

The Report of the Outbreak of SARS in Alice Ho Miu Ling Nethersole Hospital (AHNH)

Introduction

In March and April 2003, AHNH was hard hit by SARS. A number of SARS patients passed through the hospital leading to outbreak of the infection in a total of 5 wards. The outbreak had caused great concern in the local community as there was the threat of potential community spread of the disease. This is a management review report on the factual events and the management response to the outbreak.

The Outbreak

Background

2. The Prince of Wales Hospital (PWH) suffered from the SARS outbreak on March 10, 2003. On March 19, PWH Accident and Emergency (A&E) service was suspended. All A&E cases were diverted to North District Hospital (NDH) and AHNH. Occupancy in the medical wards of AHNH increased to over 120%. The increase in workload led to overcrowding in all the wards in AHNH. At the time when PWH A&E was closed, all patients with fever and suspected to have SARS in the NTE Cluster would be admitted to either PWH or Princess Margaret Hospital (PMH). Some of the patients who were initially diagnosed to have other medical problems turned out to have SARS. Their prolonged stay in the hospital had exposed staff and nearby patients to the infection, leading to the outbreak in different wards. The outbreak mainly concentrated in Wards E1, E3, E6, F6 and F5.

The Chronology

Outbreak in Ward E1 (male medical)

3. On March 24, patient A of E1 male medical ward was transferred to PMH for confirmed SARS. The patient was initially admitted for fever. He was subsequently identified to be the index case of the outbreak in Ward E1. During his stay in hospital, the patient refused to wear masks in the ward. No source of contact could be found and the infection was most likely coming from the community.

4. On March 25, the first Health Care Worker (HCW) who was the nursing staff in Ward E1 developed fever. He was confirmed to have SARS on March 28 and was transferred to PMH. The hospital started tracing the contact history, which subsequently showed that the source of infection was from direct caring of the index patient A in E1. Advice on infection control was sought to improve the protective gear and the practice from Infection Control Consultant and Nurse.

5. On March 31, 3 more nurses got fever on the same day and admitted to PMH together and all 3 nurses had direct contact with index patient A of Ward E1. One ISS worker, who was a contract-cleaning staff, developed fever and was later admitted to PMH on April 2. The ward was closed and no admission or discharge was allowed. A Medical Ad Hoc Committee on SARS was formed by the Department of Medicine and control measures were reinforced with frequent regular cleansing of the ward. Overcrowdiness of the ward was noted and measures were taken to lower the occupancy in order to lower the cross infection risk.

6. A list of staff working in E1 was immediately drawn up and they were instructed to look out for symptoms and to seek medical advice from Staff clinic as needed. A list of all discharged patients and registered visitors between March 21 and March 31 was compiled for the Department of Health for contact tracing. On April 3, 14 remaining patients in E1 were transferred to Tai Po Hospital (TPH) for convalescence and continued quarantine; E1 was vacated for terminal cleansing.

7. A total of 5 health care workers, 3 ISS (domestic service contractor) workers, 1 cohort patient and 8 ex-patients were infected in this E1 outbreak.

Outbreak in Ward E3 (male surgical)

8. On March 30, a Health Care Assistant (HCA) developed fever and was seen by an A&E medical officer (MO) in AHNH. She was admitted to PWH on April 4 and later on confirmed to have SARS. The MO later developed fever too on April 3. On March 31, a houseman who worked in various wards including Ward E3 developed fever and admitted to PMH with suspected SARS. On April 1, a Nurse in Ward E3 developed fever and was admitted to PMH on April 4.

