



SARS @ TTSH (Part 8)

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Editorial note:

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I had written about Tan Tock Seng's (TTSH) role in the war against SARS in an earlier article published in June 2003. It chronicled events from late February 2003 till

6 April 2003. By Monday 7 April 2003, all the Singapore General Hospital (SGH) cases had been transferred over to TTSH, and with the patients came the Tiger Force of doctors and nurses led by the Senior Consultant Surgeon Mr C Y Wong of SGH. In this article I will trace events up till 31 May 2003 when Singapore was taken off the World Health Organisation's (WHO) list of countries with local transmission of SARS.

BACKDATED CHRONOLOGICAL EVENTS

- 1 – 3 March 2003 – Two Singaporeans warded at TTSH.
- 4 March 2003 – First HCW (healthcare worker), a nurse, was infected.
- 6 March 2003 – Ministry of Health (MOH) informed by TTSH that these two patients have developed atypical pneumonia after travelling to Hong Kong. MOH informed TTSH (and other hospitals) to isolate patients and to take the necessary infection control measures. Contact tracing started and it was found that the patients had stayed in the same hotel in Hong Kong.
- 12 March 2003 – MOH issued a press release informing of the case in Singapore and alerted doctors.
- 14 March 2003 – MOH informed of six more cases of atypical pneumonia and issued travel advisory.
- 15 March 2003 – MOH Task Force formed. MOH informed by TTSH doctor that one of our doctors from the Department of Infectious Diseases was suspected of SARS on board flight from New York-Singapore transiting at Frankfurt. He had seen and managed the cases warded at TTSH.

At TTSH, barrier nursing was instituted.
- 21 March 2003 – No new HCW infected.
- 22 March 2003 – TTSH designated as the central hospital for all suspect and probable SARS cases. Added infection control measures for staff instituted – mask, gloves and gown.
- 24 March 2003 – First discharge of suspect SARS case who had recovered and fulfilled the WHO criteria for discharge from hospital. Infectious Disease Act was invoked to apply home quarantine orders to be implemented, not only for the isolation of contacts exposed to SARS patients but also for SARS patients discharged from hospital.

'No visitor' rule in force for inpatients.

Outpatient clinics ceased running. (This was a Monday.)
- 25 March 2003 – First SARS death.
- 26 March 2003 – Sixth imported SARS case from flight CZ 355 warded at TTSH.

- 27 March 2003 – First discharge of probable SARS case who had recovered and fulfilled the WHO criteria for discharge from hospital.
- 31 March 2003 – Screening of all in-bound flights from affected areas began at Changi Airport. Nurses did a visual screen and those unwell or with fever were sent to Emergency Department TTSH for assessment.
- 3 April 2003 – All incoming cruise vessels from affected countries had their passengers checked by nurses and if unwell, they were seen at TTSH for assessment.

IN-HOSPITAL TRANSMISSION OF SARS

As we put in place various infection control measures leading finally to the m3g mantra, these were the dates when the in-hospital chain of transmission of SARS were broken.

- 23 March 2003 – This day was the last transmission of SARS from a patient to a doctor. That is, if the incubation period for SARS in this doctor was ten days, then he got infected on 13 March and became sick on 23 March. However, if the incubation period in this instance was three days, then he got infected on 20 March and took ill on 23 March.
- 24 March 2003 – Last case of patient to patient transmission.
- 1 April 2003 – Last case of a patient getting infected from a HCW.
- 5 April 2003 – Last case of patient infecting a nurse who then became a patient herself on this day.

So in the arduous task of contact tracing, it was established that these four links of transmission were finally broken: patient to doctor, patient to nurse (because the patient was not diagnosed to be suffering from SARS when early symptoms were present), patient to patient, and HCW to patient.

The important mindset change here was to re-designate wards with SARS patients as “hot” wards (and therefore full precautions by HCWs) and all other wards as unknown SARS wards rather than non-SARS wards.

GHOST TOWN

A week after TTSH was closed to the general public on 22 March, the hospital as well as Novena Square became quiet. The noise and bustle was gone. Few bodies moved about on Level 1. So the businesses gradually shut their doors.

Taxi drivers did not want to come to TTSH even if a nurse or a doctor instructed him to do so from Yishun, Ang Mo Kio or wherever he/she boarded. Buses along Moulmein Road did not want to stop at the designated bus stop.

Life began to light up again only in May. The ghosts had gone and people were coming. The Starbucks in TTSH was the last to reopen – on 19 June. (After all, during SARS, people drank Sarsi, not coffee.)

