



Infectious Disease Surveillance in a Pandemic

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Surveillance

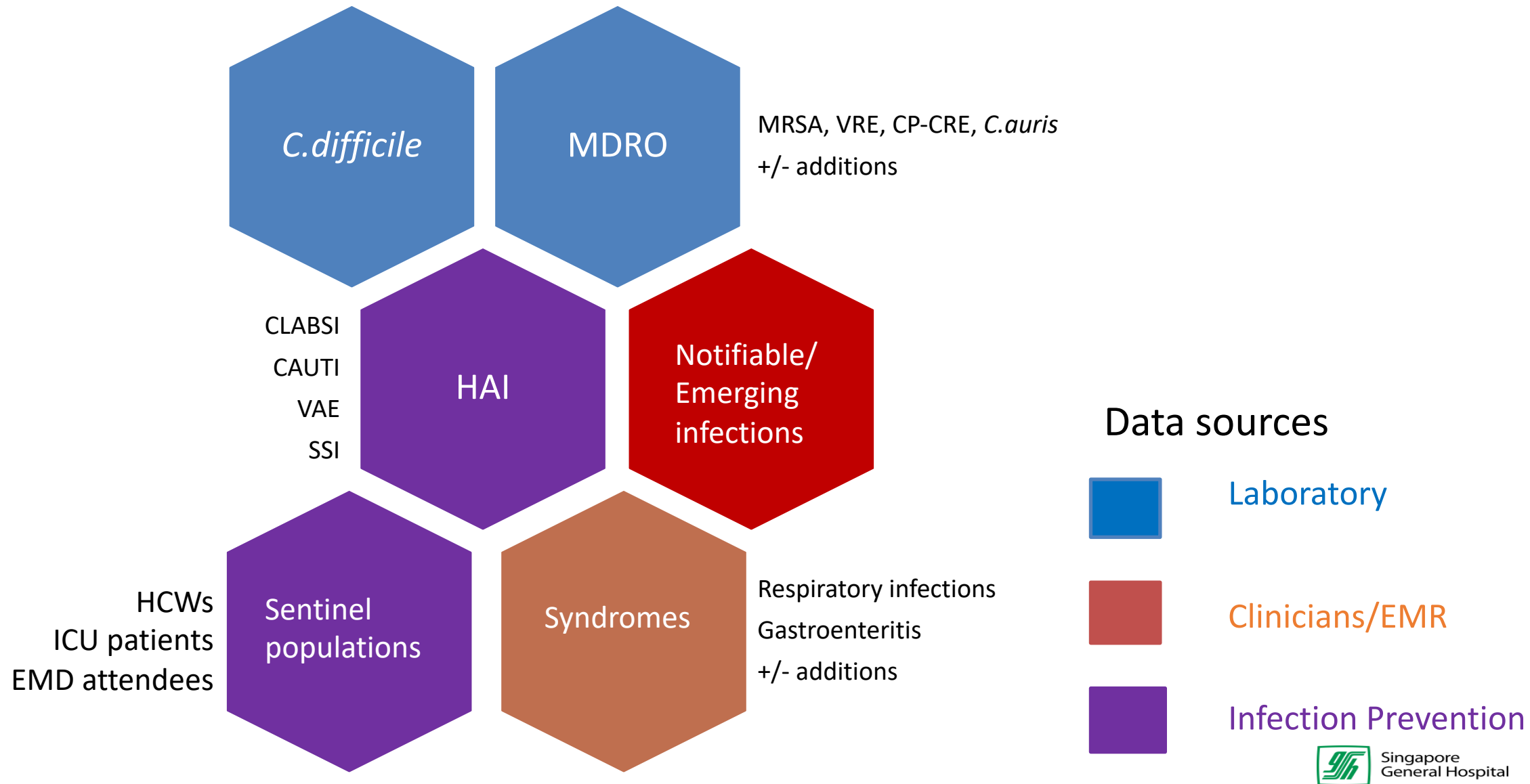
3 main features

- a) Systematic collection of pertinent data
- b) Orderly consolidation & evaluation of data
- c) Prompt dissemination of results to those in position to take action

2 types

- a) Passive
- a) Active

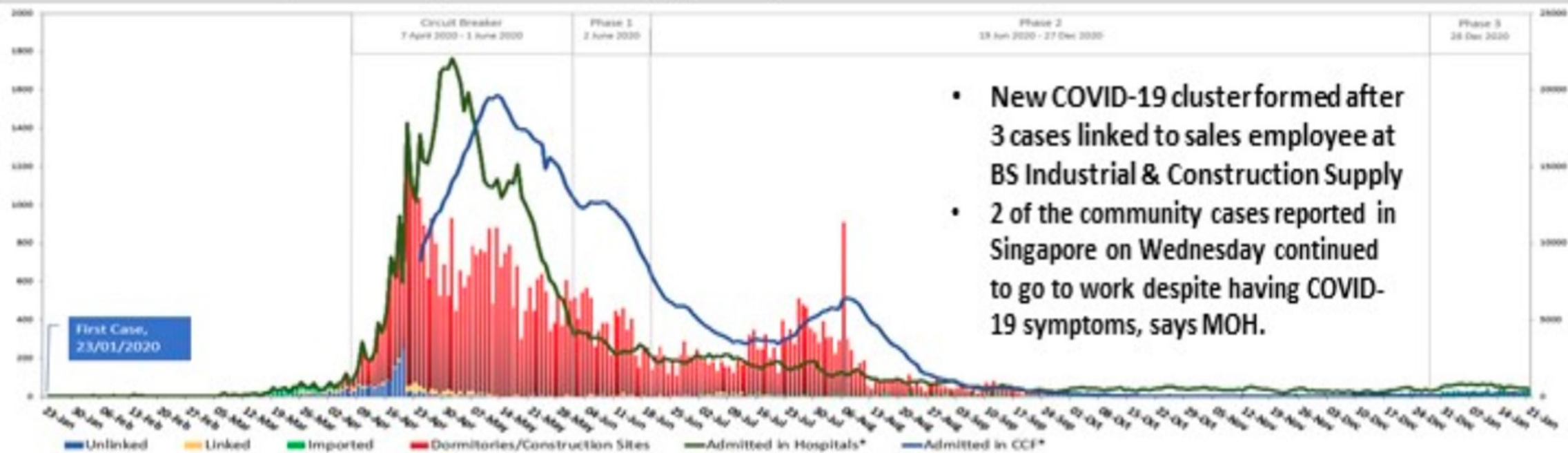
Infectious Diseases Surveillance in a Hospital



Setting and population

- SGH is the largest public tertiary hospital in Singapore
- 63 wards
- 2,119 beds

Epidemiological Curve for Singapore by Cluster and Date of Case Confirmation



- New COVID-19 cluster formed after 3 cases linked to sales employee at BS Industrial & Construction Supply
- 2 of the community cases reported in Singapore on Wednesday continued to go to work despite having COVID-19 symptoms, says MOH.

23 Jan 2020: 1st COVID-19 patient in SGH

Please receive update on Wuhan Pneumonia census.