9. An outbreak in Ward E3 was noted and an index patient was being looked for. All patients in Ward E3 were screened for "hidden" SARS with CXR and lymphocyte count. It was found that there was a patient admitted on March 25 to Ward E3 with rectal bleeding. He had no fever initially. He was discharged on March 29 and was re-admitted with fever again on April 1. Later

on, it was confirmed that this patient, index patient B, had low lymphocyte count and CXR haziness with suspected SARS. He was transferred to PWH SARS ward. Ward E3 was closed on April 4. The patients were quarantined for 7 days; patients wanted to quarantine themselves at home were given precautionary measures and advice to follow up at the Department of Health designated medical clinics. The name list of all discharged patients and visitors from March 23 to April 4 was given to DH for immediate action. The Ventilation system of the ward was also checked.

10. The Ward E3 outbreak was caused by a surgical patient with a typical presentation. It resulted in infection in 4 health care workers and 9 ex-patients.

Outbreak in Ward E6 (male medical)

11. On March 27, index patient C was transferred from Ward E3 to E6 for treatment of bronchopneumonia. He was initially admitted to Ward E3 with abdominal pain and diarrhea and there was no fever on admission. Sputum grew streptococcus with a diagnosis of streptococcal pneumonia. On March 29, a nurse who had taken care of the patient C in Ward E6 developed fever. She was later admitted to PWH on April 4 with suspected SARS. On March 29, patient C died and his family stayed around the patient at the dying moment. Many of his family members contracted SARS later. A second nurse in Ward E6 who had taken care of the same index patient C developed fever and was suspected to have SARS on April 4.

12. Ward E6 was closed on April 4 for quarantine after the second HCW was affected. With this atypical patient who presented with abdominal pain and diarrhea and later on with 'bacterial' pneumonia, a total of 1 doctor, 12 nurses, 1 ward steward, 2 HCA, 13 in-patients and 11 ex-patients were consequentially infected as the result of the E6 outbreak. Most of them were infected in an unaware situation. Before death, the index patient C was placed in a bed close to the window in the last cubicle of E6. Most of the nurses that were infected with SARS in the early phase worked in that cubicle during his hospitalization.

13. Eleven ex-E6 patients who were discharged before ward closure developed SARS subsequently. It was also noticed that most of the patients who developed SARS in Ward E6 after the index patient C died were in the same or opposite cubicle. Overcrowdiness of the ward (average occupancy rate of about 110%) during this period was one of the factors.

Outbreak in Ward F6

14. On April 10 and 11, two HCAs from Ward F6 were admitted to PWH

for suspected SARS. The ward was closed and the patients were cohorted. In the following 3 days, 4 more HCWs were infected. The ward was noted to have 4 isolated suspected SARS patients transferred out to PMH between March 25 and April 9. There was no obvious linked or clustered history of these 4 cases with prior hospital cases. Their duration of stay in Ward F6 ranged from the same day of admission to 2-3 days. The first one was admitted on March 23 and stayed in Ward F6 for 3 days. The second one was admitted on March 29 and was transferred out on March 30. The last two cases were admitted on April 4 and 9 respectively and they were transferred out the same day. There was no overlap in their period of stay in the ward. They were all considered to be the possible index case leading to infection of the HCWs working in then overcrowded ward. All in all, the outbreak in Ward F6 led to infection of 6 HCWs, 3 in-patients and 7 ex-patients.

Outbreak in Ward F5

15. On April 15, one of the nurses in the ward was suspected to have SARS. The ward was immediately closed. Investigation showed that there were 4 possible cases leading to the infection. Two of these patients were transferred out within 1-2 days of admission. The other two patients had been staying in the hospital for a relatively prolonged period with one presented with hemoptysis and the other stroke. The outbreak in Ward F5 affected 1 HCW, 2 in-patients, 9 ex-patients and 2 social contacts.

16. The detailed sequence of events of the outbreak in AHNH is shown in Appendix I.

Epidemiology and Statistics

17. The epidemic curves of the AHNH outbreak is shown in Appendix II. From the epidemic curve, the peak of outbreak was during the period from April 4 to April 18. Including all the possible index cases, the outbreak affected a total of 41 HCWs and 90 patients.

