

MINUSTAH's Role in Reintroducing Cholera into Haiti

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Before October 2010, there had been no reported cases of cholera in Haiti for half a century.¹ As of January 2012, the *Ministère de la Santé Publique et de la Population* (MSPP), Haiti's Ministry of Health, reported that the cholera epidemic had claimed over 7,000 lives.² Over half a million cases have been documented.² Lack of infrastructure combined with a median attack rate of 5 percent, and currently as high as 32% in some regions, prevent recording of all cases, leading to underreporting.³ From Haiti, cholera has spread to the Dominican Republic, Venezuela,⁴ Florida,⁵ and Massachusetts.⁶ Despite an overall decrease in incidence, the epidemic is projected to continue until two thousand fourteen.⁷

Since the birth of epidemiology during an English cholera epidemic in 1854, a foundation of control and prevention is identification and removal of the source. Taken as a whole, research published in peer-reviewed journals and findings of the independent panel commissioned by the United Nations (UN) indicate that the *Mission des Nations Unies pour la stabilisation en Haïti* (MINUSTAH) camp near Meille (also spelled Meyé) was the source of cholera in Haiti. This was due to inadequate sanitation and waste disposal infrastructure causing fecal contamination of waterways.⁷ The MINUSTAH camp introduced cholera into Boukan Kanni, a waterway that feeds into the Meille Tributary System, which empties into the largest river in Haiti, the Artibonite.⁸

From 28 July 2010 to 14 August 2010, there was a cholera epidemic in Nepal.⁹ On 23 September, an epidemic began in the capital, Kathmandu.¹⁰ Nepali soldiers were training in Kathmandu for 3 months prior to their arrival in Haiti in 2 waves, the first on 8 October,⁸ with soldiers arriving in Meille on 9 October, 12 October, and 16 October.¹⁰ The second wave arrived 24 October.⁸ Asymptomatic carriers unknowingly shed the bacterium in their stool¹¹ and are more numerous than symptomatic patients, especially in areas like Nepal where cholera is endemic.¹² Brig Gen Dr Kishore Rana, chief medical officer of the Nepalese Army, responsible for clearing recruits prior to UN deployment, confirmed¹⁰ that they followed UN protocol¹³ by not testing for asymptomatic carriage. Two days after his statement, UN Under-Secretary-General for Peacekeeping Operations, Alain Le Roy declared that "all soldiers had tested negative for the strain."¹⁴ MINUSTAH spokesperson Vincenzo Pugliese admitted almost 3 weeks later that no Nepali soldiers were tested for cholera during their medical clearance.¹⁵

Locals observed waste flowing from the MINUSTAH camp directly into the Meille Tributary System from broken pipes.¹⁰ This was confirmed by visiting epidemiologists¹⁰ and the UN-commissioned investigative panel.⁸ Further, the private waste disposal company contracted by the UN mission, SANCO Enterprises SA (<http://www.sancohaiti.com>), used open, unprotected septic tanks at the top of a hill near an adjacent waterway.⁸ According to residents, these often overflowed into the river during rainfall.⁸ Of MINUSTAH, SANCO, and the local government, no group has taken responsibility for overseeing the maintenance of these off-site tanks. However, Pugliese stated that on-site sanitation infrastructure was built to US Environmental Protection Agency standards and disposal sites were checked by MINUSTAH's environmental compliance unit to ensure they adhered to international standards.¹⁶

On 12 October, a young man drank from the Latem River, part of the Meille Tributary System, and promptly developed severe, watery diarrhea.⁶ He died within 24 hours.⁶ His funeral was 14 October and on 16 October, two workers who prepared his body also developed acute-onset, severe, watery diarrhea.⁶ On 18 October, Cuban medical brigades reported 61 cases of acute, watery diarrhea in the

Mirebalais-area in the preceding week.¹⁰ The first hospitalized patients lived 150 meters downstream from the MINUSTAH camp.⁸ By 19 October, a nationwide cholera alert had been disseminated, with cases noted from Mirebalais to over 100 kilometers away in Grande-Saline, a coastal commune where the Artibonite empties into Gulf of Gonâve.¹⁰ Due to the Mirebalais public water system undergoing repairs in October, many surrounding residents were forced to access water from the river.¹⁰ Two-thirds of sampled patients hospitalized in Mirebalais between 21 October and 23 October admitted drinking untreated river or canal water.¹⁷ There were over 3,000 cases and 129 deaths in less than 48 hours.¹⁰ The initial mortality rate was 7 percent, one of the highest in recent history.⁴ On 21 October, after testing multiple stool samples, the MSPP confirmed a cholera epidemic. On 25 October, Pugliese released a statement denying involvement of MINUSTAH.¹⁶ The next day, MINUSTAH quietly began refurbishing its water and septic systems.⁸ But on 27 October, over a week after the initial cholera alert, an unannounced visit by reporters found pipes still leaking into the waterways and off-site septic tanks to be overflowing.¹⁵ Days later, reporters were allowed access to the camp and found the pipes fixed, though camp denizens initially denied that the repairs occurred after the outbreak.¹⁵

