Letter to the EDITOR

Public Health Consensus and Point-of-Care Multiplex Diagnostics for Shipboard Outbreak Control

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To the Editors:

The article by Harwood et al[1] exemplifies the types of analyses the US Navy should routinely conduct to inform the development of evidence-based guidelines for disease control within populations in unique shipboard environments. In addition to the conclusions offered by the authors, military commanders should consider why pandemic control protocols were different between ships that were simultaneously operating within the same geographic combatant command. We hypothesize that knowledge of disease severity of 2009 H1N1 pandemic influenza (pH1N1) at the time of the outbreak, differing pandemic control and reporting requirements between US Navy ships stationed within different fleets, and lack of consensus among US Navy public health specialists played significant roles in why the control protocols were different. We recommend that the US Navy implement point-of-care multiplex diagnostics aboard large-deck ships to allow diagnosis of outbreak etiologies and disease-reporting requirements under the foreign port quarantine and International Health Regulations.

At the time of the H1N1 pandemic, the USS *Ronald Reagan* (RR) and the USS *George Washington* (GW) were at their respective home ports in San Diego, California, and Yokosuka, Japan. The US Navy ship fleets in these ports have different commanders, numerated as 3rd Fleet (C3F) in San Diego and 7th Fleet (C7F) in Yokosuka. Within each of these commands are medical staff who provide support to the fleet commander in the development of policy, including guidance on outbreak control and treatment. For this reason, it would not be uncommon for each numbered fleet to have differing outbreak control protocols, particularly at the onset of the pandemic. However, during the outbreaks of pH1N1 aboard GW and RR, both ships were operating in a deployed status under the authority of C7F, which should have standardized the pandemic response protocols between the ships.

The knowledge of disease severity may have tempered the urgency of expending vast resources in controlling the outbreak aboard RR in comparison to GW. Although cases of pH1N1 had not yet been reported in Japan, the Japan-based US fleet under C7F had strict prevention and control protocols in place to meet the requirements of the Japanese health authorities. These requirements were different from those for the US-based C3F, as well as those under the Status of Forces Agreement for the US military in Japan and shipboard international quarantine regulations. In contrast, cases of pH1N1 had already been confirmed in the United States, including aboard US Navy ships. The USS *Dubuque* (under C3F in San Diego) had an outbreak shortly after confirmation of pH1N1 in the United States, and the severity of illness of pH1N1 cases confirmed in the United States was less than that previously reported from Mexico when the pandemic started.

US Navy public health authorities lacked consensus on recommendations for pandemic control, which was largely a result of differing administrative and operational accountability and priority. The US Navy Environmental and Preventive Medicine Units (NEPMUs) staff public health authorities that provide consultative support, including for outbreak investigation and response, to navy operational forces, including ships. NEPMU No. 5 and NEPMU No. 6, which are located in San Diego and Pearl Harbor, Hawaii, respectively, were administratively and operationally aligned under Naval Medical Center San Diego (NMCSD). They were not directly supporting operational forces, as they had previously been when aligned under the Navy and Marine Corps Public Health Center (NMCPHC) before the H1N1 pandemic. This alignment made prioritizing fleet support extremely difficult, because public health resources and consultation preferentially went to NMCSD and its branch medical clinics.

In addition to the geographic separation of the NEPMUs, 2 public health specialists were detached to the US Pacific Command and C7F staffs located in Pearl Harbor and Yokosuka, respectively. Unfortunately,

https://doi.org/10.1017/dmp.2013.17 Published online by Cambridge University Press

effective communication was complicated by differences of opinion that often occur among public health specialists and, as a result of a military culture, among shipboard commanding officers and fleet staff. These scenarios likely created a situation that complicated consensus-building among public health specialists regarding outbreak control protocols. The article highlights this problem, which, when confronted with a more severe pandemic, could result in grave consequences in terms of morbidity, mortality, and military readiness. It is fortunate that no overall effect on mission capability was observed during the period of the outbreaks aboard RR and GW. Nevertheless, this analysis should prompt a reassessment of navy public health policy, a solution to provide a better network for the public health community, and a hierarchy for sharing information and building consensus.

We believe that one critical step toward resolving these problems would be to establish point-of-care multiplex diagnostics on large-deck ships such as GW and RR. Confirmation of pH1N1 during this outbreak took many weeks, primarily because of the logistics in shipping samples to reference laboratories. While providing resources to detect novel pathogens during a future pandemic scenario similar to pH1N1 would be impractical, if not impossible, aboard ship, having the capability to detect pathogens that routinely cause respiratory and diarrheal illness (the US Navy's most common shipboard outbreak illnesses) would shorten the time to confirm diagnosis and to implement tailored and effective control measures. For example, the FilmArray (Idaho Technology, Inc) is a multiplex polymerase chain reaction detection system, which is approved by the US Food and Drug Administration (FDA), that rapidly tests for 20 different respiratory pathogens that could be implemented aboard ship. This technology is an integrated diagnostic that has been successfully used in military deployment settings by minimally-trained personnel. Even though control measures for outbreaks can and should begin before a definitive diagnosis is made, having better diagnostics would aid reporting requirements for international quarantine when ships enter foreign ports and for International Health Regulations. In addition, smaller class ships would benefit from this advanced diagnostic capability while accompanying the large-deck ships when deployed as an expeditionary or carrier strike group.

The required weekly reporting of syndromic disease surveillance data (disease nonbattle injury) from each navy ship to the EpiData Center at the NMCPHC allows the US Navy to maintain an extensive, longitudinal database of respiratory infections and outbreaks. By combining these data with outbreak investigations performed by the NEPMUs, strategically placed globally in support of deployed navy ships, the US Navy could develop models for respiratory disease transmission specific to each class of ship. These models would assist public health authorities as they prepare infection control and respiratory pandemic preparedness and response protocols, with the ultimate goal of implementing the best prevention and mitigation strategies to ensure military readiness during disease outbreaks.

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Published online: April 23, 2013.

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https://doi.org/10.1017/dmp.2013.17 Published online by Cambridge University Press