INPATIENT POLICY CHANGE

When we were declared SARS central, we emptied the wards of inpatients. We stopped all outpatient admissions

and the only source of inpatient admissions was through the Emergency Department (ED) of TTSH. However, few if any members of the public dared venture to our ED. Even private ambulances and taxis were directed away from TTSH by their occupants. So our inpatient pool gradually decreased in size.

On 8 April, TTSH housed 157 patients, with 37 probable, 74 suspect cases and 46 more under observation. There were 35 admissions the day before, four of them TTSH staff. In the ICU were 14 patients, 13 probable and one under observation. Sixteen were discharged, including five TTSH staff. Fifty-six patients from SGH had been transferred to TTSH. On 12 April, we had 172 cases with 58 probable, 81 suspect and 33 under observation. Cases were still coming to us from other hospitals – National University Hospital (NUH) and SGH. Why was this so?

It was the result of a change in an important policy. This policy stated that all inpatients of TTSH before 15 March had to be transferred back to TTSH for inpatient care should they be in any other hospital outside TTSH. The reasoning was like this. As had happened with the SGH cluster, one discharged inpatient of TTSH became ill again and got himself admitted to SGH for a surgical problem. He turned out to have been infected with SARS while in TTSH before 22 March, incubated the illness while at home and became warded in SGH where his fever manifested days later and the disease evolved to the clinical picture of SARS, despite his

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surgical condition. So the SGH cluster was born with patients, HCWs and visitors coming down with SARS.

WARD CLASSIFICATION

As it was preferable to nurse SARS patients in isolation rooms, we soon ran short of isolation beds. It was not fair to observe patients who were not diagnosed as SARS together in case one among them actually had SARS and spread it to the others. So all our single bedded wards got converted almost instantaneously into isolation wards.

The ward configuration therefore had to cope with the following groups of patients, based no more on paying status, but on the medical indications for need of isolation and intensity of care. We had nine categories of wards:

1. SARS paediatric patients.
2. SARS adult patients requiring isolation.
3. SARS patients with risk of absconding. (Remember the infectious Diseases Act had not been amended yet. This was done in Parliament on 24 April 2003.)
4. SARS probable patients.
5. SARS suspect and observation patients.
6. Ex-inpatients of TTSH who were hospitalised 21 days prior to current date including those transferred back to TTSH from the other hospitals, as explained earlier with policy change.
7. Existing SGH patients transferred over the weekend of 5 and 6 April.
8. Remaining non-SARS TTSH patients, renamed later as unknown SARS patients.
9. Quarantine wards.

In addition we had our four ICUs merged and running as one large ICU. The original four are Medical, Surgical, Coronary and Neurosurgical.

The paediatric cases were managed entirely by the team of doctors and nurses from KK Women's and Children's Hospital (KKWCH), and later NUH. The SGH cases were likewise managed by SGH staff. But all this care had to be coordinated as they were using our facilities and we met each other for regular meetings to ensure MOH guidelines were implemented.

ED ADMISSIONS

Our ED suddenly became empty by 24 March. Everybody was afraid to come to TTSH but it took almost two days for this message to reach everybody out there. At ED, no patient could be turned away so we saw them. On 14 March after the WHO alert, ED had begun physically segregating at risk patients (fever with travel history) from other patients while they were waiting to see the doctor. On 23 March, the first tents were erected under the ED porch – to segregate patients outside the main building (which is air conditioned) and conduct ED activities out there. By 26 March, our ED became the national screening centre for SARS and actively

turned away other patients. Before that, patients with fever were screened at the Communicable Disease Centre (CDC).

Thereafter, patients were "forced" to come to ED either from the airport, seaport, Causeway or from GPs and polyclinics who called for special transport to send patients here for screening. ED remained in this mode of operation and daily reports to our operations room were filed. For example, from the report of 5 April, 166 were seen the day before. One hundred and fifty-three were for SARS screening of which 46 were staff. Out of these 153, 26 were admitted of which 14 were nurses. And from the report of 13 May, the figures were 198 seen of which 177 were for SARS screening. Twenty-six were referred from the GPs, three from the airport and four from the Causeway. All were discharged. From Bowen Secondary school, 22 students were screened. All were discharged. Thirty were admitted, all for observation, including five HCWs.

For SARS admissions, the Standard Operating Procedure (SOP) was:

1. All SARS admissions will not be categorised at ED.
2. All SARS admissions were to be vetted by the ID (Infectious Diseases Team).
3. All SARS patients were admitted into individual isolation rooms.
4. The nurses would inform the Nursing Officers on duty regarding where the vacant beds in TTSH were so that the patient could be appropriately transferred (with all the precautions necessary) from ED directly to the ward.