Once cholera was identified, scientists began searching for a source. Using whole-genome sequence-typing, pulsed-field gel electrophoresis (PFGE), and antimicrobial susceptibility, Hendriksen et al compared Haitian cholera to Nepal strains from the 2010 epidemic, made available by the National Public Health Laboratory in Kathmandu.⁹ All 3 methods confirmed that Nepal was the origin of the Haitian cholera epidemic.⁹ One cluster of samples demonstrated only a single DNA base-pair difference between Nepali and Haitian strains.⁹ Cholera has over 4 million base pairs.¹⁸

Other studies using less definitive methodology came to similar conclusions. Comparing hydrological and epidemiological data, Cravioto et al found that the spread of the epidemic mirrored the flow velocities of rivers from the Meille Tributary System to the Artibonite River and its delta.⁸ Using spatiotemporal modeling of epidemiological data provided by the Haitian government and confirmed by independent third party surveyors, Piarroux et al found that the epidemic began near the MINUSTAH camp and spread along the Artibonite River basin, rather than roads.¹⁰ Using multilocus variable-number tandem-repeat analysis of the genome of Haitian cholera samples, Ali et al found that the Haitian cholera strain originated from South Asia, but noted that his group's methodology did not allow for further refinement of origin because they did not obtain isolates from the 2010 epidemics in Nepal.¹ Performing phylogenetic analysis on both whole-genome sequences and core genome high-quality single-nucleotide polymorphisms, Reimer et al found that Haiti's cholera strain was most similar to ones of South Asian origin.¹⁹ However, in their study, they also did not obtain samples from the 2010 Nepali epidemics.¹⁹ Talkington et al, using antimicrobial drug susceptibility testing, PFGE, and detection of toxin genes subunit sequences, biotyping genes, and species-specific genes, were able to tie Haitian cholera strains to South Asia, while noting they did not test any Nepali strains from two thousand ten.²⁰ Chin et al found a genomic connection between the Haitian cholera strain and South Asia using third-generation single-molecule real-time DNA sequencing, but did not test any Nepali strains.²¹ Also noted in the UN-commissioned report were unpublished findings from the Wellcome Trust Sanger Institute in Cambridge, England, and the International Vaccine Institute in Seoul, Korea that showed relation to South Asian strains.⁸ Again, isolates from the 2010 Nepal outbreak were "unavailable."⁸

As late as November 2011, UN Secretary-General spokesperson Martin Nesirky declared that "it was not possible to be conclusive" about the origins of cholera in Haiti.²² Employing 12 different, scientifically-validated methods, 9 independent research groups, including one commissioned by the

UN, all found a link between the Haitian cholera strain and South Asia. All results were publicly available before Nesirky's comments. While the early studies were limited by not directly comparing the Haitian strain to Nepal 2010 epidemic strains, the one, most recent study that did (Hendriksen et al) found the two strains to be nearly an exact match, with greater than 99.9999% genetic similarity. Field researchers, epidemiologists, and journalists all corroborated local reports of both sewage directly leaking from the MINUSTAH camp into the waterways, as well as overflowing from improperly stored waste off-site. The only organization in the Mirebalais area with any contingent from South Asia was MINUSTAH. On 6 March 2012, an Associate Humanitarian Affairs Officer with the UN Office for the Coordination of Humanitarian Affairs deferred to the Department of Peacekeeping Operations official response denying fault (R. FitzGerald, pers. comm.). The next day, the UN Special Envoy to Haiti, Bill Clinton, declared in a press conference that a "UN peacekeeper...was the proximate cause of cholera...It came from his waste stream into the waterways of Haiti."²³ The same day, Daniele Lantagne PhD, a co-author of the UN-commissioned report, stated, "Based on the summation of the circumstantial and scientific evidence, the most likely scenario is that someone associated with the UN MINUSTAH facility was the person responsible."²⁴ The UN still denies responsibility for reintroducing cholera into Haiti.²⁵

When dead-end ultrafiltration—a technique with a greater than 90% sensitivity for detecting microbes in water²⁶—was used on large-volume water samples (up to 30 liters) from Haiti's waterways, cholera was readily noted.²⁷ Though environmental samples collected by the UN were negative, it has not publicized what volume of samples was collected—reporters at the time noted samples being collected in "jars," not a term used to describe 30-liter containers¹⁵—or how they were tested. The environmental samples were processed by a patient clinic, Cedimat (<http://www.cedimat.com>), in Santo Domingo.¹⁵ It is not known if large-volume water samples were collected by the UN or if dead-end ultrafiltration, a process not normally done on human samples or available at patient clinics, was used to test the samples.