Daily Censuses: Current inpatient(s) as of 24-Jan-2020, 2000HRS			
	24-Jan-20		Cumulative Summary
Wuhan pneumonia cluster	Number	Remarks	Total number
Suspected cases* *MOH definition	7	NPHL test nCoV Confirmed - 2 Respiratory virus multiplex PCR Not detected - 5	7
Internal Screening criteria (admitted) cases	4	Respiratory virus multiplex PCR Pending results -2 Not detected - 2	4
Total Admission	11		11
Total cases screened and discharged from DEM (will be tracked for readmission within 14 days from date of exposure)	Awaiting report		
Staff Contacts	Without PPE --> 4 staff		Pending to initiate quarantine

30 Jan 2020

Daily Census: Current inpatients as of 30-Jan-2020, 1600HRS						Cumulative Summary From 06/01/2020
Location	Pneumonia (China) cluster	Number	Remarks			Total number
Ward 68 Level 1 isolation	Confirmed Cases (nCoV)	2	Patient 1: nCoV positive on 23/1/2020 Patient 2: nCoV positive on 24/1/2020			2
	Suspected cases (MOH criteria)	2	1x negative test: 1, Equivocal: 1 1x equivocal: 1			38
	Internal Screening cases	13	1x negative test: 5, pending 4 2x negative test: 4, pending 5 <i>Out of 13, 3 are healthcare professional</i>			54
	Total Admissions	17				94
Ward 57 Level 2 isolation	Step-down from Level 1 isolation	2	* Case 1 – day 15 today Case 2 – day 8 today			5
Ward 73A & 47A Level 3	Travel to China within preceding 14 days	0	W73A - Case 1 – day 10 today			1
Daily Census: Patients discharged from DEM as of 30-Jan-2020, 1400HRS						Cumulative Summary From 06/01/2020
DEM	# Triaged to fever area but not admitted	Prior Data	28/01/2020	29/01/2020	30/01/2020	113
			101	9	5	

*Monitored for 14 days from time of departure from China

Discharged after review or discharged against medical advice or transferred to KKH

Daily Census: Staff contacts as of 30-Jan-2020, 1800HRS					Cumulative Summary From 06/01/2020
Staff Contacts	Exposed staff	Total - 172	PPE	172	326 2 cases developed URTI symptoms after contact with confirmed case, PPE worn. Informed to go DEM. 4 cases Under quarantine till 06/02/2020 followed-up by MOH
			Inadequate PPE	0	
			Actively monitored daily (T & URTI)	1	
			Admitted and isolated	1	
Staff with Travel History to China	Total - 2	Admitted and isolated	2		









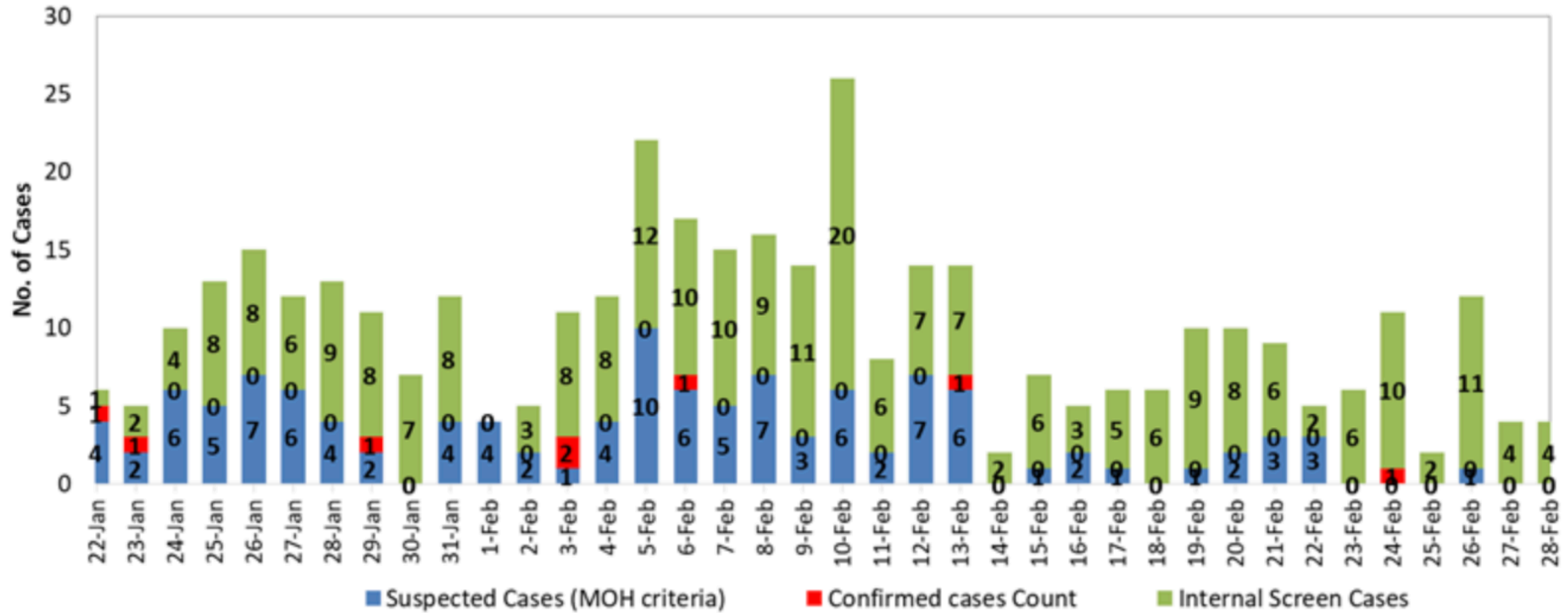
28 Feb 2020

Daily Census: Current inpatients as of 28-Feb-2020, 1600HRS					Cumulative Summary From 06/01/2020	
Location	nCoV cluster	Number	Remarks			Total number
Ward 68 isolation	Confirmed Cases (nCoV)	2	Case 35: Confirmed on 07/02/2020 Case xx: Confirmed on 26/02/2020			8
	Suspected cases (MOH criteria)	0				119
	Internal Screening cases	19	2x negative test: 7 1x negative test: 10 Pending tests: 2			257
	Total in Ward 68	21				
Ward 57A isolation	Internal Screening cases	4	2x negative test: 1 1x negative test: 3			
Total Admissions		25				384
Daily Census: Patients discharged from DEM as of 28-Feb-2020, 1400HRS					Cumulative Summary From 06/01/2020	
DEM	#Triaged to fever area but not admitted	Prior Data	26/02/2020	27/02/2020	28/02/2020	543
		496	20	17	10	
	Swab test result available and conveyed to patient successfully*	96	11	8	Not available yet	115
	To be mailed as contact number not available	4	1	0		5
	Pending	0	0	1		2
Total number of patients discharged with swab taking		100	12	9		121

#Discharged after review or discharged against medical advice or transferred to KKH


*All results were negative so far.

