Laboratory and Epidemiology Communications

Cluster-Based Approach to Coronavirus Disease 2019 (COVID-19) Response in Japan, from February to April 2020

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Communicated by Masayuki Saijo

On February 25, 2020, the Japanese Ministry of Health, Labour and Welfare (MHLW) established a coronavirus disease 2019 (COVID-19) cluster response taskforce designed to facilitate collaboration between governmental officials and non-governmental public health experts in Japan. Experts from multiple institutions were invited to support the MHLW and the taskforce worked onsite at the MHLW building in Tokyo. The response taskforce supported the Ministry's efforts toward the early detection of and appropriate care for severe cases, early identification of and response to case clusters, and promotion of behavioral change to reduce disease transmission. This close collaboration was redesigned based on how the Japanese government and academics collaborate during health-related emergencies. Here we describe and reflect on the cluster-based prevention measures instituted in Japan against the spread of COVID-19 and provide insight into the next stage of the response.

More than 150 confirmed COVID-19 cases were reported in Japan as of February 25, 2020 (1). Some of these cases were analyzed by taskforce experts to determine the characteristics of secondary transmission in Japan. Initial findings suggested that 80% of infected people did not transmit the virus to others (2). Instead, most transmission occurred via a small proportion of cases (3), often leading to the formation of clusters. Therefore, identification of clusters via tracking the activity of cases backward in time to elucidate avenues of transmission (4) became a priority of Japan in order to provide opportunities to identify clusters and introduce public health measures that could reduce future cluster formation. Ultimately, by preventing the formation of clusters, COVID-19 transmission can be

largely suppressed.

Around the same time, the taskforce also searched for common environmental and behavioral characteristics of COVID-19 clusters. Most cases of transmission occurred in settings related to what we call the "Three Cs": i) closed spaces with poor ventilation, ii) crowded spaces with many people, and iii) close contact, such as from intimate conversations, loud cheering, singing, or exercise within a short distance from others. This finding indicated a need for physical distancing and suggested that the "Three Cs" should be avoided to prevent transmission of severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2), the causative agent of COVID-19. Based on this finding, Japan subsequently introduced public health measures requesting that residents and visitors avoid environments related to the "Three Cs." In some cases, local jurisdictions also recommended closing venues with environments related to the "Three Cs."

In late March, 2020, there was an increase in the number of cases reported without an identified epidemiologic link, indicating that unrecognized chains of community transmission were occurring (5). The taskforce estimated that residents would need to reduce their number of close contacts by 80% to suppress transmission to a level that would allow for a sustainable public health response (6). Consequently, and in accordance with legislation developed following the H1N1 influenza pandemic of 2009 (7), which provides the legal basis for restrictions on the use of venues determined to be high-risk for transmission, Japan declared a state of emergency. As of April 28, 2020, the Japanese government was set to remain in a national state of emergency until May 6, 2020, at which point the taskforce would continue evaluating necessary public health measures and provide recommendations based on incidence trends and other data.

Additional technologies are being considered for implementation or have been applied to further improve cluster response activities and to supplement traditional epidemiological methods. For example, random mutation analysis of the SARS-CoV-2 gene over time has been helpful in identifying the spread of the virus within the community and has been applied to epidemiologic investigations (8). In addition,

Accepted May 29, 2020.

J-STAGE Advance Publication June 30, 2020.

DOI: 10.7883/yoken.JJID.2020.363

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in situations where the incidence of COVID-19 is extremely high (9), contact tracing, which forms the basis of cluster response, could become unsustainable. Thus, the use of additional tools for contact tracing and close-contact management (10), such as mobile phone applications, is being considered.

Although the first COVID-19 case detected in Japan was identified less than 1 month after the disease was reported in China, a large increase in cases was initially averted. However, once the spread of the disease reached pandemic proportions, residents returning to Japan from new COVID-19 epicenters sparked fresh domestic chains of transmission. As the local scale of the epidemic increased, experts in the taskforce also assumed the role of risk communication, reaching out to the public to provide scientific-based messages for behavioral change and physical distancing recommendations announced as necessary to suppress SARS-CoV-2 transmission. As the pandemic continues, the taskforce will need to adapt its role and collaborate with decision-makers to find a sustainable balance between public health response and socioeconomic stability.

