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The New Tengah Air Base Medical Centre

Background

1. Tengah Air Base Medical Centre (TAB MC) was conceptualised as the next-generation Republic of Singapore Air Force (RSAF) Medical Centre, incorporating technology-enabled efficiency improvements as well as extensive medical centre process re-design to enhance patient experience and deliver high quality medical care to our airmen and women. Its infrastructure was designed to support a full spectrum of medical operations, including pandemic outbreak response or mass casualty scenarios. It was also designated as a medical innovation testbed for novel concepts and initiatives aimed at improving healthcare service delivery. TAB MC's official opening will lead the way with technology-enabled efficiency improvements and a keen focus on service quality and patient experience for future RSAF medical centres.

Pandemic-ready Infrastructural and Technological Features

2. Taking lessons learnt from previous experiences with the Severe Acute Respiratory Syndrome (SARS) and H1N1 influenza, the TAB MC incorporated pandemic-specific infrastructural and technological features. This forward thinking spring-loaded TAB MC's medical response following the COVID-19 outbreak. The pandemic-readiness features include:

a. Sheltered Driveway. The sheltered driveway facilitates conduct of drive-through swabs at TAB MC for personnel requiring testing whilst minimising their exposure to other personnel and the consequent transmission risk. This is useful for scenarios such as mass screening. Personnel would remain within the confines of their vehicle throughout the entire swab administration process, increasing convenience while ensuring that other medical centre visitors remain unexposed.

b. Sheltered Outdoor Foyer. The benefits of having a permanent structure include speed and ease at which reconfiguration and repurposing can be done without incurring significant manpower and logistics cost. Natural ventilation in a sheltered outdoor area is optimal for the triage, consultation and subsequent diversion of high-

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risk personnel requiring isolation. An outdoor swab booth for walk-in swabs was incorporated at the sheltered outdoor foyer to minimise contamination of other medical centre visitors and reduce Personal Protective Equipment (PPE) usage.

c. Swab Management System. To manage the volume of surveillance swabs conducted by TAB MC, a digital identity verification and labelling mobile application was developed by the RSAF's innovation office (SWiFT Office) in conjunction with Air Force Medical Service (AFMS) and Headquarters Air Power Generation Command (HQ APGC). The application has been deployed since October 2020 and will be on trial for the next six months. It aims to digitalise the swab administration process to increase efficiency[1] and reduce human error.

d. Effective Physical Personnel Segregation. The RSAF, together with the Defence Science and Technology Agency (DSTA) incorporated design thinking into the building's design to allow for personnel segregation workflows wherein personnel requiring isolation could be directed via a separate route straight to the isolation rooms located at Level 2, bypassing uncontaminated zones. Such a design also enabled cohorting of medical staff to ensure business continuity.

e. Smart Ventilation System. The RSAF and DSTA also designed a Smart Ventilation System that uses video content analytics to control airflow depending on the number of occupants at the patient waiting area. Different control settings for air pressure and air flow direction are also pre-programmed for operating scenarios such as a pandemic.

f. Isolation Rooms with Separate Ventilation Systems. Isolation rooms were designed with separate ventilation systems to prevent contamination of the airflow that is routed to the rest of the medical centre. The clear segregation of airflow and designation of isolation area allows for infectious medical conditions, such as COVID-19, to be contained and treated without compromising the integrity of the medical centre's operations, hence minimising the risk of exposure to all personnel in the medical centre and enabling the medical centre to continue serving other patients.

g. Large Configurable Indoor Waiting Area. The large indoor space allocated permitted flexibility in configuration to incorporate safe distancing measures and medical centre zoning into clean and contaminated areas, reducing risk of viral transmission amongst medical centre visitors.

h. Outward-facing Dispensary. This design was key to the safe dispensing of medications to patients with acute respiratory infection symptoms without risk to other patients as potentially infectious patients would otherwise contact other medical centre visitors if they were required to proceed indoors to collect medications.

[1] The conventional means of patient identity verification, registration and swab labelling via manual methods would require approximately 5 to 10 minutes. Following digitalisation, this process can be easily completed within 2 to 3 minutes.

Technological Enablers and Innovative Concepts to Deliver High Quality Healthcare Services

3. TAB MC strives to adapt to the evolving healthcare landscape, ensuring service quality and engendering positive patient experiences, through leveraging technology and incorporating it within daily processes in tandem with the nationwide digitalisation effort. Adopting a "digital first" concept for all medical functions has enabled the Air Force Medical Service (AFMS) to spearhead several initiatives aimed at improving overall healthcare service delivery and to reap efficiencies.

