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Perspectives

Rapid response of a medical center upon the surge of COVID-19 epidemic in Taiwan

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Abstract A surge of coronavirus disease (COVID-19) cases emerged in northern Taiwan in mid-May 2021. In spite of over one-year preparedness, the medical system in this area suffered from the crisis. Far Eastern Memorial Hospital (FEMH) responded quickly with decreased total hospitalization cases (about 50%) to free manpower and space. With simple construction work, the in-hospital service capacity increases from 11 negative-pressure ward (1 unit) and 2 negative-pressure ICU (1 unit) beds to over 130 ward (5 units) and 58 ICU beds (4 units) without negative-pressure design within 3 weeks. For a period of time, FEMH takes care of 10% of all intensive care services in Taiwan. The vaccination rate of workers reaches 90% since mid-May. The amount of testing performed during the period, including PCR and rapid tests, comprised of more than 20% of tests performed in New Taipei City. Two hotels for mild/asymptomatic COVID patients were handled by FEMH workers. By mid-July, about one-fifth of COVID-19 cases in New Taipei City received services from the FEMH system. With determined leadership and concerted efforts, combined interventions can increase the capacity of medical care within weeks and help society against the COVID-19 epidemic.
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Perspective

Since the outbreak of the COVID-19 epidemic in late December 2019, the virus had spread globally, resulting in great impacts to all human beings and healthcare systems.[1,2] Taiwan, as an island with previous experience of SARS, successfully limited the spread of COVID-19 in 2020 with strict border control, mandatory face masks in public areas, and many intensified infection control case-based and population-based interventions.[3,4] In spite of some skeptics questioning about the low prevalence of disease could be due to lack of large scale surveillance, a study performed in May—July 2020 showed among 14,765 patients at one major hospital in northern Taiwan, the unweighted seroprevalence of anti-SARS-CoV-2 antibodies was only 0.07%.[5]

However, in mid-May 2021, COVID-19 cases emerged rapidly in northern Taiwan, mainly linked to the exposure to Wan-Hua District, Taipei City as an epicenter (Fig. 1). The source of the surge is possibly linked to a change of border control policy in early April and subsequent COVID-19 outbreak at an airport hotel in Tao-Yuan City, the international airport city. The initial community transmission was left undetected until clusters of community cases in several cities and several community-hospital transmissions with subsequent nosocomial outbreaks, including Far Eastern Memorial Hospital (FEMH), were noticed suddenly. FEMH is a medical center located in Ban-Chiao District, New Taipei City, Taiwan. The only barrier between Wan-Hua District, the epicenter, and Ban-Chiao District is a river, but people in these 2 districts interacted closely. The COVID cases diagnosed in Ban-Chiao and Wan-Hua District comprised a big proportion of all cases (Fig. 1). FEMH has 1400-bed and provides average of 6000 outpatient services daily. The monthly emergency department service volume is around 10,000 cases. There works a total of 3547 full-time healthcare workers, 769 outsourced workers, and 770 volunteers in the hospital. For FEMH, about 60% of daily admission was from outpatient and 40% from the emergency department. Since the start of the COVID-19 epidemic in 2020, a committee has regular meetings on daily basis to weekly depending on the heat of the epidemic. FEMH is not originally designated hospital to take care of COVID-19 patients. As a tertiary hospital, the role of FEMH is to support the designated COVID hospitals, especially for critical cases. Before the surge, there were 11 negative-pressure single rooms in one ward unit, and 10 negative-pressure beds in 5 ICU units. Due to the small indigenous outbreak (less than 100 cases) in Taiwan in 2020, we had modified 10 single rooms in one ICU unit with increased ventilation, but none of these rooms were activated until May 2021.

Since 14th of May, 2021, the FEMH COVID-19 committee held daily meetings. The most important goal is to stop the spread and transmission of the virus and to provide healthcare services to people in New Taipei City. The