Total number of admissions for 2019 nCoV



RESEARCH ARTICLE

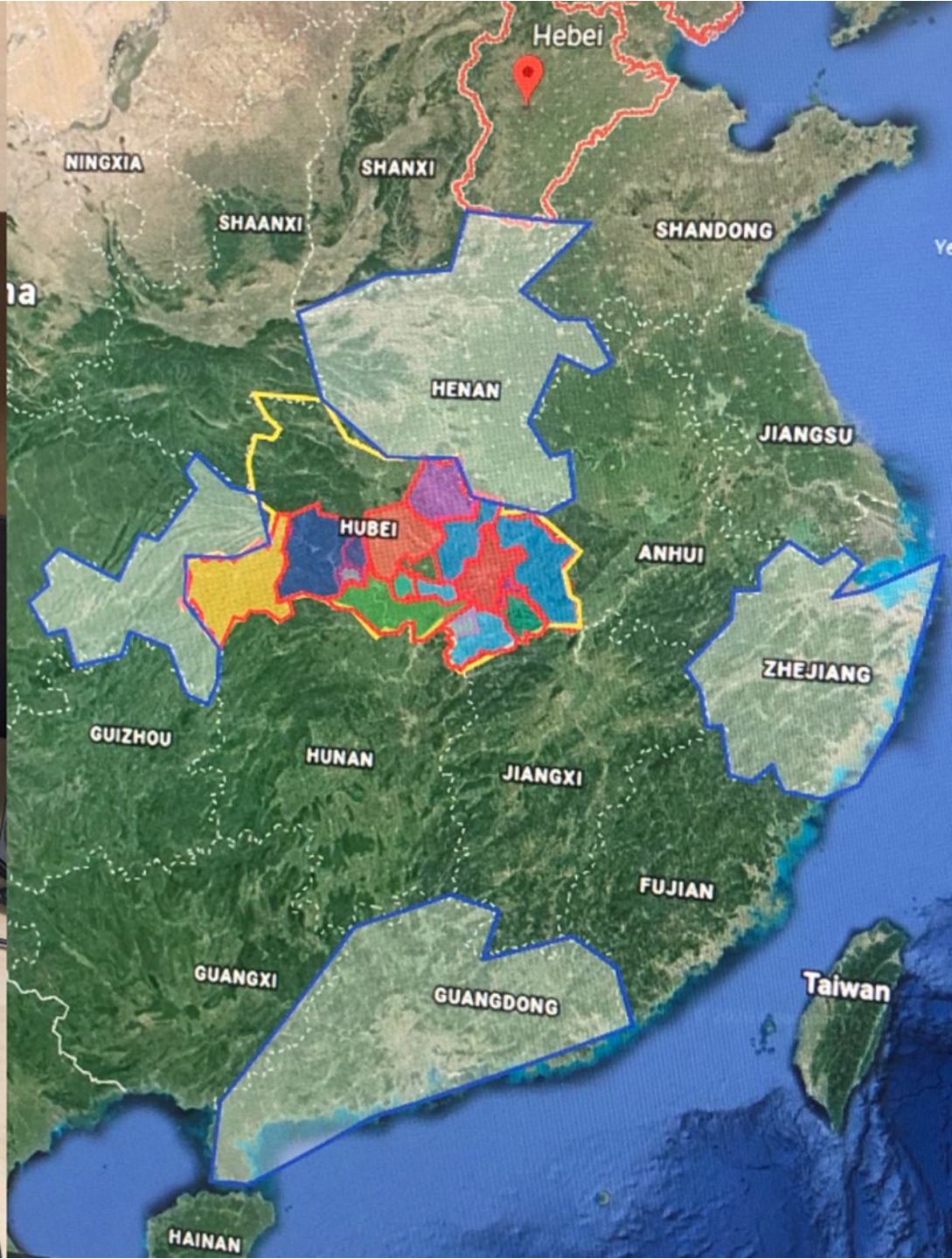
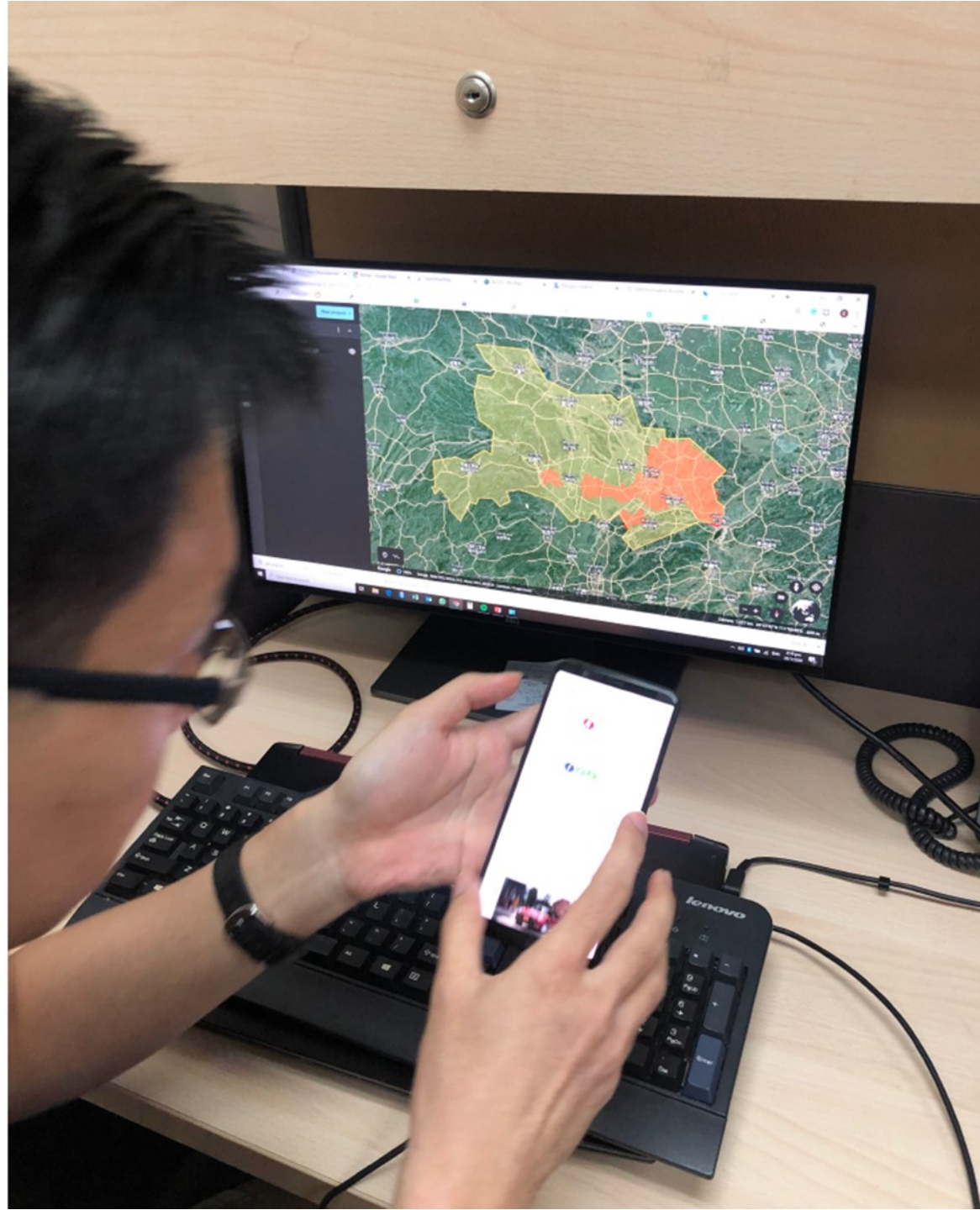
A comparative study on the clinical features of COVID-19 with non-SARS-CoV-2 respiratory viral infections

Jing Yuan Tan MBBS¹  | Xiang Ying Jean Sim MRCP^{2,3} | Liang En Wee MPH^{2,3} |
Ying-Ying Chua MRCP² | Benjamin Pei Zhi Cherng MRCP² |
Ian Matthias Ng MBBS³ | Edwin Philip Conceicao BSc^{1,2,3} | Tzu-Jung Wong PhD⁴ |
Yong Yang PhD³ | May Kyawt Aung MPH³ | Moi Lin Ling FRCPA³ |
Indumathi Venkatachalam FRACP^{2,3}

Staff – symptomatic			Cumulative
Inpatient		0 (on 28/02/2020)	75 (from 06/01/2020)
Outpatient	Staff clinic – swab taken	23 (on 27/02/2020) – not detected	447 (from 07/02/2020)
	DEM (Treated and Discharged)	0 (on 28/02/2020)	53 (from 06/01/2020)

SGH Staff including MOHH doctors (28-Feb-2020)		HOME
MOH Quarantine	On Quarantine period	0
	Completed Quarantine period	5
Institutional Home Isolation	On home isolation (Exposure)	0
	Completed home-isolation (Exposure)	5
Stay Home Notice (South Korea)	On Stay Home Notice (South Korea)	2
	Completed Stay Home Notice (South Korea)	0
Stay Home Notice (China)	On Stay Home Notice (China)	1
	Completed Stay Home Notice (China)	0
LOA (China)	On LOA (China)	4
	Completed LOA (China)	77