For unknown SARS admissions, the SOP was to decide which of the following three groups the patient qualified as:

1. For the unknown SARS group, if the patient was on Home Quarantine, admission was to the unknown SARS ward's isolation room.
2. If the patient had fever or pneumonia, the admission was to the unknown SARS ward's isolation room.
3. If the patient did not belong to either of the above, then admission was to the general unknown SARS ward.

We salute our staff working at ED, frontline in every sense of the word. Nurses, doctors, administrative staff, porters and others did us proud.

STAFF COMMUNICATIONS

It is always of paramount importance that staff know what is going on and what is about to happen. MOH continued to issue many new directives and changes to existing directives so that it became easy for the staff to become confused. But this did not happen because of excellent staff communications. Every available channel was used: from e-mail, which was CEO communicating with all staff, on a daily basis, to messages, letters in the lifts, message boards in the wards, and of course formal face-to-face staff briefings by the CEO and relevant senior staff. For example, on 14 April, three sessions were held at 8 am, 2.45 pm and 4.30 pm at

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our Theatre. These sessions allowed staff to voice their concerns and provide feedback, for example, when the public shunned nurses and discriminated against TTSH staff. Plans for new facilities at TTSH and CDC were also announced so that our capabilities to care for non-SARS patients could be resumed.

MEDICAL LEAVE

As SARS affected many HCWs during the outbreak, it was important to stop HCWs becoming infected, and if infected, to stop them from passing SARS to fellow colleagues, patients, family and friends. HCWs are human and do fall ill. Many of our colleagues came down with SARS. Five HCWs died.

TTSH needed to monitor the medical leave of staff closely on two important counts. One was to detect SARS early in HCWs and get them warded. The other was to look for "clusters" of febrile patients among staff in their different work sites to alert us to possible local transmission of disease at that site. Our Human Resource Department only accepted medical leave issued or endorsed by the TTSH staff clinic or ED.

All staff had to take their temperatures thrice daily and record it for submission to the department head. And this included their temperatures when they were at home, for example, on Sunday, or off duty, or on annual leave. Should staff (especially foreign staff working at TTSH) stay with other HCWs from TTSH, or other restructured institutions, this fact was to be made known to department heads. If anyone in the flat falls ill, the department head would be notified, and contact tracing, isolation, monitoring and surveillance of the other flat occupants would be done if deemed necessary. Sick staff given MCs were to remain in isolation at home with temperature monitoring (MC was given because their temperature had not reached 38.C but was above 37.5.C). Should their fever rise above 38.C, they would be asked to come to ED again for consultation. For all other staff with temperatures above 37.5.C, they were to put on a surgical mask, rest for two hours, recheck their temperatures, and if still raised, to report sick to ED TTSH. If the staff were at home, they came to ED via ambulance by ringing the hotline numbers 91788477/8. They were not to use public or their own private transport (driven by another family member).

DISCHARGES

For some time after TTSH was declared SARS central and we had discharged as many patients as possible in order to have beds for SARS patients, we began "collecting" patients with SARS, and those who were probable, suspect and under observation. In addition, we had a remnant who had been with us before 22 March and whose conditions (medical and/or social) did not permit us to discharge them. They were first classified as non-SARS but later after the painful lesson of the SGH and NUH clusters, we reclassified them

as unknown SARS. Left with these patients types, we were told by MOH that we had to observe the "in, no out" rule. This meant patients could be admitted into TTSH but could not be discharged – a type of "constipating" rule. Before long we would run out of isolation beds and other types of beds. So we needed some pragmatic discharge rules which would not allow community spread of SARS either to the general public, or the aged homes or to other healthcare facilities.

As at 10 April, the discharge policy was as follows. The patient had to be afebrile for the past 72 hours, the chest X-ray had to be stable or improving from a non-SARS condition, and the total white cell count had to be normal. The patient was informed that he/she could be contacted on a daily basis by our Home Surveillance team for the coming three weeks following hospital discharge, for the purpose of checking on his/her temperature and state of health.

The above discharge criteria were not applicable for non-SARS patients who had been in a cubicle in which a suspect/probable SARS patient was subsequently diagnosed. The non-SARS patient was then deemed to be a contact of SARS and had to remain at TTSH for another ten days from the last day of contact.

On 19 April, a new set of guidelines was issued. CEO and I as Chairman Medical Board, were issued letters from MOH signed by the DMS, delegating to us further powers under Section 15 of the Infectious Diseases Act to issue Home Quarantine Orders (HQOs) for ten days to TTSH patients with concurrent chronic conditions upon their discharge, because they were suspected to be contacts of SARS. This daily name list was forwarded to MOH so that they could liaise with CISCO to ensure that those served with HQOs complied. Patients under HQO were not allowed to go to polyclinics when under quarantine for any dressings or minor procedures.

