

ceding the first reported cholera case (See Figure 1).<sup>9</sup> Communities where water and sanitation infrastructure had been destroyed or were non-existent experienced particularly high contamination levels, especially in seven communes downstream of the Artibonite River (Figure 2).<sup>10</sup> Further evidence of the strong correlation between rainfall and exposure shows most affected individuals worked or resided in rice fields alongside a stretch of the river. Further, reports indicate that 67% of people drink untreated water from the river or canals.<sup>11</sup>

In the years since exposure, incidence has lowered but the pathogen's mortality and morbidity continues. By October 20, 2012, the health ministry reported 604,634 cases, 329,697 hospitalizations, and 7,436 deaths from cholera.<sup>12</sup> Children observed playing near the unrestricted site were most susceptible. Those under 5 years of age accounted for 78,938 cases (13.1%), 34,394 hospitalizations (10.4%), and 580 deaths (7.8%) (Figure 3).<sup>13</sup> By June 30, 2013, 663,134 cases, 366,995 (55.3%) hospitalizations, and 8,160 (1.2%) deaths were reported.<sup>14</sup>

New technologies are imperative to combatting exposure in the years since the outbreak. Attempts at controlling cholera are hindered by inadequate medical systems and sanitation, so new technologies like bivalent whole cell oral cholera vaccines (OCV) are of utmost importance. Ivers et al. found that OCVs were highly immunogenic in Haitian adults and children, which conferred protection beyond 6 months and up to 2 years.<sup>15</sup> The Haitian government authorized two pilot studies to assess the practicality of the Shanchol vaccine in urban and rural areas of the country. Charles et al. found the proportion of vaccinated Haitians, who demonstrated vibriocidal seroconversion, approached or exceeded 75% across all age cohorts.<sup>16</sup> These seroconversion rates parallel successful vaccinations seen in Bangladesh, where community coverage in the region was between 62.5-92.7%.<sup>17</sup> Charles et al. illustrated that robust immune responses to bivalent oral cholera vaccine Shanchol can effectively remediate the pathogen among Haitian adults and children. Ivers et al. concluded that the most effective strategy combines public health interventions that include the use of OCV while expanding access to clean water and sanitation. Haiti's vaccination campaign was strongly associated with significant improvements in knowledge of cholera and practices related to waterborne disease.<sup>18</sup> Although Haiti is taking the necessary steps, the available OCV supply is not sufficient to vaccinate the entire Haitian population with the required two-dose regimen.<sup>19</sup>

It seems that no clear end is in sight for Haiti and the rest of the Caribbean. The South Asian pathogenic strain's presence placed the UN in a peculiar position. If held responsible for the cholera outbreak, the UN will be helpless against lawsuits from around the world, citing misconduct over actions of its peacekeeping forces. Although Haiti's vaccination campaign appears to be flourishing, the pathogen appears to be as well because of the Caribbean's warm climate. The public must be mindful in its visits to the Caribbean, and take preemptive measures to prevent contracting cholera.