26 Jan 2020





Situation in Southeast Asia

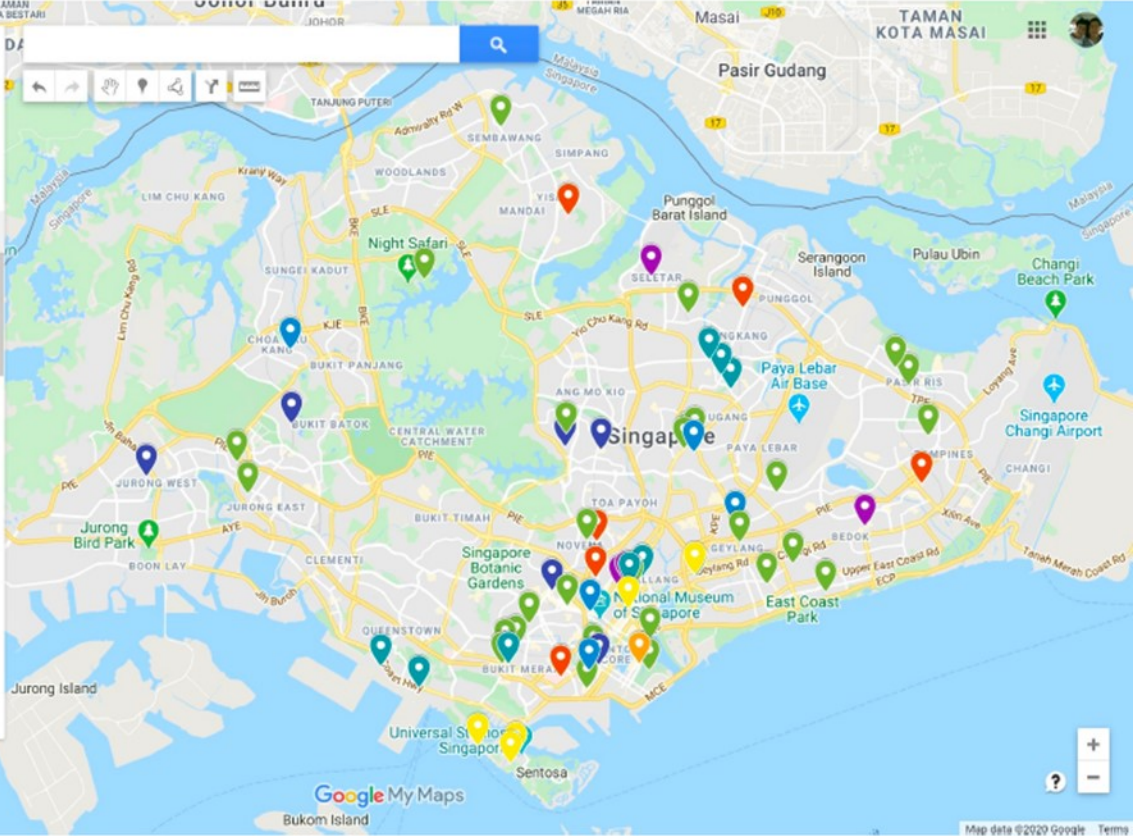
Local Cases Location Mapping

Does not include: Private GP clinics, Airports.
Based on MOH press releases. Correct as of 12/2/2020 1417hrs. Identified Clusters sorted by more
1 view
All changes saved in Drive

☰ Add layer 👤 Share 👁 Preview

Locations

- Individual styles
- Yong Thai Hang Cluster
- Grand Hyatt Cluster
- Life Church Cluster
- Seletar Aerospace Cluster (B...
- The Leo
- Paya Lebar Methodist Church
- Resorts World Sentosa
- Fernvale Road
- Veerasamy Road
- Sembawang Drive
- Certis CISCO Security Pte Ltd
- F1 Pit Building
- SingHealth Polyclinics - Bedok
- Mustafa Shopping Centre Si...
- Hougang Polyclinic

