SMJ Singapore Medical Journal

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Protecting high-risk institutionalised residents from COVID-19: a Singapore dormitory experience

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Singapore Med J 2022, 1–7
https://doi.org/10.11622/smedj.2022059
Published ahead of print: 25 May 2022

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In March 2020, we diagnosed cases of Covid-19 in 53 purpose-built dormitories in the northen and western parts of Singapore, housing 323,000 foreign workers.[1] Case numbers surged through April and were not brought fully under control until August 2020. Ultimately over 54,000 were swab-diagnosed and 47% were serology positive for Covid-19 but there were only 25 ICU admissions and 2 deaths amongst this population.[2,3] In the context of an uncontrolled transmission during a pandemic, our strategic response was based on 3 principles which included risk stratification, regular and frequent testing, and immediate removal of an infectious source. Thus, we identified workers with concomitant co-morbidities who were age ≥ 45 years to temporarily and physically move them from the transmission zone in order to maintain a clean cohort.

From May to July 2020, we re-purposed an unused military barracks in northern Singapore, which comprised of 6 blocks, each with a capacity to house 100-400 residents. Individual bunks within each block had 4-18 beds each. Residents from each block were segregated from other blocks. Toileting and shower facilities were available on each floor of a block to facilitate segregation between floors. A fence around the perimeter of the facility with a guardhouse at the entrance allowed for surveillance and contact-tracing of anyone who entered and exited the area. In addition, a field medical post was established within walking distance from the blocks which provided onsite medical care for residents.

A total of 1,098 migrant workers were extracted from a total population of 25,000 residents of 2 high density parent dormitories. Internal segregation at these parent dormitories was not possible due to the high occupancy rates of over 90%. The parent dormitories consisted of up to ten 13-storey residential blocks. Each storey consisted of multiple bunks, and bunks were shared by up to 12 inhabitants. Communal toilet and shower facilities were shared per storey. Extracted residents were categorized into lowest-to-highest risk based on a geospatial heat-map exhibiting

their location, their proximity to, and possible contact with Covid-19 positive individuals. They were chosen based on their higher risk of Covid-19 infection, i.e. age ≥45 years of age, and/or presence of medical co-morbidities.

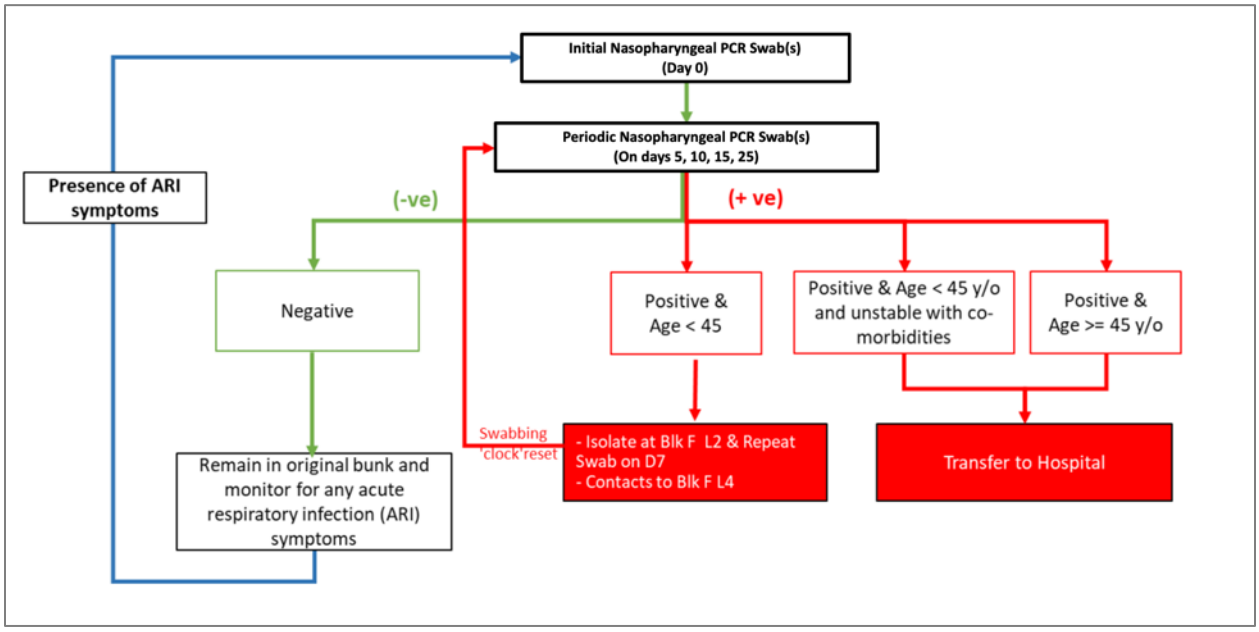
When Covid-19 first appeared in migrant worker dormitories in Singapore, it was expected that spread would be exponential due to high occupancy rates and high density living quarters. The scale of measures implemented to curtail the spread of a highly transmissible disease in these large scattered clusters required a complex and prolonged response, focusing on preventing severe disease and mortality, and isolating suspicious and Covid-19 positive patients immediately. Parent dormitories were too highly populated, which limited the creation of adequate swing space to isolate Covid-19 patients in situ. Thus, an interim strategy which allowed the displacement of high risk residents from the infectious source, coupled with close monitoring of these residents who may still be in the incubation phase of the disease could help to curtail the spread of infection. Additionally, such a strategy could also simultaneously free-up much needed space in parent dormitories to isolate Covid-19 positive patients in situ, further limiting the rapid spread of infection.