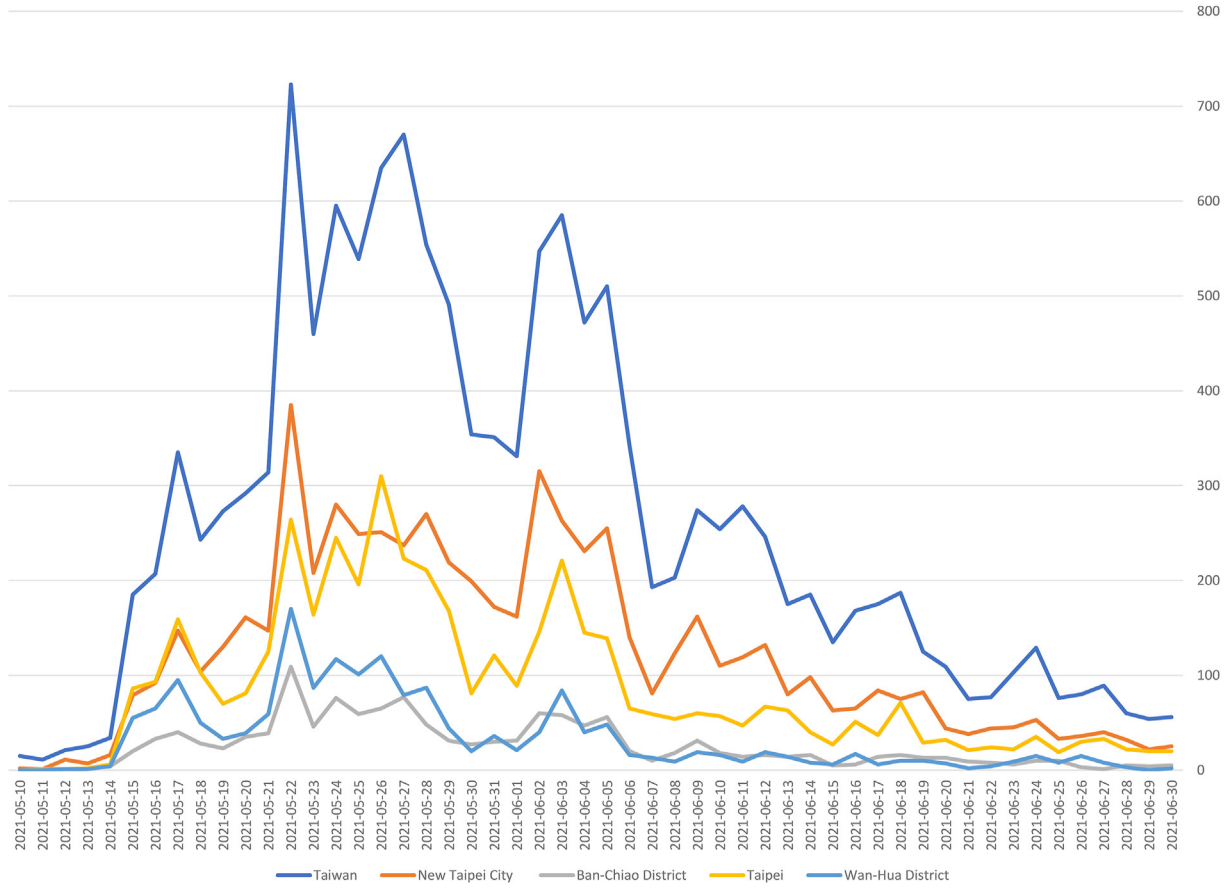

Figure 1. Daily COVID-19 case number in Wan-Hua and Ban-Chiao District.

number of patients with COVID-19 increased rapidly in northern Taiwan. More than 100 cases in one day was found in Ban-Chiao District at the peak of the surge (Fig. 1). Foreseeing the medical need based on experiences from other countries, we started to transform regular wards/ICU to COVID-19 specialized wards/ICU. The major concern of the specialized COVID-19 service area is whether negative pressure is a necessity or not. With the experience from countries with numerous cases, proper PPE and enough buffer zone areas are much more important than negative pressure rooms, which had been advocated by Yen as traffic control bundle in the hospital.[4,6] We convinced our workers with a newly-constructed wooden walls at ICUs and general wards separating patients, buffer, and clean zone as shown in Fig. 2. Those constructions were completed within days, and within 3 weeks, the capacity of the ICUs increased from 10 beds (1 unit) to 58 beds (4 units) and in the case of general ward increased from 11 negative-pressure beds within 1 unit—138 beds with no negative-pressure design in 5 units. We stopped the air return in these rooms to prevent the possibility of recycling air particle containing SARS-CoV-2. The number of COVID-19 patients hospitalized at FEMH peaked on 3rd June, 2021, including 51 cases in ICU and 126 cases in ward, about 30% of all hospitalized patients were admitted due to COVID-19 as shown in Fig. 3. No HCW worked in the specialized area contracted COVID-19 during this period. With the expanded capacity, the risk of nosocomial infection caused by COVID-19 patients clustering and prolonged stay of COVID-19 patients in the emergency department is decreased, which often leads to subsequent nosocomial outbreaks.[7]