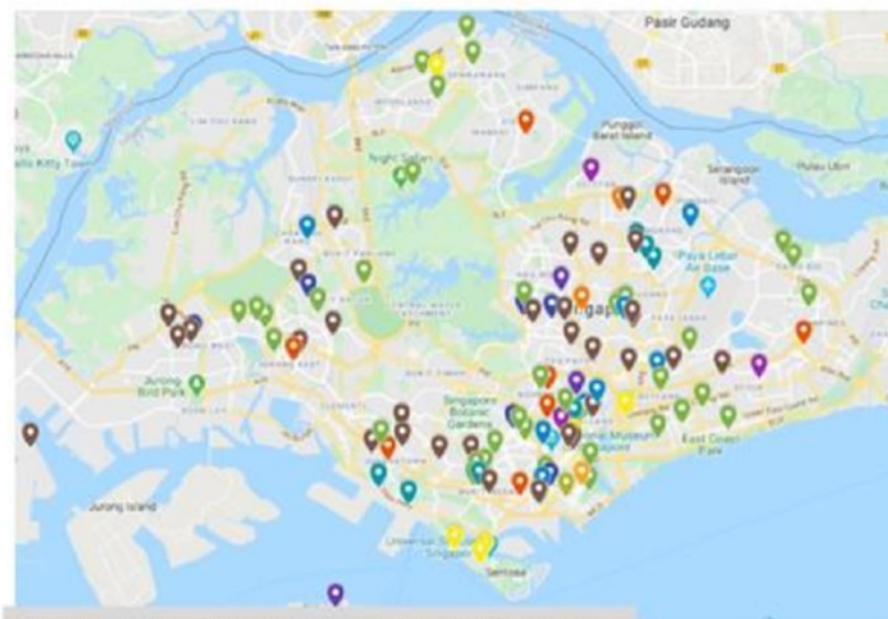


FRONTLINE REPORT: COVID-19

Sunday, 23 Feb 2020 0900hrs



Situation in Southeast Asia and China



Location mapping of patients up to Case 88

SARS 2003

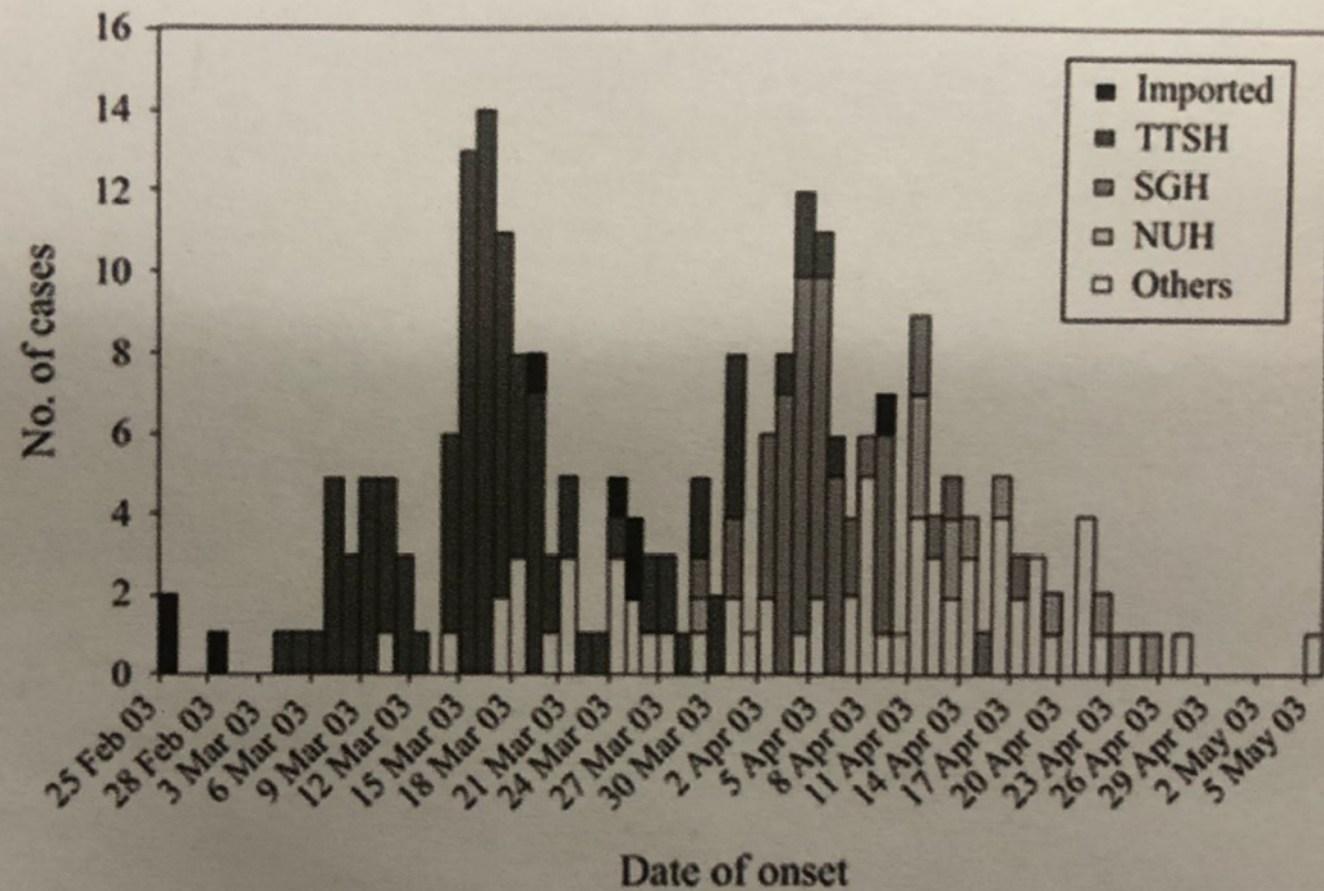


Fig. 8. Epidemic curve of 238 reported cases of SARS, March-May 2003

Friday, 06 Mar 2020 1400hrs



Trend towards more new cases in the rest of the world than China

Situation in Southeast Asia and China (existing cases)

Wednesday 11 Mar 2020 0730hrs



Situation Globally

Wednesday, 18 Mar 2020 0900hrs

Global Situation



Daily Census: Current inpatients as of 29-April'2020, 0800HRS				Cumulative Summary From 06/01/2020
COVID-19	Location	Number	Remarks	Total number
Confirmed cases	Ward 68 isolation	17	<u>Admission</u> 28 Patients - Confirmed on 24/04/2020 17 Patients - Confirmed on 25/04/2020 21 Patients - Confirmed on 26/04/2020 39 Patients - Confirmed on 27/04/2020 11 Patients - Confirmed on 28/04/2020	361
	Ward 67 isolation	46		
	Ward 66 isolation	57		
	Ward 66A isolation	55		
	Ward 57 isolation	16		
	Ward 47A isolation	17		
Resolved Infection cases	Ward 63B	1		
Total Confirmed Cases		209		
Suspected cases (MOH Criteria)	Ward 68 isolation	6	1x negative: 3, Pending: 3	669
	Ward 57 isolation	2	1x negative: 2	
	Ward 67 isolation	3	1x negative test: 2, Pending: 1	
	Ward 66 isolation	0	NA	
	Ward 47A isolation	1	1x negative test: 1	
Total Suspected cases (MOH criteria)		12		
Internal Screening cases	Ward 68 isolation	4	1x negative: 1, Pending: 3	626
	Ward 57 isolation	1	Pending: 1	
	Ward 67 isolation	3	2x negative test: 1, 1x negative: 2	
	Ward 66 isolation	0	NA	
	Ward 47A isolation	2	2x negative test: 1, Pending: 1	
Total Internal Screening cases		10		
Total Admissions		231		1656*

* The "Total Admissions" has been revised to use the "Date of Admission" which will also account for all the transferred cases.

29 April 2020

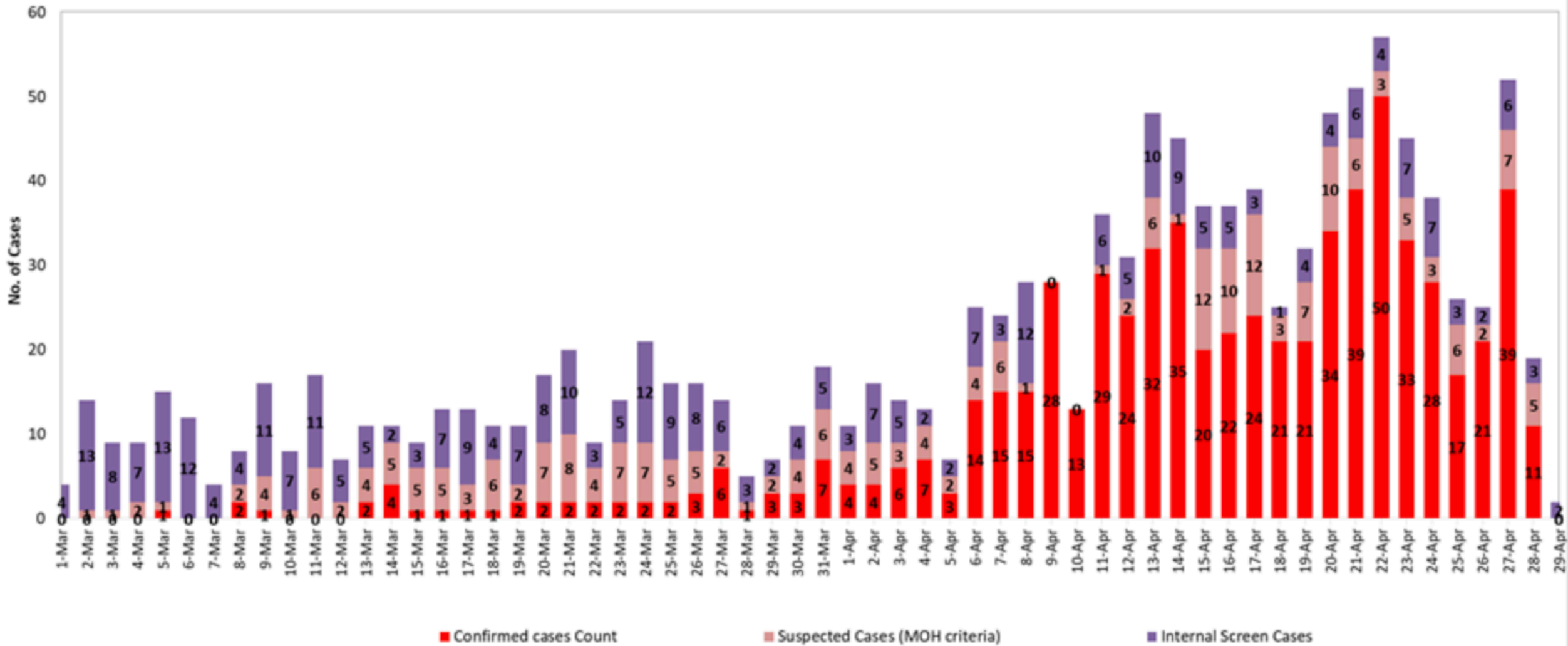
COVID-19	Location	Number
ARI Wards	All Disciplines: W63A (Rm 1 to 10, 23, 24, 26), W65A (Rm 1 to 5), W65B (Rm 6 to 12, 15), W73A (Rm 1 to 12), W75A (Rm 1 to 12), W75B (Rm 23 to 26), W75C (Rm 16, 18 & 22), W76A (Rm 1 to 12), W76B (Rm 23 to 26), W76C (Rm 22)	77
	Haem: W48 (Rm 16 & 18) & W72 (Rm 18, 20 & 22)	4
	Onco: W48 (Rm 9 to 12, 16 & 18)	1
	Neurology: W74 (Rm 18)	0
	Renal: W42 (Rm 1, 2, 4 to 6)	0
	CTS / CVM: W56 (Single Rooms), Rm 9 to 12	4
Total Admissions		86