Organization

Hospital Management

18. AHNH followed the HA SARS network organization. Department Heads Meeting (DHM) was convened up to three times a week for rapid decision and communication, since the first one on 17.3.03. From 25.4.03, Hospital Management Committee (HMC) Meeting (comprising HCE, GMs and COSs) was held in place of the DHM. The latter was spaced out to once a week.

19. The SARS Data Controller and the SARS Infection Control Officer (ICO) were appointed on 3.4.03, to work closely as a team with counterparts at the cluster level. They worked with the two Infection Control Nurses and staff deployed to assist in data collection and contact tracing. A Contact Tracing Group was also formed, comprising the Departmental Managers in Medical Social Work and Occupational Therapy as well as a Chaplain as core members. Their work was to support the contact tracing work of the Department of Health.

20. The SARS ICO led a team to supervise and monitor the implementation of infection control measures. The team also conducted training, policing and auditing works. They met virtually on daily basis to review the progress and revise action plan.

Medical Management

21. The medical management was under the supervision of the Chief of Service of Medicine. Prof Joseph Sung, as Cluster Coordinator for Medicine, was providing overall leadership in service planning, coordination and staff deployment. The protocol for management of the SARS patients was essentially the same as what was adopted in the PWH. Prof Sung also provided clinical direction as well as conducting ward round on SARS/infection triage cases in AHNH.

Admission of the Medical Patients

Mid to late March 2003 (triage to PMH)

22. The outbreak of SARS started in PWH on March 11. The A&E department of PWH was closed on March 19. AHNH received all emergency cases from Shatin and Tai Po regions. Since then, AHNH medical ward occupancy was around 120%. The A&E attendance was up to a record high of 626 per day. Many patients originated from Shatin area were seen with some of them having fever or pneumonia.

Late March 2003 (isolation of suspected cases in AHNH)

23. All cases of pneumonia were cohorted in E1 so that they were looked after by respiratory team in late March. All pneumonia cases without enough criteria for SARS were treated with conventional antibiotics. Such pneumonia cases were put in isolation rooms. However, in AHNH, there were a total of only 14 isolation rooms in the Medical Department. More cases needed isolation rooms than the number available.

Early April (Triage ward in AHNH)

24. A&E Department would admit cases of either fever or pneumonia or with contact history to the Triage ward in E1 since April 7. The Medical Department tried its best to avoid contact of the medical cases with suspected SARS. If a patient was confirmed with SARS, they were sent to PWH/PMH until April 14 when a SARS ward was opened in AHNH.

Mid April (Open SARS Ward)

25. The first SARS ward (F1) was opened on April 14; the second one (E1) was opened on April 28.

Disease Control

26. On March 17, the first Ad Hoc Department Heads Meeting was held to discuss about the SARS outbreak with the advice from Infection Control Nurse as well as microbiologist. ICN worked with Unit Officers to tighten up the infection control. Dr. So HY was appointed as Chairman of Hospital Infection Control Task Force.

27. On April 4, the SARS Outbreak Task Force was formed with Dr. Alex Yu as the Data Control Manager. The Task Force was also responsible for investigating the outbreak in the wards. Relevant epidemiological data were collected. Decisions were made on cohorting, contact tracing and staff screening. The SARS Data Controller would provide all SARS related information in AHNH to the Cluster SARS Disease Control Center, HAHO as well as the Department of Health for disease control.

28. When there was an outbreak occurring in the ward, the ward would be closed. All patients were required to be quarantined for 7 days. Those who refused quarantine were regarded as Discharge Against Medical Advice. They would be advised on the precautionary instructions and were instructed to attend the Department of Health's designated medical clinics. The name list was also given to Department of Health for follow up action.

29. In addition to the quarantine of existing patients, a list of patients that were discharged from the outbreak ward 10 days before closure was retrieved. A visitor list was also generated. The name lists were faxed to Department of Health for follow-up action. The Hospital Contact Tracing Team would also call these discharged patients and visitors to inform them of the precautions required and to instruct them to see a doctor or attend A&E in case fever

developed.