4. Tele-consultation[2] reduces the need for servicemen's physical attendance at medical centres, which leads to waiting- and commute-time savings, while tele-collaboration[3] enables remote and efficient conduct of Routine Medical Boards. Servicemen or medical personnel would otherwise have to physically commute from one location to another for their medical appointments or to review and discuss medical cases. TAB MC is trialling the use of the following technology for a convenient and safe remote healthcare journey:

a. Mobile Healthcare Application for Tele-consultation. Eligible patients[4] are provided with the option to access medical care via a secure mobile healthcare application co-developed by AFMS, HQ APGC and SWiFT Office. Tele-consultation reduces the need for a serviceman's physical presence at the medical centre, and in doing so reduces waiting time and resources required for a conventional in-person visit.

b. Remote Photo-plethysmography (RPPG) for Vital Signs Measurement. RPPG is a non-invasive means of measuring vital signs, i.e. heart rate, respiration rate and oxygen saturation, through a camera-enabled device. Patient parameters obtained could potentially improve overall remote consultation fidelity through the provision of additional data points that both facilitate the medical personnel's initial assessment of the patient's condition, and better inform the tele-consultation. TAB MC intends to embed this feature within the Mobile Healthcare Application for Tele-consultation following the trial period.

c. Smart Locker Medication Dispensing System. TAB MC is exploring the use of customised smart lockers as a secure and reliable means of collecting prescribed medications at the serviceman's convenience. This initiative, alongside tele-consultation and RPPG use, would enable a fully contactless healthcare experience.

d. Tele-conferencing for Tele-collaboration. TAB MC is leveraging secure tele-conferencing to conduct Routine Medical Boards in order to reduce commuting time of the medical staff involved and enhance the overall efficiency of case reviews.

5. Digital Queue Management System. Should a physical medical centre visit be required, the digital queue management system enables patients to book medical centre appointments remotely and receive updates on the waiting time to consultation before deciding on the most appropriate time to arrive at the medical centre. This reduces waiting time at the medical centre and serves as an effective crowd management tool.

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[2] Tele-consultation refers to interactions between remote healthcare professionals and patients/ caregivers for the purposes of direct clinical care, e.g. triage, history, examination, diagnosis and treatment.

[3] Tele-collaboration refers to interactions between (facility-based or mobile) on-site and remote healthcare professionals for clinical purposes, e.g. referral, co-diagnosis, supervision or case review.

[4] Servicemen undergoing Operationally Ready Date (ORD) Fitness for Instruction (FFI) medical reviews and the Health Screening Programme (HSP).

6. Mobile Application for Air Base Logistics and Medical Support. This is an integrated mobile application serving a variety of Air Base-related functions. A first-responder function has been embedded within the application with location pinning capability to facilitate ambulance dispatch in the event of an in-base medical emergency. The digitalisation of such a critical function negates the need to memorise telephone numbers and provide complex descriptions to direct medical staff during emergencies.

7. 1-visit Health Screening Programme (HSP). The 1-visit HSP has been implemented in all RSAF medical centres since May 20. This programme streamlines the conventional two-visit conduct of the HSP (the first visit for the conduct of medical investigations and second visit for the medical consultation) into a single visit involving both processes, resulting in time- and commute-savings for both Active and NSmen personnel. A second consultation will only be required if any of the investigations return abnormal. Following on from this optimised process, TAB MC will trial the incorporation of tele-consultation for suitable cases.

8. Evening Clinics. Acknowledging the busy schedules of our NSmen, TAB MC has trialled the conduct of evening clinics for NSmen to better cater to their daytime commitments. This increases overall convenience for our NSmen population and minimises barriers to healthcare accessibility.

Competent and Operationally-ready Medical Personnel to Strengthen Training Safety

9. Rigorous and Realistic Medical Training. All Singapore Armed Forces (SAF) Medical Officers and Medics undergo rigorous and realistic medical training, incorporating the use of high-fidelity manikins, to maintain medical response standards and upkeep competency levels. The SAF's medical staff are knowledgeable, well-equipped and always prepared to respond to medical emergencies.

10. Medical Tunics. To project a professional image as the face of RSAF's healthcare, customised medical tunics were designed, taking into account hygiene considerations, with functionality and overall image portrayal as focal points. These tunics have additional pockets for storage of medical accessories, are more comfortable when worn while performing medical procedures, and are laundered centrally within the medical centre at the end of each day.

11. Service Excellence Course for Medics. To provide high quality customer service to engender a positive patient experience, all RSAF Medics undergo a service-oriented course, which equips them with the relevant knowledge and skillsets to increase service consciousness and improve service quality.

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