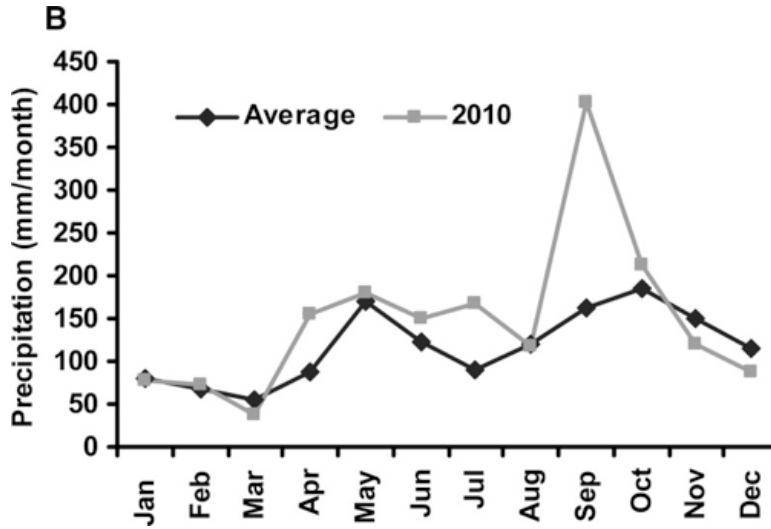
## NOTES

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1. Vaccine, Shanchol, in Haiti. *PLoS Neglected Tropical Disease* 8(5): 2828.
2. Antarpreet, Jutla et al. "Environmental Factors Influencing Epidemic Cholera." *The American Journal of Tropical Medicine and Hygiene* 89.3 (2013): 597–607.
3. Lantagne D, Nair G, Lanata C, and Cravioto A (2014). *The Cholera Outbreak in Haiti: Where and how did it begin?* *Current Topics in Microbiology and Immunology*, 379, 145-164.
4. Ibid.
5. Barzilay, Ezra et al. "Cholera Surveillance during the Haiti Epidemic — The First 2 Years." *The New England Journal of Medicine* 2013; 368:599-609
6. Antarpreet, Jutla et al. "Environmental Factors Influencing Epidemic Cholera." 597–607.
7. Piarroux, Renaud et al. "Understanding the Cholera Epidemic, Haiti." *Emerging Infectious Diseases* 17.7 (2011): 1161–1168.
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9. Antarpreet, Jutla et al. "Environmental Factors Influencing Epidemic Cholera." 597–607.
10. Ibid.
11. Piarroux, Renaud et al. "Understanding the Cholera Epidemic, Haiti." 1161–1168.
12. Barzilay, Ezra et al. "Cholera Surveillance during the Haiti Epidemic — The First 2 Years." 599-609
13. Ibid.
14. Lantagne D, Nair G, Lanata C, and Cravioto A (2014). *The Cholera Outbreak in Haiti: Where and how did it begin?* 145-164.
15. Vaccine, Shanchol, in Haiti. 2828.
16. Charles, Richelle et al. Immunogenicity of a Killed Bivalent.
17. Vaccine, Shanchol, in Haiti. 2828.
18. Charles, Richelle et al. Immunogenicity of a Killed Bivalent.
19. Vaccine, Shanchol, in Haiti. 2828.

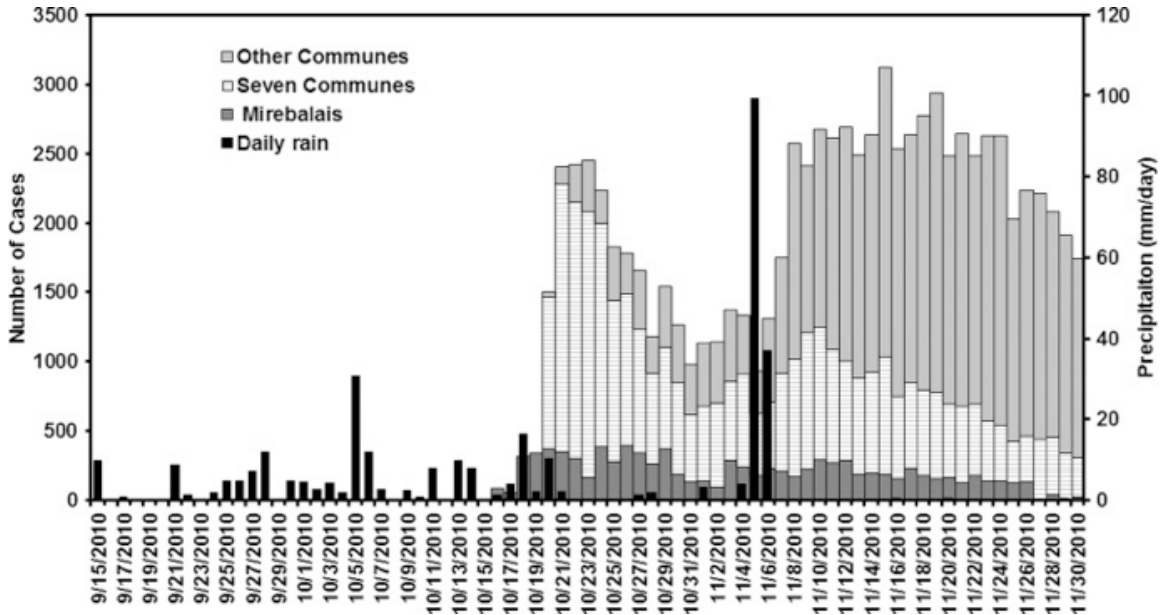
APPENDIX

Figure 1:



