



# What Have We Learnt from the Tragic Events Related to Humidifier Disinfectant Inhalation in 2011?

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In the spring of 2011, 17 patients with severe respiratory failure were admitted to our medical intensive care unit (MICU). At presentation, 6 patients were pregnant and 4 had given birth 2 weeks previously. Our critical care team had never experienced such cases before. Moreover, we did not observe any reports with similar findings in literature. The ensuing investigation was triggered by our notification to the Korea Centers for Disease Control & Prevention (KCDC). The KCDC responded with an immediate visit to our MICU.

Our first priority was to define this new disease based on its common manifestations. After several rounds of multi-disciplinary conferences, an epidemiologic study, and experimental approaches undertaken by healthcare professionals, including critical care physicians, chest radiology specialists, lung pathologists, pediatric lung specialists, epidemiology specialists, toxicology specialists, and staff members at the KCDC, the underlying cause was eventually found to be the inhalation of humidifier disinfectants. Through a retrospective review of the medical records at the university hospitals, we also identified the lung injury cases that could be associated with humidifier disinfectants. The tragic irony was that the agents responsible for killing or seriously affecting the individuals were actually used to prevent possible lung infection by pathogens that could reside in the water of humidifiers at home.

The collaborative efforts over approximately 8 months involved many healthcare professionals and were true learning experiences. It yielded many findings that were shared with the medical community. First, the role of the intensive care unit as the sentinel in identifying this new phenomenon was found to be crucial in safeguarding the public from unidentified health casualties. Were it not for the experienced critical care team that recognized and differentiated the clinical manifestations of the disease, the cause of the casualties may have gone unnoticed in 2011. Second, the KCDC played a critical role as a control tower in coordinating and performing different tasks. The KCDC staff stayed faithful to their roles in acting as the platform for the in-

vestigation. They recruited the necessary professionals to address the identified questions and tasks, while also quickly responding to the involved professionals' requests. The KCDC, which is an organization dedicated to safeguarding public health against infectious diseases, agreed with our suggestions for investigating the cause of these unfamiliar casualties, even after ruling out causes of infectious nature, following extensive microbiological investigations during the early stage of the investigation. Third, as conventionally emphasized in disease diagnosis, careful history taking led to the identification of humidifier disinfectants as a probable cause of the casualties. This assumption was validated through a well-executed case-control epidemiologic study wherein the odds ratio of humidifier disinfectant was found to be 47.8. Fourth, the dedication and successful collaboration of the involved professionals enabled the identification of the underlying cause within a relatively short period of time. All of the newly established clinical data, epidemiologic study results, and animal experimental data were carefully reviewed by the peers of the investigation group members. Although such a process required additional time for discussions, it eliminated any unnecessary suspicions from the medical community that would be cast over the results. Finally, we observed that most commercial household chemicals had been sold here without undergoing an appropriate certification process with regard to health impact assessment.

We remain unaware of the entire spectrum of this illness, from mild manifestations to serious cases, with some patients even requiring lung transplantations for survival. As no novel cases have been reported since the withdrawal of humidifier disinfectants from the market, a full scientific description of the illness may not be possible. To retrospectively identify a patient with humidifier disinfectant associated lung injury, a history of humidifier disinfectant exposure together with relevant clinical manifestations including radiologic findings should be considered. Through this painful casualty, the role of KCDC should be expanded to include the realms of public health issues caused

by noninfectious medical problems. Moreover, the government should provide continuous healthcare support for patients with injuries related to humidifier disinfectant inhalation.

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