Although the healthcare systems and hospitals had prepared for COVID-19 outbreak for more than 1 year,[3,4] the sudden increased medical need challenged all hospitals and other health care systems in northern Taiwan, especially intensive care services, as it happened in other countries.[8,9] Some daily routine services, such as elective surgery or minor procedures, were canceled to expand service capacity for increasing COVID-19 cases and decrease the risk of nosocomial infection. Healthcare workers' attitudes and preparedness are the keys to a rapid transformation from regular service to COVID-19 care. In a survey of United States intensive care units (ICU) health care workers (HCWs), the most critical issues identified were personal protective equipment (PEE), specifically N95 respirator, and ICU staffing.[8] Fortunately, the Taiwan government's preparedness plans were activated early, which ensured an abundance in supply of PPE meeting the demands of healthcare facilities and citizens during the pandemic.[10]

In addition to main preventive measures, the other important and best protective measure against spread of COVID-19 is vaccination.[11] The vaccination program in Taiwan starts in late March 2021. However, the supply of vaccines is limited, and the general population, including HCWs, hesitated to receive the Astra-Zeneca vaccine, for fears over potential side effects. One nosocomial outbreak was found at FEMH due to a patient from Wan-Hua District,

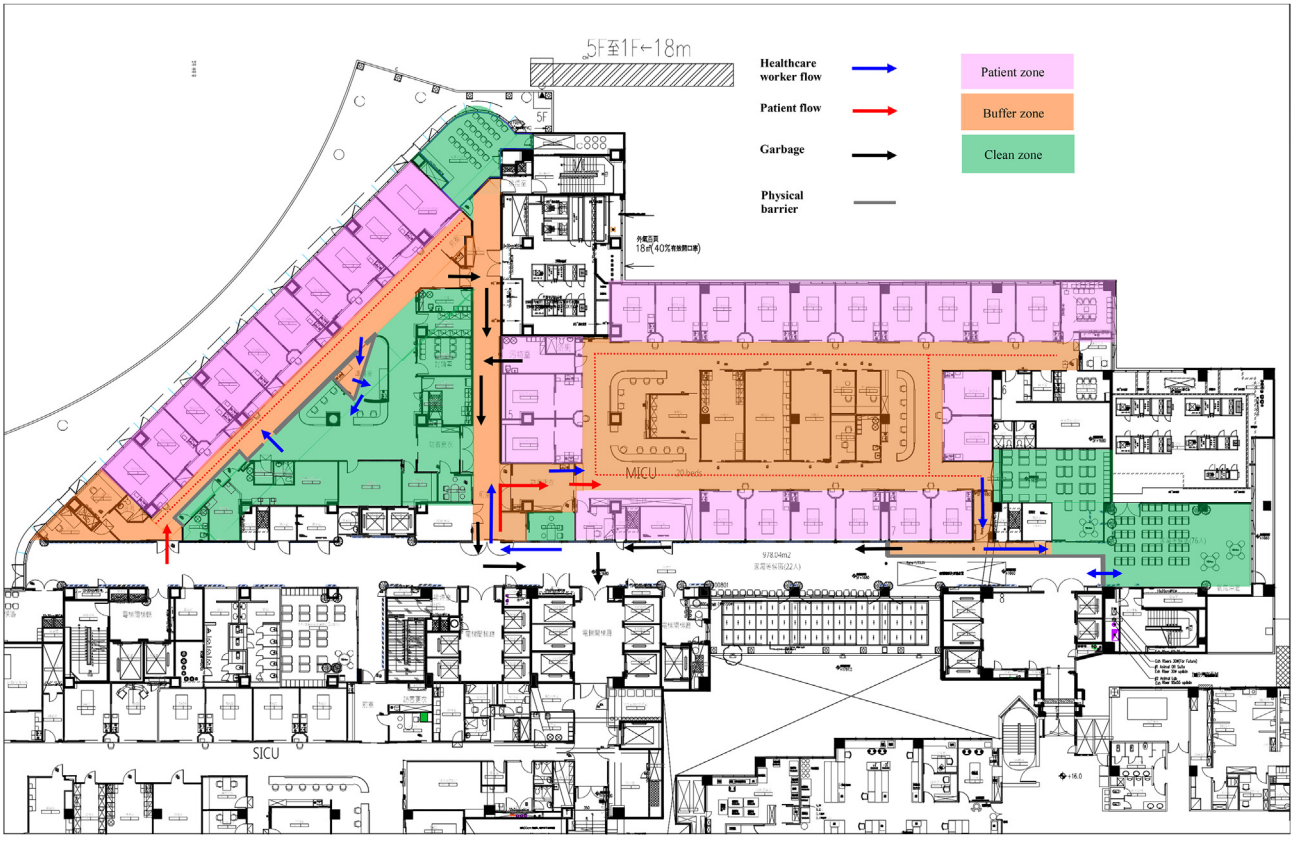

Figure 2. The layout of an intensive care unit at FEMH.

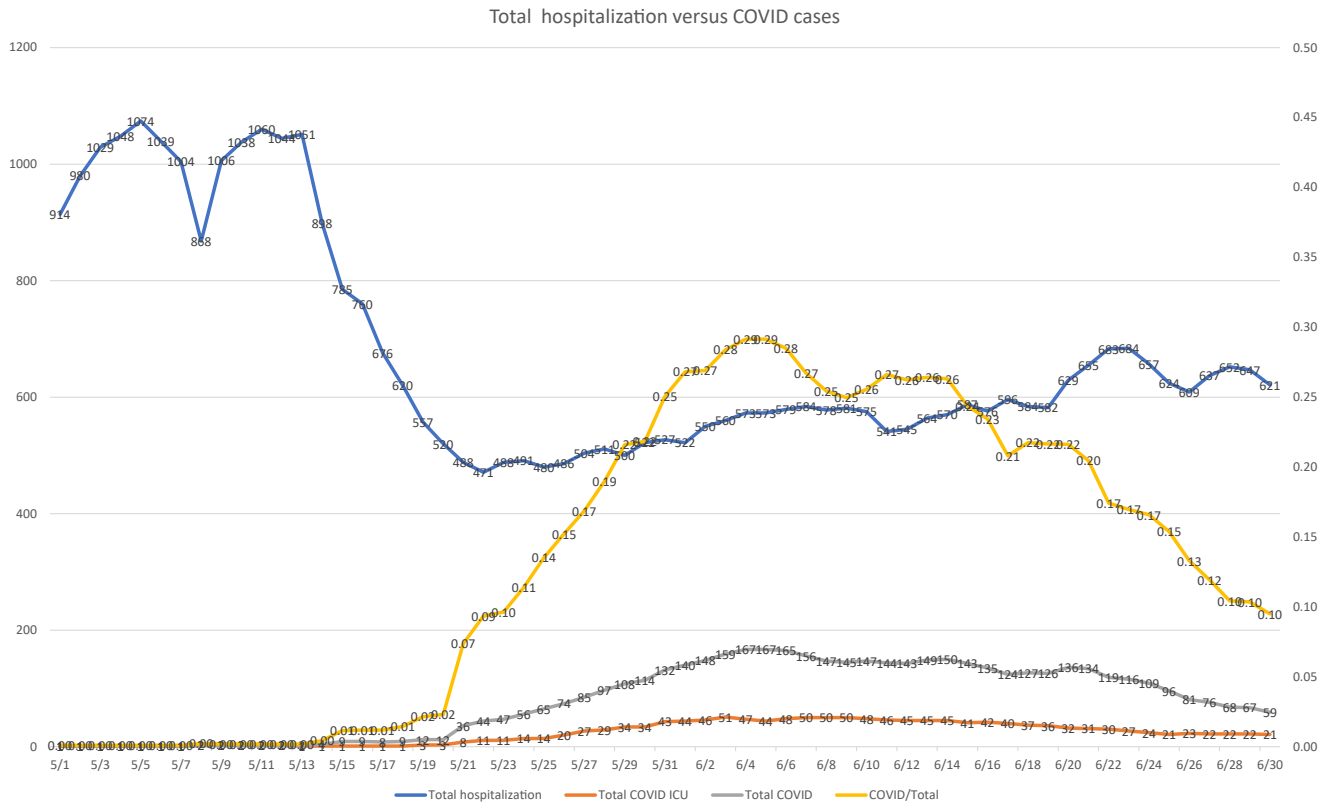

Figure 3. Number of total hospitalization and COVID cases at FEMH.