For patients in the "hot" wards of TTSH (where SARS had been diagnosed previously), the above discharge criteria were applied to them plus ten days HQO upon discharge. After the ten days were served, the patients were reviewed at TTSH with checks for fever, and abnormalities on CXR to exclude SARS, and if SARS was not probable, then the patients were continued on a further ten days of home surveillance. (This was the policy in operation as at 5 May 2003.) ("Hot" wards were defined as those which had produced probable SARS patients or had clear exposure to SARS patients or had clusters of suspect SARS staff or patients.)

As for deaths in TTSH, those with SARS had clear policies regarding autopsy, embalming, wake and funeral arrangements. What about those who died but were unknown SARS patients? MOH has no legal powers to instruct the family members of deceased patients who had not been diagnosed with SARS, on funeral arrangements. So the best advice we could give the

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relatives was that the body should not be embalmed, should be double bagged, and the coffin sealed. Burial should occur within three days of death. Compliance was voluntary.

RENAL PATIENTS

Patients with chronic renal failure and those on cancer chemotherapy are immuno-suppressed and hence constitute two very important vulnerable populations to infection like SARS. Also it is likely that SARS infection in these patients would have atypical presentations. Suddenly, our fledgling renal unit was thrown the important challenge of managing our patients in need of chronic dialysis because no other hospital or facility wanted them. (The previous rules mandated that they return to TTSH for their total care including dialysis.)

All persons who entered the chronic haemodialysis centre (later moved from ward 6C to the Artificial Limb Centre) had to be screened for SARS contact history and checked for fever. Those febrile above 37.5.C were not allowed into the centre but were reviewed by staff fully protected with PPE. The centre should have separate entry and exit points and patients on different shifts should not mix nor interact. Waiting areas had to be separate. No casual visitors were allowed. Only one person (after temperature check and screening) was allowed to help the patient and their personal particulars were recorded in case contact tracing was subsequently required. All patients undergoing dialysis had to wear surgical masks, and be assigned specific staff and specific chairs and machines. Patients undergoing dialysis had their temperatures checked pre and post dialysis. And if febrile, they were sent to ED for management. The machines, chairs and equipment had to be thoroughly disinfected before the next shift of patients was admitted. All HCWs had to be screened and fully protected. The PPE had to be changed for each new patient dialysed. For patients exposed to SARS, MOH needed to be notified. A Field Response Team would be sent down to the centre. All HCWs and patients present had to give personal particulars that could facilitate contact tracing. If a patient or HCW of the centre was diagnosed as SARS, the centre would stop functioning till MOH gave the clearance. Dialysis patients who were contacts of SARS cases outside of dialysis centres, and those discharged from SGH, TTSH and NUH, were placed on HQO for ten days. During these ten days, they had to come to TTSH as outpatients for their regular dialysis, transported to and from their homes by dedicated ambulances. These patients were monitored by us for 21 days from the last known date of potential exposure to SARS with a review on the fourteenth day. If we assessed them to be well, they could return to their respective original dialysis centres at SGH or NUH, but we at TTSH would continue to monitor them for the remaining seven days.

HCWs exposed to SARS at the dialysis centre were served mandatory HQO for ten days from the date of last contact. However should the HCW be a critical staff, MOH may be appealed to, to allow the HCW to continue to work but with extra close monitoring for ten days. The moment this HCW became febrile or unwell, he/she ceased to work and was managed by ED.

Finally, patients on peritoneal dialysis and HQO were required to monitor their temperatures thrice daily (at 8 am, 2 pm, 8 pm) at home. The dialysis centre would call them twice daily to monitor their condition. If they became unwell or febrile, they were to isolate themselves at home, wear a surgical mask and notify the centre and come by dedicated ambulance to ED TTSH. For similar peritoneal dialysis patients with no history of contact with SARS patients and not on HQO, they should go to the ED of their primary hospital, and not TTSH, should they fall ill.

ISOLATION ROOMS

The new TTSH was built with two isolation/high dependency rooms per ward. These are extra to specific wards like the ICU wards where next to the ICU beds are high dependency beds, rather than isolation beds. CDC also has isolation beds but these proved insufficient. So the plan was to put in cabins at CDC and these were ready for use in the first week of May 2003. Eighty isolation rooms were created in less than three weeks, of which 40 had medical gases as well. The other plan was to take the existing six-storey block under Ren Ci (old TTSH block) which had already been renovated as a community hospital type facility and convert all wards to isolation facilities. This was done and became operational on 17 August. On level one was an intensive care unit, as well as a surgical operating theatre. This facility was renamed CDC 2. So now outside of main TTSH building are 80 isolation rooms at CDC 1 and another 64 at CDC 2. The cost for these is about \$30 million. (*Straits Times*, 24 July 2003, pg. H2, col. 5-6.)