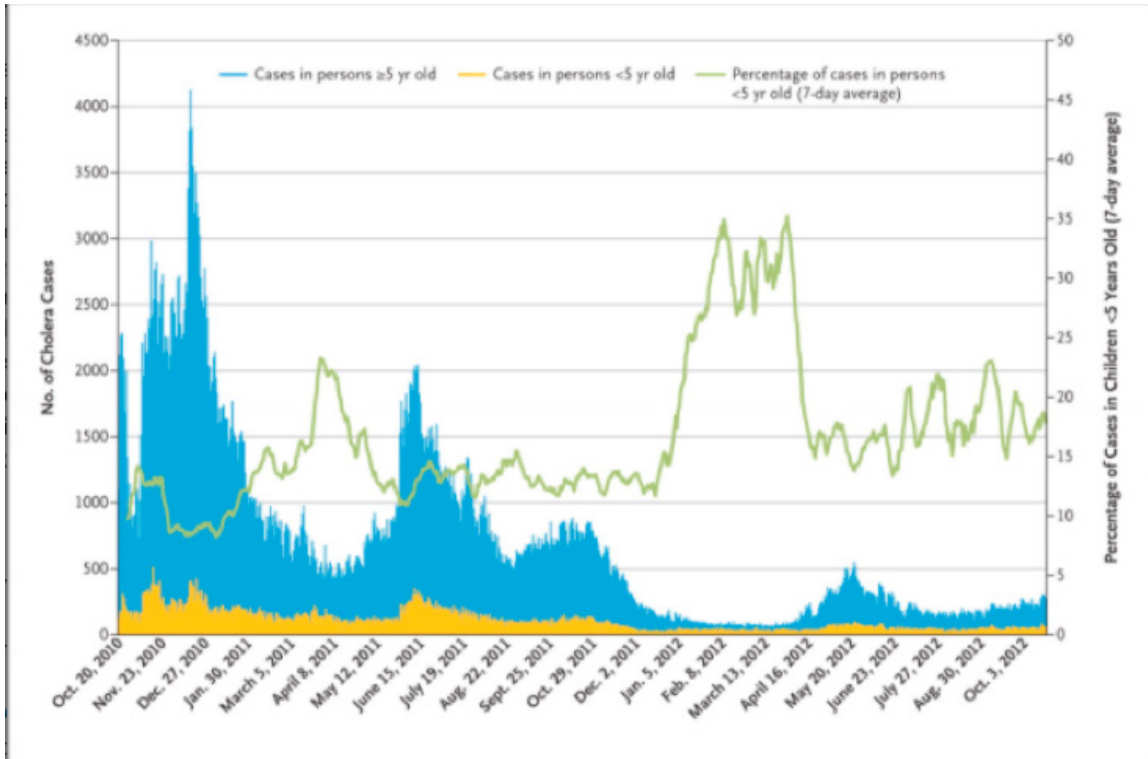
Monthly rainfall in Haiti in 2010 compared with historical rainfall data.

Figure 2:



Cholera cases in Mirebalais, seven communes (St. Marc, Dessalines, Desdunes, Grande Saline, Lestere, Petite-Rivière-de-l’Artibonite, Verrettes) and other communes (data obtained from Piarroux and others). Daily rainfall data were obtained from the Tropical Rainfall Measuring Mission satellite (black).

Figure 3:



Cases of Cholera in Haiti during a 2-year period, according to age.

## Works Cited

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