risk populations.[7,8]

The main limitation of this investigation was the lack of laboratory confirmation of all suspected cholera cases. We might have included cases of ADD due to other etiologies, which would have led to an overestimation of the number of suspected cholera cases in the Shahpur huts community.

Preventing ADD outbreaks remains a challenge in India, particularly in informal settlements. To prevent future cholera outbreaks in Shahpur huts informal settlement, we recommended strengthening surveillance for early detection and rapid response to contain outbreaks; improving water and sanitation systems; and increasing community engagement by providing chlorine tablets to households and communication of safe drinking water and sanitation practices.

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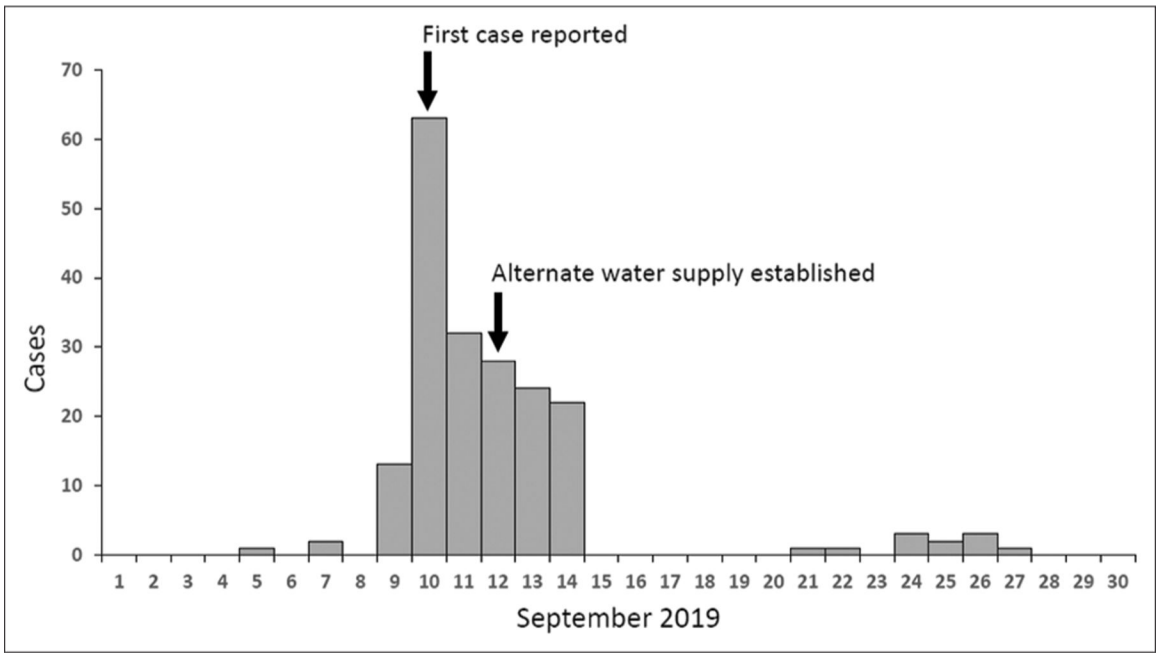

Figure 1:

Epidemic curve of 196 suspected cholera cases by date of onset of diarrhea in Shahpur huts informal settlement, Panchkula district, Haryana state, India, in September 2019.

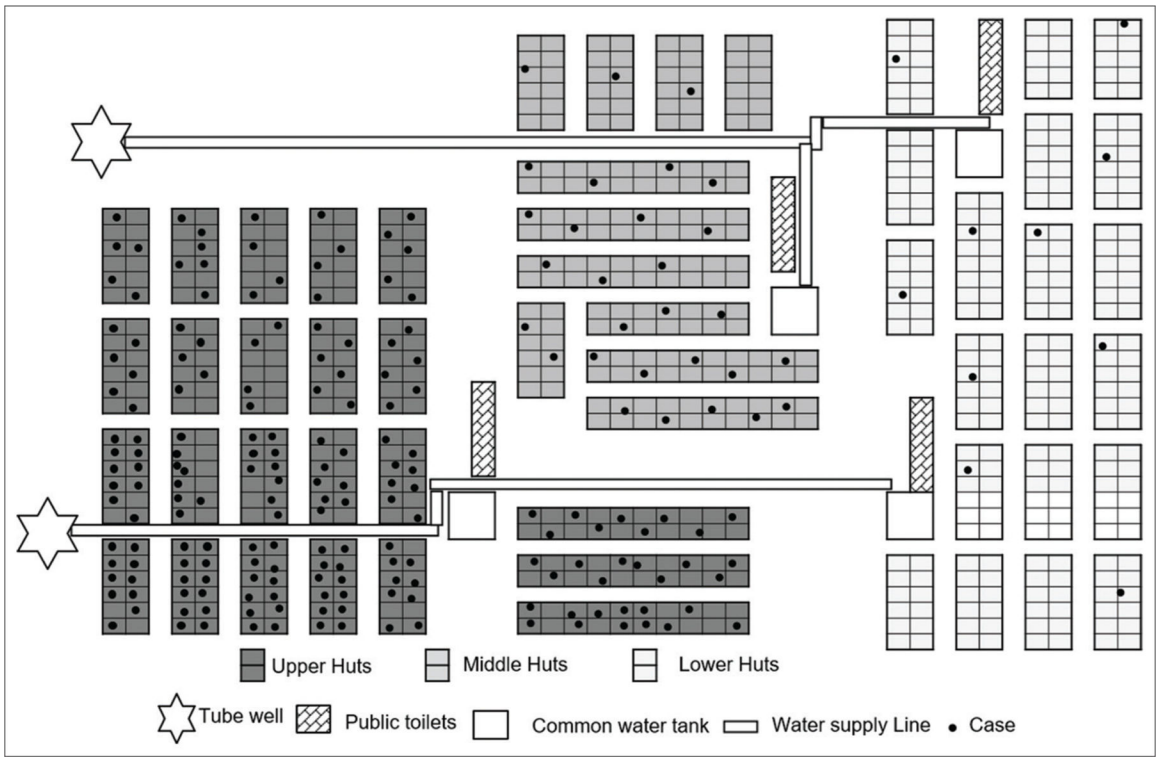

Figure 2:
Geographic distribution of suspected cholera cases and location of water and sanitation infrastructure in Shahpur huts informal settlement, Panchkula district, Haryana state, India, in September 2019.