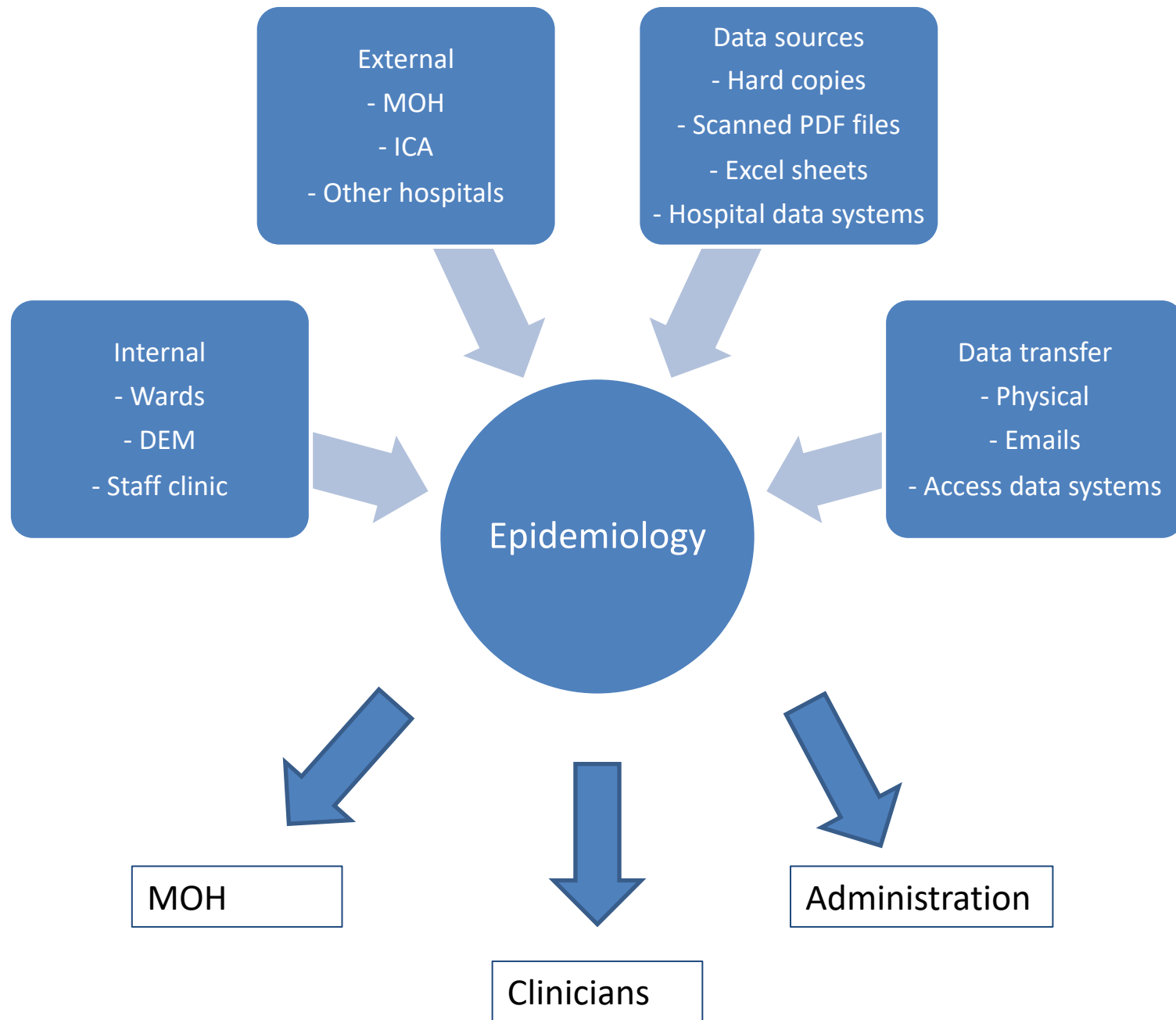
Daily Census: Patients discharged from DEM with throat swab as of 28-April'2020					Cumulative Summary From 14/02/2020
DEM	Prior Data	26/04/2020	27/04/2020	28/04/2020	Total number
Swab test result came out as 'Positive' and admitted subsequently	43	0	0	0	43
Total number of patients discharged with swab taking from DEM	2086	0	0	0	2089
Total number of patients Triaged and discharged from DEM but was not admitted		13	13	16	

Daily Census: Patients discharged from FSA with throat swab as of 28-April'2020					Cumulative Summary From 20/03/2020
FSA	Prior Data	26/04/2020	27/04/2020	28/04/2020	Total number
Swab test result came out as 'Positive' and admitted subsequently	87	0	0	0	87
Total number of patients discharged with swab taking from fever screening area	1231	2	0	0	1240
Total number of patients Triaged and discharged from fever area but was not admitted		8	11	17	



Total number of admissions for COVID-19





1st way to access logsheet

- Direct link on infopedia

The screenshot shows the Singapore General Hospital website. At the top, there is a navigation bar with links: Home, News Hub, Work Services, Groups, IT Applications, People, Divisions & Departments, and Data Security. Below the navigation bar is a large banner for a survey titled "Thriving in the 'New Normal' and Beyond for Research" (SGH COVID-19 Research Resilience Online Survey). The banner includes a QR code labeled "SCAN ME" and a list of survey aims. To the right of the banner is a vertical navigation menu with a list of hospital divisions and departments. The "Infection Prevention & Epidemiology" link in this menu is circled in red. Below the banner is a news article titled "How can research thrive in the 'new normal' post-COVID 19?".

Home News Hub Work Services Groups IT Applications People Divisions & Departments Data Security

YOUR OPINIONS MATTER

Thriving in the "New Normal" and Beyond for Research
SGH COVID-19 Research Resilience Online Survey

Aims of Survey

- Our strengths, weakness, opportunities and threats (SWOT)
- New strategies for research in this "new normal"
- How do we pre-position ourselves to emerge stronger from the situation?
- How to better prepare for the next pandemic from a research perspective?

SCAN ME

POWERED BY FORM

- ▶ Div of Anaesthesiology & Perioperative Medicine
- ▶ Div of Medicine
- ▶ Div of Musculoskeletal Sciences
- ▶ Div of Radiological Sciences
- ▶ Div of Surgery & Surgical Oncology
- ▶ Nursing Division
- ▶ Research Office
- ▶ Business Office
- ▶ **Infection Prevention & Epidemiology**
- ▶ Pharmacy
- ▶ Pre-Operative and Admitting Services
- ▶ Preparedness & Response
- ▶ Specialist Outpatient Clinics

How can research thrive in the 'new normal' post-COVID 19?