admitted to the hospital on 10th May 2021 but diagnosed having COVID infection on 14th. Since 12th May 2021, the administration decided to stop non-emergent admissions to free HCWs to care for increasing COVID-19 cases emerging from the community. The number of hospitalized patients decreased from over 1000 to 471 on 22nd May, 2021, partly due to the nosocomial outbreak reported by the media as shown in Fig. 3. During the same time, many HCWs, who hesitated to received COVID-19 vaccination started to receive 1st dose of vaccination. For full-time workers, the vaccination rate increased from merely above 20% on 10th May 2021 to over 80% within 1 week. As a result, when the community suffered from the shock of increasing COVID-19 cases in late May 2021, many HCWs at FEMH felt relatively confident due to their vaccination status. We also checked the level of antibodies among those who had received 1st dose vaccination and showed that all of tested health workers (n = 295) had detectable anti-S antibodies (Roche Diagnostics, Basel, Switzerland) against COVID-19 after 21 days of vaccination.

The third part is testing for SARS-CoV-2. Since the outbreak of COVID-19 epidemic started in 2020, regular RT-PCR test services for COVID-19 detection were set up. Before the second surge in May 2021, most of the capacity of PCR testing at FEMH is used for flight certification. However, the demand for PCR increased sharply with the surge in COVID-19 cases. The daily number of PCR testing increased from 100 to exceeding 500, which is enabled by workflow optimization, purchasing fully automated systems such as Cobas 6800, and overloaded medical technicians. Three rounds of hospital-wide PCR screening for all workers were performed during the surge, and detected 4, 2, and 0 cases, respectively. Aside from PCR, rapid antigen testing was set up at FEHM since 24th May 2021 to facilitate providing medical services, including community hotspot screening stations, universal testing at the emergency departments, weekly testing for the hemodialysis patients, and so on. The total amount of rapid antigen testing accumulated rapidly (about 2000 tests weekly), about 19% of total rapid antigen testing in New Taipei City was performed by FEMH staff.

As hospitals in New Taipei City were overstressed due to rapid rise in COVID-19 cases and widespread nosocomial infection outbreaks, hotels were recruited as alternative care site for asymptomatic/mild COVID-19 cases. The outbreak at FEMH was contained within 2 weeks, and we started to send out HCWs to provide care at specialized hotels in late May 2021. From May 28, 2021 to July 12, 2021, FEMH HCWs were responsible for 2 hotels and took care of total 871 cases. Overall, about one-fifth of COVID-19 cases in New Taipei City received services from the FEMH system.

COVID-19 has been rampant in the world for more than 1 year. Taiwan, as an island with sound public health as well as healthcare system, survived the 1st wave in March 2020, but suffered from the 2nd wave since May 2021. Fortunately, with the cooperation between people, government, and private sectors, the 2nd wave was controlled gradually since mid-June 2021. Among all the factors involved to provide COVID-19 care, the attitude and co-operation of HCWs is most important. Compared to SARS pandemic in 2003, in which some HCWs responded poorly, most of the HCWs faced the COVID-19 epidemic positively. There are

several possible reasons. First, the whole Taiwan society had prepared for the disease for more than 1 year, and PPEs, including face mask, N95 respirator, face shield, protective gown, and so on, are quite abundant. Second, the vaccination program has started in March 2021, and the willingness of HCWs to receive vaccination increase after the surge of COVID-19.[12] Third, a large-scale screening program also helps. Three rounds of hospital-wide screening have eliminated the threat of COVID-19 spread among workers temporarily and remind workers to protect themselves. If HCWs developed any suspected symptom, a PCR will be performed again.

Fourth, simple modification with a wooden wall created the physical barrier and clear demarcation for the buffer zone, and healthcare workers felt safe with this kind of modification.[6] Fifth, the nosocomial outbreak in mid-May was a disaster initially, which decreased patient volume within days, but with prompt control of the outbreak, quarantined HCWs were released in late May 2021 and the index ward was re-opened as a specialized ward within 2 weeks to provide care for patients with COVID-19.[13] Chaperones management were enhanced after the outbreak.[14,15] To cope with the COVID-19 epidemic, everyone in the hospital is important. Any break in the hospital regulations could lead to a total breakdown of the system. With determined leadership and concerted efforts, combined interventions can increase the capacity of medical care within 2 weeks and help society against the COVID-19 epidemic.

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