Communication

Communication with HAHO

30. CCE/ Deputising CCE relayed messages from HAHO at the Cluster SARS Meeting and had regular meetings in AHNH to address the issues related to SARS. The 'Fight SARS Daily News' and HA intranet helped to provide the front-line staff with the updated information. Ad Hoc meetings were held with HAHO, DH and SHWF related to the outbreak and disease control. Other communications to HAHO were channeled via respective cluster coordinators, notably on supplies and procurement, and public relations.

Internal Communication

31. The Hospital was fully aware of the paramount importance of Internal communication to staff, especially frontline staff, in time of crisis to clarify misunderstanding, to ease anxiety and to provide support. In April, five issues of SARS bulletin were published to keep staff informed of the most updated information about combating SARS in the hospital. After the outbreak in PWH, staff forum was held biweekly in March. In April, following the outbreak in AHNH, it was held on a weekly basis. Prompt actions were taken to address staff needs. The average attendance was 150 with the participation of all grades of staff.

32. Seven ad hoc department heads meetings were held in March, and fourteen in April for operational planning and communication enhancement with all department heads. Eight ad hoc nursing meetings were held to discuss the issues brought up in the department heads meetings and the implementation of management and infection control policies. Two focus groups were held for Nursing, Supporting and Allied health staff respectively to get suggestions for improvement.

33. A 24-hours hotline for enquiry about issues related to SARS including staff support and PPE was arranged since April 5. Some concerns on provision of quarters and supply of PPE were received with explanation and advice provided. A few feedbacks were also received from opinion box on shower facilities, duty hours and use of N95 with appropriate follow up actions taken.

Infection Control

34. An Infection Control Officer (ICO) network was set up for each unit/ward with clear role and responsibility. The SARS Infection Control Team led, monitored and audited all infection control related matters. They met daily and issued Infection Control Highlight several times a week to remind and update all staff on infection control policy, PPE, prevention practices etc. The NTEC Infection Control Guidelines and PPE standards on SARS were closely followed with other specific guidelines drawn up locally as appropriate. Infection Control Highlights were issued after each daily audit visit, as from April 23, to remind staff of infection control slips and tips. There was a regular communication of Infection Control guidelines, standards and highlights to various sectors of all staff of the hospital through Department Head meetings, e-mail and intranet, etc.

35. The hospital started the infection control training for all staff working in SARS related areas as priority, and then to all other staff in the hospital. Screening of all staff exposed to suspected/confirmed SARS patients was carried out which helped to allay anxiety among staff, especially the ISS (domestic service contractor) staff. Staff was asked to check body temperature before work with a thermometer provided by the hospital. They were advised to abstain from work if feverish or not feeling well. The quota in staff clinic was increased. Overnight accommodation was provided for staff with single rooms when the outbreaks started. Working clothes were made for non-uniformed staff. The seating arrangement in Staff Canteen was rearranged and advices on the potential cross infections during social contacts were given. Mass functions and group activities of staff were suspended. The hospital also improved the number and quality of the rest rooms, changing rooms, dining and shower facilities for staff working in SARS wards.

Manpower Deployment

Nursing staff

36. The Cluster Nurse Coordinators, the NTEC Service Director in Nursing and the Nursing Section of HAHO gave their support to AHNH with nursing manpower deployment. From March 31 to April 22, there were in total 19 nurses, 10 HCAs, and 1 ward clerk contracted SARS and were on long sick leave. Ten nurses and 1 HCA were deployed to A&E before the service was closed on April 24. For Medicine, a total of 62 nurses were deployed to help in the medical wards.

Supporting staff

37. Fifty supporting staff were allocated for SARS, Cohort, Infection Triage, and Step-down wards with 36 logged in SARS wards.