To conclude, this manuscript has described Japan's cluster-based approach to the COVID-19 response and the contribution of this approach to national policies. As public health measures were deliberated upon and implemented, the taskforce provided decision-makers with scientific evidence. This level of integration of non-governmental experts into the national COVID-19 response is unprecedented and paves the way for future synergistic collaboration among government, academia, and other sectors during public health emergencies. As the pandemic further unfolds and additional information about COVID-19 becomes available, the taskforce will continue providing expert opinions and timely analyses in support of the public health response.

Appendix The Experts in National COVID-19 Cluster Taskforce (a part of members, listed in alphabetical order): Andrei R Akhmetzhanov (Hokkaido University), Fumie Ando (Okinawakyodo Hospital), Asami Anzai (Hokkaido University), Satoru Arai (National Institute of Infectious Diseases), Yuzo Arima (National Institute of Infectious Diseases), Akira Endo (London School of Hygiene & Tropical Medicine; The Alan Turing Institute), Hiroyuki Fujikura (National Institute of Infectious Diseases), Yoshihiro Fujiya (Osaka University), Yuki Furuse (Kyoto University), Yoshiaki Gu (National Center for Global Health and Medicine), Katsuma Hayashi (Hokkaido University), Ikuko Horie (National Institute of Infectious Diseases), Tadatsugu Imamura (Japan International Cooperation Agency; National Center for Child Health and Development), Takeaki Imamura (Tohoku University), Kazuaki Jindai (Kyoto University), Sung-mok Jung (Hokkaido University), Keisuke Kadokura (National Institute of Infectious Diseases), Kensaku Kakimoto (National Institute of Infectious Diseases), Koki Kaku (National Defense Medical College), Taro Kamigaki (Tohoku University), Hajime Kamiya (National Institute of Infectious Diseases), Atsuhiko Kanayama (National Defense Medical College), Ayu Kasamatsu (National Institute of Infectious Diseases), Hirofumi Kato (National Institute of Infectious Diseases), Taishi Kayano (Hokkaido University), Ryo Kinoshita (Hokkaido University), Mizue Kitahara (National Institute of Infectious Diseases), Yura K Ko (Tohoku University), Tetsuro Kobayashi (Hokkaido University), Yusuke Kobayashi (National Institute of Infectious Diseases), Nobuhiro Komiya (Japanese Red Cross Wakayama Medical Center), Masaaki

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Acknowledgments All experts listed in the appendix developed the concept of the report. Kazuaki Jindai and Natalie Linton wrote the first draft, with equal contributions. Tomoya Saito, Yuki Furuse, and Hitoshi Oshitani provided additional feedback on the first draft. All authors edited and finalized the manuscript. Secretariat members of the taskforce also contributed to this manuscript. The authors would like to acknowledge the following institutions for their contribution to support the cluster-based approach: public health centers, prefectural governments, public health institutes, and medical facilities. The authors would also like to thank volunteer members (Kozue Amemiya, Kayako Chishima, Aya Fujiwara, Yoko Hamasaki, Naomi Ikeda, Keiya Inoue, Sachi Ishida, Tomoe Mashiko, Kota Ninomiya, Akiko Sayama, Ayaka Takeuchi, Hiroto Tanaka, Fumie Tokuda, Shogo Yaegashi, Lisa Yamasaki, Fumi Yoshimatsu, and Mariko Kanamori), external experts (Kyoko Fujisawa and Megumi Kawashima), and the Bureau of International Health Cooperation at National Center for Global Health and Medicine for information gatherings and data cleaning. Natalie Linton and Sung-mok Jung received a graduate study scholarship from the Ministry of Education, Culture, Sports, Science and Technology, Japan. Akira Endo is financially supported by The Nakajima Foundation and the Alan Turing Institute and received a research grant from Taisho Pharmaceutical Co., Ltd.

The opinions expressed here are that of the authors and do not reflect the official policy of the MHLW.

Conflict of interest None to declare.

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