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## Original Research

# Did point-of-use drinking water strategies for children change in the Dominican Republic during a cholera epidemic?

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## ABSTRACT

**Objective:** Point-of-use (POU) strategies to improve drinking water, particularly chlorination, are promoted within cholera epidemics when centrally delivered safe drinking water is lacking. Most studies examining POU practices during cholera epidemics have relied on single cross-sectional studies which are limited for assessing behavioural changes. This study examined POU practices in a community over time during a cholera outbreak.

**Study design:** Secondary data analysis of existing dataset.

**Methods:** During attendance at well-baby clinics serving a low-income peri-urban community in the Dominican Republic, mothers had been routinely asked, using a structured questionnaire, about POU strategies used for drinking water for their children. Frequency distribution of reported practices was determined over a 21 month period during the cholera outbreak on the island of Hispaniola.

**Results:** An estimated 27.8% of children were reported to have had some exposure to untreated tap water. Unsustained reductions in exposure to untreated tap water were noted early in the epidemic. POU chlorination was infrequent and showed no significant or sustained increases over the study time period.

**Conclusion:** High reliance on bottled water, consistent with national household patterns prior to the cholera outbreak, may have reduced the perceived need for POU chlorination. Examination of the safety of relying on bottled water during cholera outbreaks is needed. Additionally, further inquiries are needed to understand variation in POU practices both during and beyond cholera outbreaks.

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## Introduction

*Vibrio cholerae* is an important contributor to gastroenteritis and death in children within cholera epidemics. The provision of an adequate supply of safe water is a key prevention strategy to reduce cholera spread given that transmission is often through contaminated water.<sup>1</sup> Chlorinating water at the household level or point-of-use (POU) is a common recommendation in settings where the infrastructure to provide an adequate supply of safe water is lacking.<sup>1</sup> This is supported by evidence that POU chlorine reduces risk of childhood diarrhoea.<sup>2</sup> Little, however, is known about the extent of change in POU practices during cholera outbreaks.

Reports from longitudinal studies or repeated cross-sectional studies of POU chlorine use within cholera epidemics were not identified in the peer-reviewed literature. Several reports from Haiti appear to be based on single cross-sectional designs that asked about practices precholera and postcholera outbreak. For example, one report described an increase in POU chlorination from 29% to 87% precholera to 1 month postcholera outbreak<sup>3</sup> (cited by Patrick et al.<sup>4</sup>). Another study reported a significant increase in ‘any’ water treatment, with water purification tablets and bleach being the most common.<sup>5</sup> Within a case-control study, 85% of controls reported ‘treating their drinking water’ during the outbreak vs 51% prior to the outbreak.<sup>6</sup> While these studies are informative and the only feasible option when responding to an outbreak, such approaches are at risk for over estimating changes secondary to social desirability bias.

This current epidemic in Hispaniola (the island shared by Haiti and the Dominican Republic [DR]) started on Oct 14, 2010 in Haiti.<sup>7</sup> By Nov 19, 2010, all 10 administrative districts in Haiti were reported to have been affected by cholera.<sup>8</sup> By Oct 2012, there were 604,634 reported infections in Haiti with 7436 reported deaths attributed to cholera including 580 children under 5 years of age.<sup>8</sup> Meanwhile, in the DR, the first case of cholera was confirmed either by Oct 31, 2010<sup>9</sup> or Nov 15, 2010.<sup>10</sup> By Dec 18, 2010, 59 reported cases had confirmation of *Vibrio cholerae* from three separate outbreaks that included a resource-poor neighbourhood in Santo Domingo, the capital city of the DR.<sup>11</sup> By Dec 2012, 29,433 cases had been reported with 422 deaths in the DR.<sup>10</sup> A public education program in the DR was reported to have commenced in the first 3 months of the epidemic and included ‘4300 mass media messages, nearly three million flyers, 50,000 classroom booklets for teachers, and a volunteer effort to visit one million homes’ (p. 2091).<sup>9</sup> Furthermore, it was reported that in a knowledge survey in the capital city, 89% reported having received cholera prevention messages.<sup>9</sup> Messaging indicated that cholera was transmissible through water and recommended prevention strategies included boiling or chlorinating drinking water.<sup>12</sup>

The majority of Dominican households have access to ‘improved drinking water’ as defined by the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation.<sup>13</sup> However, questions have been raised as to the quality of both ‘improved’ and ‘unimproved’ water sources in the DR, including bottled water.<sup>14</sup> A 2013 report summarising a plan to

eliminate cholera in the DR cited a 2009 report which indicated substantial gaps in chlorination coverage in the water distribution system in the DR.<sup>10</sup> Potentially in response to water quality concerns, the majority of Dominican households identify bottled water as their primary drinking water source, at least since 2002, based on Demographic and Health Survey (DHS) data.<sup>15–17</sup> Unfortunately, the DHS data from the DR do not have information from a stand-alone POU chlorine question. However, in a study in a low-income district in the DR from a 2007–2008 sample, prior to the recent cholera outbreak, only 3.6% and 2.0% of caregivers of young children reported ‘always’ or ‘sometimes,’ respectively, adding chlorine to children’s drinking water.<sup>18</sup> The recent risk of cholera might have led to a rise in POU chlorination of drinking water in the DR.

The objective of this study was to determine whether there were any changes in POU strategies employed by caregivers for improving drinking water for children in a community in the DR during the cholera epidemic by examining data that were previously collected and captured the period of the cholera epidemic. It was hypothesised that there would be an increase in POU chlorination.

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## Methods

### Setting

This study used an existing dataset obtained from a longitudinal child health project based in a low-income, peri-urban community on the outskirts of Santo Domingo, DR. The community is located on the border between two provinces, one which was listed at ‘high risk’ given a cholera attack rate of 0.2–0.49% and another listed at ‘moderate risk’ with an attack rate of 0.1–0.19% in epidemic week 52.<sup>10</sup> Many, but not all, homes in the community are served by a piped water system. Water flow and pressure are variable and there are periods of times when there is no water flow. Other sources of household water include purchased bottled water from corner stores or from water trucks. In some cases, water may be fetched from a river source. A pump well in the community was defunct during most of the study time period. One active biosand filter was located in the community. Informants from the community indicated that in the past piped water was thought to have been chlorinated but not more recently, nor during the period of the study. Community piped water was checked by the community clinic during part of the study period (approximately monthly for a 6 month period) with chlorine test strips (‘Water Quality Test Strips’ from Water Works™) and no residual chlorine was detected. There is no centralised sanitation system in the community. A few homes are linked to small sanitation cisterns and some homes have access to pit latrines. Estimated community population is between 1200 and 1600 persons. The extent to which community members were exposed to cholera education is unknown, however, during the epidemic public health officials did visit the community given a suspected cholera case and did provide information to the community about prevention measures.

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