Monday, 11 May 2020 | Singapore General Hospital

The global and local COVID-19 situation is likely to take months to improve. Give us your ideas on how we can continue to do research in this "new normal". Scan the QR Code or key in the url
<https://form.gov.sg/5ea14c7ff89c490011d75cc4> or <https://tinyurl.com/y8mmrwp> (internet access required)

The link will be on the IPE homepage



The image shows a screenshot of a web application interface. On the left is a vertical navigation menu with several items: 'Lists', 'Contact Tracer Survey', 'Surveys', 'Home', 'About Us', 'Epidemiology', and 'Staff Contact Logsheet'. The 'Staff Contact Logsheet' item is circled in red. The main content area features a large banner with the text 'INFECTION PREVENTION & EPIDEMIOLOGY' at the top. Below the banner is a photograph of a hand holding a small figure of a healthcare worker in blue scrubs, who is holding a yellow disinfectant spray bottle. Below the photograph, the text 'Primary Goals of IPE' is followed by a list of two bullet points: 'Protect the patient' and 'Protect the healthcare workers, visitors, and others in'.

Lists

- Contact Tracer Survey

Surveys

Home

About Us

Epidemiology

- Staff Contact Logsheet**

INFECTION PREVENTION & EPIDEMIOLOGY



Primary Goals of IPE

- ▶ Protect the patient
- ▶ Protect the healthcare workers, visitors, and others in

2nd way to access logsheet

- Direct from SCM

The screenshot displays the Allscripts Gateway interface for 'My Applications | Acute Care'. The 'Tools' menu is open, and 'REDCap' is highlighted with a red circle. The interface includes a top navigation bar, a menu bar with options like 'File', 'Registration', 'View', 'GoTo', 'Actions', 'Preferences', and 'Tools'. Below the menu bar is a toolbar with various icons. The main area shows a 'Patient List' with columns for 'Patient Name' and 'Patient ID / Visit Nur'. A table with columns like 'Admit Time', 'Provider', 'Service', 'Hids', 'Visit Status', 'Flag N...', 'New Results', 'Priority Attn', 'Hando...', and 'Handover Purpose' is visible. The status bar at the bottom shows system information including 'SGH5NL170033-S [Citrix] SH5CTX1VPXA64A (8.4.1321.1040)', 'SHSSCMVPWEB50', 'Sim, Xiang Ying Jean (Doctor)', '14/05/2020 20:43', '000:46', and 'pSCMDB'.

Login via REDCap



Account Information

User name:

Password:

Domain:



Log In

Enter patient data in this page

SGH Staff Surveillance for COVID-19

Dear Staff,

Please aid us in completing the Staff Contact Log Sheet to help in surveillance and contact tracing measures. We appreciate all your help during this difficult time.

Thank you for all your help!

Record Source / Hospital

SGH

Patient's information

Case NRIC

Case Name

Submit

Contact's NRIC / Passport No.

Contact's Name

Contact's Mobile Number

Designation

Doctor (Consultant, Associate Consultant, Senior Resident, Medical Officer)

Nurse, please state designation

Allied health (PT, OT, Dietician, Pharmacist, MSW, ST, Others)

Environmental services

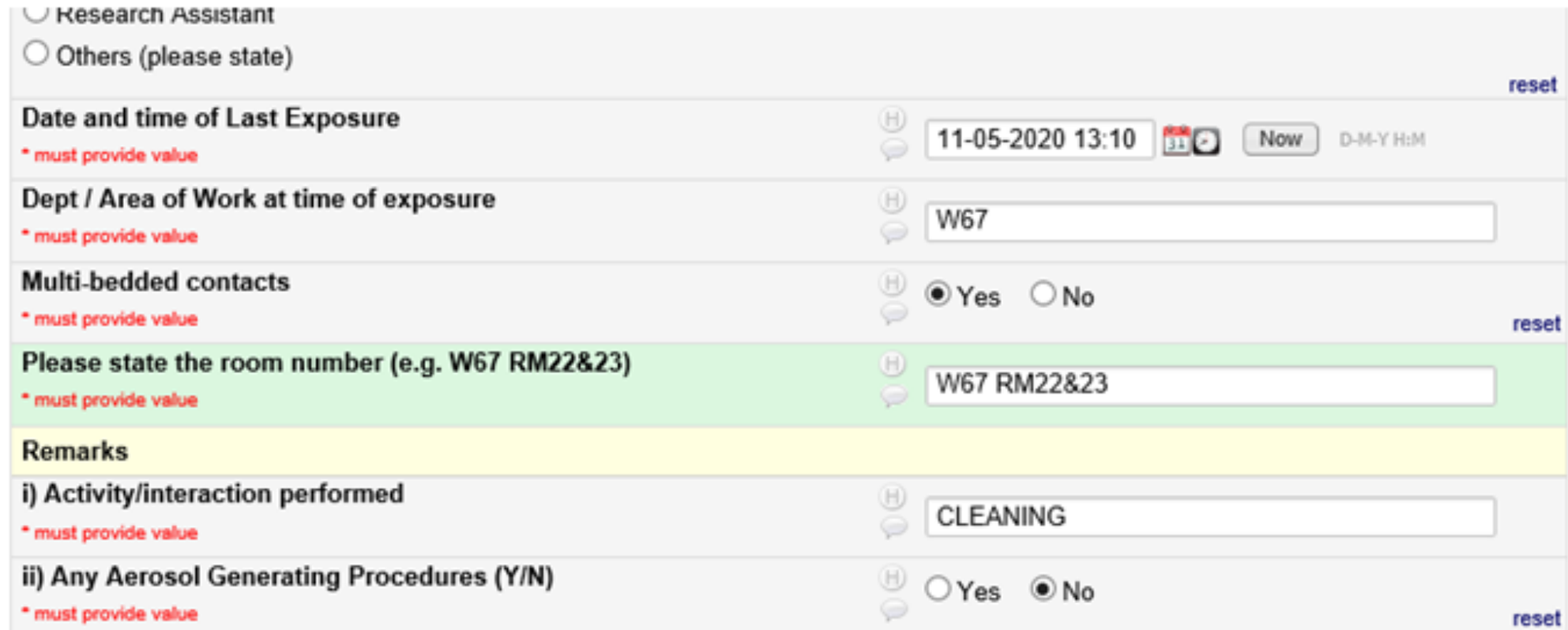
Research Assistant

Others (please state)

[reset](#)

Other modifications

- For entry into cohort room – cleaning etc.



Research Assistant
 Others (please state) reset

Date and time of Last Exposure (H) [11-05-2020 13:10] [31] [Now] D-M-Y H:M
** must provide value*

Dept / Area of Work at time of exposure (H) [W67]
** must provide value*

Multi-bedded contacts (H) [● Yes ○ No] reset
** must provide value*

Please state the room number (e.g. W67 RM22&23) (H) [W67 RM22&23]
** must provide value*

Remarks

i) Activity/interaction performed (H) [CLEANING]
** must provide value*

ii) Any Aerosol Generating Procedures (Y/N) (H) [○ Yes ● No] reset
** must provide value*

ARI - Single
 Exposure Could
 outside of
 window

ARI - Single
 Exposure Could
 outside of
 window

Staff A
 Staff B
 Staff

Date of
 Symptoms

ARI

ARI only 23/19
 1408/19
 1503/19

Staff Surveillance

pre-type ✓
 Pushing to Real time

Cluster → zero spectrum?