The UN's official stance that evidence is inconclusive regarding MINUSTAH's role in reintroducing cholera into Haiti is disingenuous. Cholera epidemics tend to occur in resource-poor settings with poor health and environmental infrastructure. Robust epidemiological and microbiological data are often incomplete or unavailable entirely, as was the case when initial researchers were unable to obtain samples from the 2010 Nepal epidemics. Given the failure to test MINUSTAH soldiers for asymptomatic carriage once the epidemic was identified, and to use a proven technique like large-volume dead-end ultrafiltration to test the leaking sewage at a laboratory that specializes in environmental samples, there will never be the proof that the UN is demanding. The UN's failure to collect the proper, time-sensitive data allows the UN to say that it can never be satisfied with the evidence provided. Nevertheless, all available data, using the best available methodology and technology, has shown that the source of Haitian cholera was MINUSTAH. That 9 independent research groups all came to the same conclusion using different methodologies is virtually impossible to be chance occurrence.

MINUSTAH's reintroduction of cholera into Haiti was not the fault of Nepali soldiers, but rather systemic failures, inadequate UN policy, and failure to follow existing UN standards for sanitation and waste disposal. The failure to test asymptomatic carriers from an endemic area during an epidemic before they traveled to a cholera-naïve region that was 147 out of 147 on the Water Poverty Index before the earthquake²⁸ and whose water security decreased in the years leading up to the earthquake²⁹ is a policy failure. The UN-commissioned report also agreed that pre-screening for

asymptomatic carriage should be implemented,⁸ but this policy change cannot occur if the UN continues to deny flaws in its protocol. The poor construction of the MINUSTAH camp sanitation system, described in the UN-commissioned report as "haphazard, with significant potential for cross-contamination through leakage from broken pipes and poor pipe connections, especially from pipes that run over an open drainage ditch that runs throughout the camp and flows directly into the Meye Tributary System,"⁸ is an infrastructure failure. Inability to maintain off-site standards to prevent sewage leaking into the waterways through its environmental unit was also an infrastructure failure. MINUSTAH failed to follow its own standards and policies. Further, rather than dumping directly into the rivers that citizens rely on, paying a company whose failure to follow UN standards was visible just 60 meters away from camp, or contracting with a private company to transport untreated waste, the UN should treat waste on-site.⁸ In cases where on-site treatment would be conducted by private contractors, there should be close UN oversight. Again, the UN-commissioned report echoes these recommendations, but the impetus for change does not exist without accountability.⁸

This lack of infrastructure and MINUSTAH's response to the disaster it caused demonstrates its inability to follow its own mandates to tie security to development,³⁰ help build basic social services,³⁰ coordinate with the government on humanitarian assistance,³¹ and address the needs of disaster-affected people.³² These UN Security Council resolutions were all passed before the cholera epidemic. Further, the failure to accept responsibility despite overwhelming evidence goes against the MINUSTAH mandate to build the trust of the Haitian people.³³

It is ironic that in the post-earthquake discourse, epidemics were predicted as a result of poor sanitary conditions of displaced Haitians³⁴—though the Centers for Disease Control reported that a cholera epidemic was "extremely unlikely" to occur³⁵—but that when an infectious outbreak arose, it was due to an international force entrusted to maintain the rule of law failing to follow its own rules. Beyond the necessity of determining the source as a measure of public health, the UN must take responsibility for its mission's errors on a moral level. Pursuant to the Status of Forces Agreement that gives MINUSTAH immunity from Haitian law, it must establish a commission to receive and review any claims for injury, illness, or death caused by them.³⁶ Despite similar agreements existing during other UN missions that have committed offenses, such a commission has never been established in the UN Department of Peacekeeping Operations' history.²⁴ No such commission has been established in Haiti either, resulting in a claim being filed with the UN on behalf of 5,000 cholera victims asking for a public apology, a tribunal to be formed, funding and development of prevention and treatment programs, and remuneration for loss of income of people killed or infected by cholera.³⁷ By building and financing treatment centers, funding surveillance and monitoring, supporting education for behavioral change, and improving water security in Haiti through infrastructure improvement, the UN would begin to take ownership for the reintroduction of cholera. Both the UN-commissioned report⁸ and a consensus statement of Haitian and international policy makers, healthcare providers, government leaders, and the lead author of the UN-commissioned report⁴ support these calls.

Given that the Haitian Senate has called for an expedited withdrawal of MINUSTAH,³⁸ and that the majority of Haitians want MINUSTAH to leave,³⁹ these infrastructure developments should be funded and implemented by a non-military arm of the UN. If it were not for MINUSTAH's failures, cholera would not have been reintroduced into Haiti during a time of pronounced water insecurity and damaged infrastructure. To move forward in a new Haiti where cholera will become endemic requires MINUSTAH to publicly take responsibility for its role, and redress the harm it has caused.

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