At the repurposed facility, a swing site was created from one of the blocks, where affected residents were isolated from other blocks and segregated between floors. Additionally, an in-situ isolation block to house contacts and an interim holding area to await swab results, were also created.

Prior to entry into the facility, a negative entry swab was required in the preceeding 12 hours. Thereafter, a testing strategy consisting of serial nasopharyngeal swabs for polymerase chain reaction (PCR) was undertaken to rapidly identify emergent cases. Covid-19 positive individuals were transferred to a tertiary hospital for further management.[4-6] An on-site medical

post was manned by reassigned hospital-based physicians, nurses and volunteers. Additionally, a centralised team could perform up to 1000 swabs daily that were processed at laboratories optimized for high volume testing with same-day results (Fig. 1). Epidemiological oversight through geospatial heat mapping guided isolation decisions within the facility.

Figure I. Swab testing algorithm and disposition plan of residents who underwent nasopharyngeal PCR swab testing for COVID-19.



Blk F = separate unoccupied block at the swing site, L2 = Level 2, L4 = Level 4.

Our residents originated from Bangladesh (40.0%), India (33.8%), China (17.2%), Thailand (5.9%) and Myanmar (2.0%). The diversity of cultural backgrounds including Hinduism and Islam necessitated careful consideration of the religious and dietary requirements of our residents e.g. calls to prayer and breaking fast timings most notably as the period of our operations coincided with Ramadan. The age of our residents ranged from 20 to 69 years (mean & SD, 44

years +/- 9.6). Approximately 7.4 % of patients had co-morbidities including diabetes mellitus, hypertension and hyperlipidemia. Social mixing was discouraged through the housing of residents with the same ethinic and religious backgrounds and regular risk communication and community engagement (RCCE).

A proactive approach to RCCE involved serial messaging in seven languages. These were broadcasted via a public announcement speaker system which was additionally adapted into short videos shared through QR-enabled mobile devices and pamphlets. In addition, face to face sessions were conducted to allow bidirectional communication which helped to understand the concerns and anxieties of our residents. Hygiene guidelines were reinforced and early reporting of respiratory symptoms was encouraged. Subscriber identification module (SIM) cards were provided to the workers so that they would be able to stream entertainment and maintain contact with their family members. Face masks and hand santisers were distributed regularly to improve hygiene standards.

Our strategy of successive PCR swab and serology testing resulted in a total of 101 swab-positive workers which were identified early and transferred to nearby hospitals. Our efforts yielded a "clean cohort" of 997 men who were subsequently transferred back to their parent dormitories after 10 weeks of stay. The clean cohort included 73.2% of residents who had both negative serology and PCR results. As entry serology was not sought prior to entry, some individuals could have had earlier infection (Table I). The decision to end the strategy was made when PCR negativity rates reached 100% and the transmission of Covid-19 was under control in the parent dormitories, paving the way for the safe return of residents to their dormitories of origin.

Table I. Results of COVID-19 tests performed at the facility at various time intervals.

Type of COVID-19 Test	On day 0	By day 5	By day 10	By day 15	By day 25
PCR Negative N(%)	1,098 (100%)	1,081 (98.5%)	1,026 (95.0%)	997 (97.2%)	997 (100%)
PCR Positive N(%)	N=0 (0%)	11 (1.5%)	55 (5.0%)	29 (2.8%)	0 (0%)
Serology Negative N(%)					730 (73.2%)

The confinement of residents for prolonged periods may result in stress, depression and anxiety. Inability of residents to venture out on their own and directly interact with their family and peers may affect their psychological well-being. Frequent monitoring of their psychological state, regular updates to the residents, and provision of entertainment are encouraged to ameliorate this.

Our strategy is based on 3 simple principles – risk stratification, regular and frequent testing, and immediate removal of infectious source. Interim accommodation for migrant workers may be applicable to institutionalised patients who are living in high density and often times overcrowded institutions in certain parts of the world. Residents who are at high risk for contracting the disease can easily be displaced from the source of infection, triaged according to their age and medical comorbidities, then isolated, quarantined and observed for a period of time prior to their return to society in order to ensure freedom from infection and curtail the spread inside dormitories and in the community. During this period, an onsite medical post can provide timely care for symptomatic patients, while serial PCR testing can be performed to screen for asymptomatic patients that could potentially be infected. Early removal of suspected or confirmed patients can circumvent the spread of disease, with an on-site medical post providing outpatient care, reserving the hospitals for severe cases that require more urgent medical attention.

We describe a real-world experience of closed settings with a high level of transmission and little opportunity to isolate contacts. Innovative approaches can be implemented to minimise the impact of uncontrolled transmission in the context of a pandemic. Each pillar of the response has its challenges including RCCE, logistics of food, sanitation, waste management, hygiene, entertainment, health service delivery, testing, contact tracing, quarantine and epidemiological data management and response. This strategy was associated with no severe disease in more than 1000 high-risk workers and can potentially be adapted to other closed and dormitory style settings such as refugee camps, homeless shelters and prisons.[2,7,8]

Singapore has instituted a multi-layered strategy of safe living measures within dormitories to prevent the risks of transmission, detect cases early through wastewater testing and regular routine testing, coupled with swift isolation and containment.[9] Density within dormitories have also fallen. Migrant workers also have access to medical support at regional medical centres, enabled by telemedicine consultations. These measures will ensure a safe living environment for migrant workers and make dormitories more resilient to public health risks, including future pandemics.

DISCLOSURES

Leonard Yeo and Amanda Chan have received substantial grant funding from the National Medical Research Council (NMRC), Singapore and substantial support from the Ministry of Health (MOH), Singapore.

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