As events turned out, by early May the epidemic in Singapore had already petered out. The last SARS patient was diagnosed on 11 May. The MOH press statement on 7 May stated that the latest date of onset of a probable SARS case was 27 April 2003. The number of patients who had recovered from SARS was 150. Twenty-six patients remained in hospital with nine in intensive care. Three hundred and eighty-five discharged patients were under home quarantine, and the total number under home quarantine was 1,015. The total number of probable cases was 204, and 27 patients had died.

PASIR PANJANG WHOLESALE MARKET

On 19 April, a cluster of febrile family members whose household head worked at the market was admitted to TTSH. MOH made the decision to close the market for ten days. All stall holders and employees at the market

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were placed on ten days of HQO. The same day, the Ministerial SARS combat team was set up and announced. SARS screening at our ED rose to 207 on 21 April, compared to 114 the previous day. Forty-four workers from the market came for screening and seven were admitted as suspects. The following day, ED saw 183 patients for SARS screening. Twenty-nine were related to the market, and one was admitted as a suspect SARS. And following our Prime Minister's open appeal to residents to be socially responsible, ED SARS screening cases rose to 290 on 24 April.

INSTITUTE OF MENTAL HEALTH OUTBREAK

The MOH press release of 13 May began with "there are no new probable cases of SARS today." Then it mentioned that a cluster of 24 patients and six nurses at the Institute of Mental Health (IMH) had developed fever which was detected over the two-day period from 11 to 12 May. Of these, 23 patients were from wards 60 and 64, and one was from ward 65. All were referred to TTSH ED for assessment, after which all, save three nurses (who were given medical leave), were warded at TTSH for observation. Two IMH doctors from these wards were also warded. Further, all patients who had been discharged from IMH from 23 April till 2 May were called up for review at TTSH. Also, those discharged from 3 May onwards, were put on HQO for ten days starting 10 May. Home and close contacts of febrile staff and patients were also on HQO. Both the CEO and CMB of IMH became our inpatients.

The final number from IMH admitted to TTSH over the next few days were 20 staff and 33 patients. All were for observation, none with probable or suspect SARS. Tests for coronavirus on several IMH patients with chest X-ray changes were negative. Several staff were found to be positive for influenza B virus. The clinical picture of the IMH cohort was not typical of SARS. Many had running noses and for almost all, the fever had subsided by 16 May. A few had TB and dengue fever.

HOPES DASHED

On 17 May, we were hopeful that on 18 May, WHO would declare Singapore SARS-free. It had been already 65 days since TTSH went into the emergency mode of operation. The press release from MOH stated that "MOH has now established that the cluster of IMH patients and staff who came down with fever from 11 to 12 May is not due to SARS. A total of 34 inpatients and 20 staff from IMH were admitted to TTSH for observation for fever. All the patients were in stable condition. Since yesterday, 25 have been discharged. So far, PCR testing for coronavirus has been negative in samples taken from 40 patients. Of nine patients who were tested, six were positive for influenza B virus."

Then on 18 May came the big disappointment. MOH released the following statement. "A patient who has been admitted to TTSH since 11 May 2003 has been diagnosed to have probable SARS today." This patient became unwell on 5 May, was admitted to TTSH on 11 May with X-ray changes of early pneumonia. He had travelled to Malaysia on 18 April, 1 and 5 May. PCR testings for coronavirus on 11 and 12 May were negative. He deteriorated and entered MICU on 13 May and was intubated on 15 May. Repeat samples sent for PCR tested positive on 17 May. The same sample was retested on 18 May and was positive again. Using a different PCR test kit, two additional samples taken on 18 May were also positive. And blood serology on 18 May was also positive for antibodies to SARS.

As his history of contact with SARS was negative, MOH made a public appeal for contacts of his and released his name and work place address. In the end, even after 31 May, we were not able to trace where he got the infection.

CONCLUSION

The situation continued to improve. Home surveillance monitoring for patients discharged from all restructured hospitals and those seen at ED except TTSH was lifted. We remained the lone facility prepared for battle with SARS. Staff from other hospitals like Alexandra Hospital, SGH, and KKWCH (and NUH for paediatrics and obstetrics) returned to their bases. On 31 May 2003, Singapore rejoiced. It was off the WHO list of countries with local transmission. We were SARS-free. ■