Contingency Measures

38. When A&E (PWH) started diverting triaged medical patients to AHNH and NDH, all departments in AHNH had been alerted and prepared for contingency. The closure of A&E (PWH) for the period from March 19 to April 6 led to all ambulance diversion to AHNH and transfer of trauma patients to NDH. The workload of A&E (AHNH) reached the record high at 626 on March 27. Statistics were updated to alert all departments regarding the workload. Decanting exercises were undertaken in April to better cohort patients, to prepare for intake of SARS patients and to reduce congestion. A local "Contingency Plan" in response to the outbreak of suspected SARS was drafted by COS (A&E) which included the definition of hot, warm and cold zones in the hospital, the rules for staff in these zones, the personal protective gears, the practices and the ways to improve the environment.

39. A coordinator for PPE Supplies was appointed to vet and consolidate the requirements of each ward/department. Stock levels in ward/hospital were closely monitored. Hospital worked with the cluster to ensure sufficient provision. Alternatives were also explored to ensure sufficient supply, such as from donations, or homemade device like the face shield. Assessment on the need of additional supporting services was made since March 15. The provision was upgraded to match with increasing demand, as in cleansing, messengerial, laundry, linen supplies and security.

40. A number of improvement works were completed to improve the environment like ventilation and for better infection control. These included installation of exhaust fans in every cubicle of the ward, installation of partition between cubicle and corridor, increased air change and fresh air intake, cordon off high-risk /ultra high-risk areas with red lines on floor for extra alertness, designated don and doff areas and the increased use portable HEPA filter.

41. Works were also done to provide additional facilities to staff/departments for changing, cleansing and showering. Sixty temporary single room quarters on J4 had been made available for staff working in SARS wards and ICU who wanted to stay away from home. Forty additional temporary quarters provided by vacating all storage area at J8, E7 and F7. Temporary quarters were also made available at Wu Kai Sha, Diamond Hill and Tin Shui Wai by the Housing Authority. Shuttle bus was arranged.

42. With the large number of patients and staff affected, the A&E service of AHNH was suspended on April 24. Surgery, Pediatrics, Eye, O&G services were moved to NDH or PWH.

Staff Support

43. Positive attitude and high morale among staff was crucial to overcome the crisis. In order to boost the staff morale, the hospital management targeted on several areas: a) protect our staff; b) improve quality of work life; c) enhance communication; d) keep updated on condition of sick colleagues on daily basis; e) demystify the many questions surrounding the outbreak in AHNH; f) environmental modification; g) show them support from the senior management and the Cluster.

44. In addition to what was afore-mentioned, there were several distinct examples of the support for our staff: experienced frontline managers and clinicians from PWH to lead the AHNH SARS team, for the start up, operation and consultation; one extra day-off every two weeks of work in SARS ward, according to cluster policy; Positive Coping Skills Workshop prior to opening of SARS ward; psycho-spiritual support by chaplains including gifts, books and cards, small support groups; and regular and frequent open staff forum by HCE and CCE.

Possible Causes of Outbreak with Operational Implications

45. Since 23.4.03, no staff was infected by SARS and none of the involved staff had infected their family members. The followings were possible causes of the outbreak in AHNH: (a) overwhelming workload at both A&E and medical wards, when the PWH A&E was closed; (b) overcrowded ward area when occupancy reached 120% with 9 beds put in a 6 bed cubicle; (c) inadequate vigilance to cryptic presentation of SARS, especially among elderly patients; (d) lack of experience or familiarity with infection control measures among staff; (e) environmental factors, especially the existing ventilation for general ward is not designed for infectious cases; (f) insufficient time for preparation before handling the upsurge of workload especially in terms of infection control; (g) high touch hospital culture, between patient and staff, and among staff; (h) inadequate quarantine of exposed patients, in too crowded ward, for too short duration; (i) high background SARS in the community; and (j) insufficient isolation facility with no admission/ infection triage ward in the early phase of the outbreak.

Sequence of Events

Date	Event
<i>Pre-outbreak</i>	
March 10	<ul style="list-style-type: none"> SARS outbreak in PWH
March 12	<ul style="list-style-type: none"> Direct admission from A&E(PWH) to clinical department of AHNH
March 14	<ul style="list-style-type: none"> NTEC Infection Control guideline first promulgated
March 16	<ul style="list-style-type: none"> All pregnant woman (>37 weeks) and Gynaecology emergency service in PWH transferred to AHNH
March 19	<ul style="list-style-type: none"> PWH AED service suspended. All AED cases were diverted to NDH and AHNH. Promulgation of Infection Control Guidelines Use of mask and gown in ICU and SARS wards
<i>The outbreak</i>	
March 24	<ul style="list-style-type: none"> Index patient A from Ward E1 confirmed to have SARS and transferred to PMH Classification of clinical areas into hot, warm and cold zones
March 25	<ul style="list-style-type: none"> First nursing staff of Ward E1 developed fever. Second index patient from Ward F6 confirmed to have SARS and transferred to PMH
March 27	<ul style="list-style-type: none"> HAHO announced no visitor allowed to SARS wards
March 28	<ul style="list-style-type: none"> Nurse of E1 transferred to PMH with suspected SARS
March 29	<ul style="list-style-type: none"> Ward E6 suspected index patient (patient C) died
March 30	<ul style="list-style-type: none"> A&E(PWH) re-opened services to walk in cases, ambulance diversion continued. One HCA from Ward E3 developed fever
March 31	<ul style="list-style-type: none"> 3 more E1 nurses taking care of the index patient A developed fever and admitted to PMH, later confirmed to have SARS Closing of E1 ward; patients quarantined and no admission was allowed One house officer worked in Ward E3 developed fever
April 1	<ul style="list-style-type: none"> Contingency Plan in response to outbreak among staff issued
April 3	<ul style="list-style-type: none"> All acute wards closed to visitors Appointment of Hospital Infection Control Officer Ward E3 index case (patient B) noted 14 patients from E1 transferred to TPH for convalescence and continued quarantine; E1 vacated for terminal cleansing
April 4	<ul style="list-style-type: none"> No admission and discharge allowed from E3 and E6 One Ward E6 nurse admitted PMH for suspected SARS
April 5	<ul style="list-style-type: none"> DH announced E1, E3 & E6 Wards of AHNH SARS affected, asking contacts to report; list of discharged patients and visitors

	from 23.3.03 to 4.4.03 passed to DH for action
	<ul style="list-style-type: none"> • Patient in the affected wards to be quarantined for 7 days
April 6	<ul style="list-style-type: none"> • A&E (PWH) reopened emergency admission
April 7	<ul style="list-style-type: none"> • E1 re-opened as SARS infection triage ward • Enhanced policing of infection control practices
April 10	<ul style="list-style-type: none"> • One HCA from Ward F6 admitted to PWH for suspected SARS
April 12	<ul style="list-style-type: none"> • E6 re-opened
April 14	<ul style="list-style-type: none"> • F1 opened as SARS Ward
April 15	<ul style="list-style-type: none"> • Formation of SARS Audit Task Force • One nurse from Ward F5 suspected to have SARS
April 17	<ul style="list-style-type: none"> • E3 re-opened • F6 re-designated as SARS step down ward.
April 18-21	<ul style="list-style-type: none"> • Infection control inspection of the medical wards
April 23	<ul style="list-style-type: none"> • Last healthcare worker admitted for SARS
April 24	<ul style="list-style-type: none"> • AHNH A&E closed since 00:00 hour. • Daily auditing by SARS Audit Task Force started

Appendix II

The following graph shows the total number of cases (patients and health care workers) contracted SARS in AHNH

Overview of SARS cases in AHNH