10/3 → make H&P

Index $I = 1$
 $C = 1$
 $S = 1$

Crossed

ARI

Serial - Surveillance

ARI Cluster
 - ARI - Cough / Flu / B / B.o.B.
 ↳ ARIA, Fluores

7 case Cluster
 ≥ 25%

Using multiple
 UNO-19

Location detection via IP
 ID base location
 ID base name

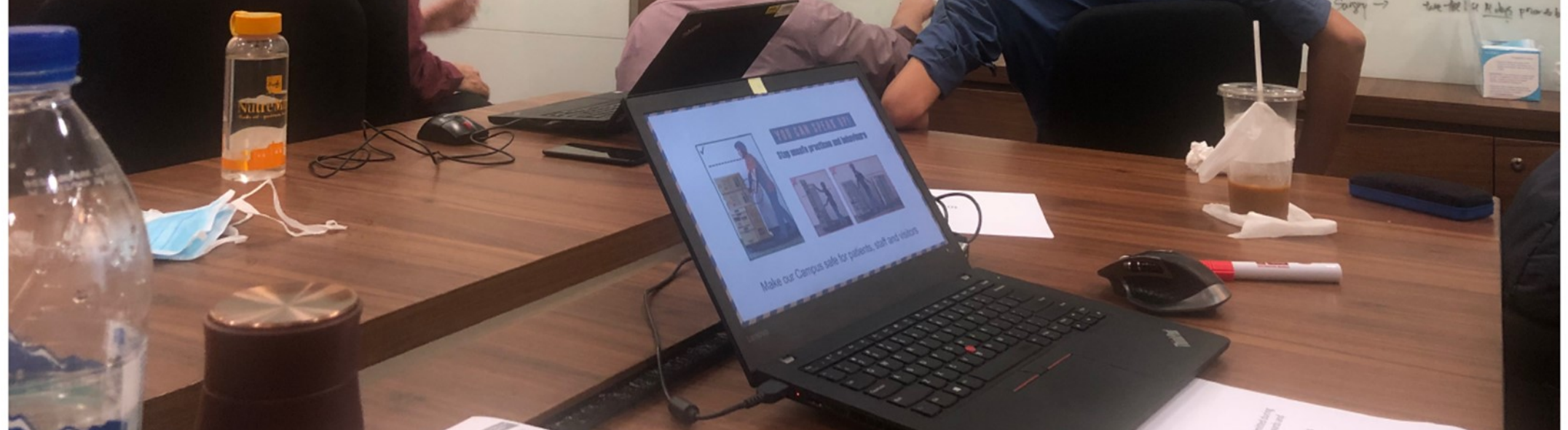
ARI
 ID all ARI/
 location work

All patients with 37.5°C
 ID minimum of symptoms
 ID base on 10 days

All patients 2019/19 patients

ID all 100-100% for all movement type

Surgery →



Surveillance in COVID-19 pandemic

- Acute Respiratory Illness (ARI) surveillance (Syndromic)
 - Staff
 - Patients
- Routine MDRO/HAI surveillance (Disease)

Syndromic surveillance systems



- Track discernable clinical features before the diagnosis is confirmed
- Monitor the patients from onset of symptoms
- Observe changes in disease activity
- Foster immediate decision making
- Better protect patients and healthcare workers

Staff surveillance

We utilized the EHR database to build a syndromic SSS using SNOMED diagnosis codes of staff who presented the emergency department (DEM) and the staff clinic (SC) – persons identified were deemed at-risk staff

All at-risk staff, were then mapped in time and location and presented in a heat map for visualization

Baseline data was obtained for 2 weeks, and thereafter reviewed daily together with a weekly aggregated output

A cluster was defined as a signal of >50% the previous baseline or an upward trend for 2 weeks of aggregated results of > 1 standard deviation

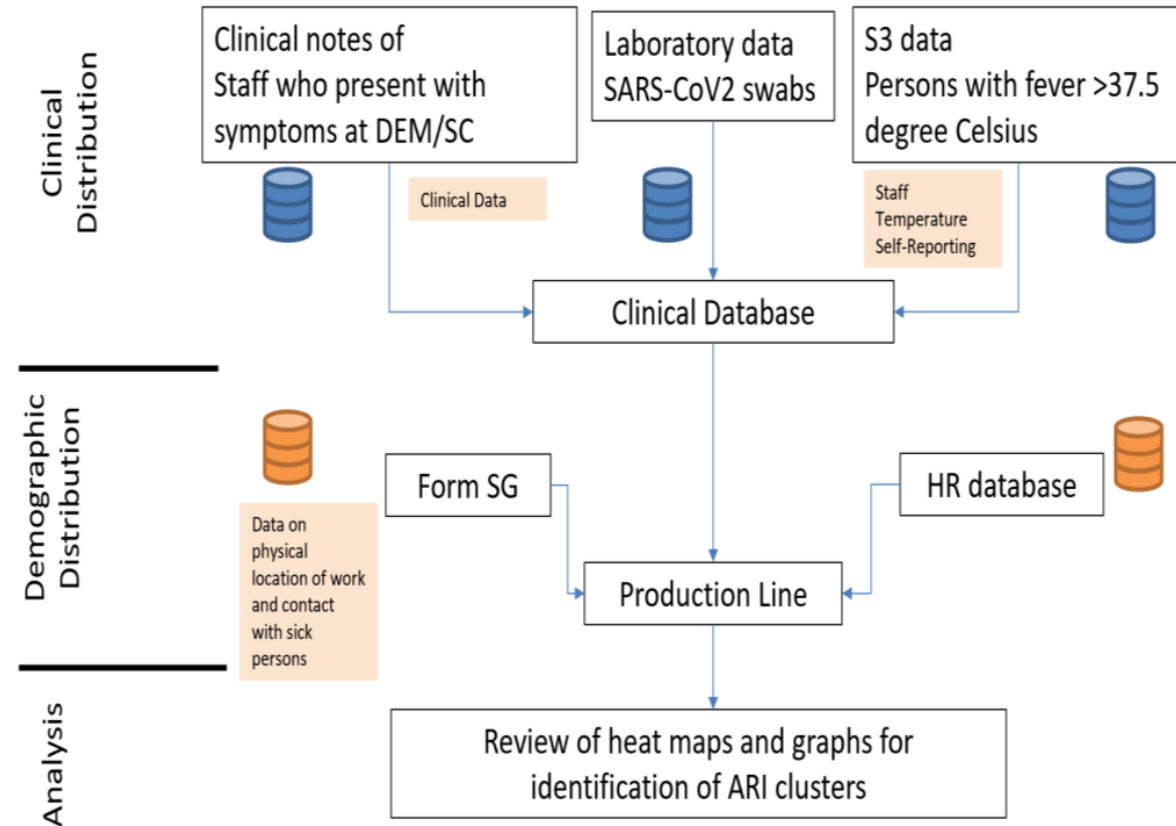


Figure 1. Data sources and workflow of creation of staff surveillance system for ARI clusters

Staff surveillance

Reference Number

Timestamp

Staff Name

Staff NRIC

Visit Details

Date of symptom onset (earliest date)

In the 2 weeks before symptom onset, did you have direct patient contact OR work in a clinical area?

Yes - select all that are applicable

No - select all that are applicable

In the 2 weeks before symptom onset, have you:

Travelled out of Singapore?

Where have you travelled to (City, County)?

Been in close contact with any healthcare workers on Outram Campus who have been unwell?

Could you provide more details of the healthcare workers?

Been in close contact with any person(s) outside Outram Campus who have been unwell?

Could you provide more details of the person(s) outside Outram Campus?

- S3: a national-wide temperature surveillance for outbreak monitoring
- FormSG: At-risk staff were also prompted at SC and ED to submit a self-administered questionnaire via FormSG separate from the S3 fever declaration (available at: <https://form.gov.sg/#!/5e5b6857130b0100115f3e93>) to give further granularity to their locations of work

The FormSG Support Team

Script Version: 1.4

Figure 2. Sample of FormSG questionnaire

Slide credit: Dr Jean Sim

Staff surveillance

Results

- A total of **10 ARI clusters in 7 departments** were identified involving radiology, ambulatory endoscopy centre, outpatient pharmacy, medical social services, central operating theatre, emergency department and physiotherapy.
- Amongst these staff identified to be part of an ARI cluster, 1 staff from the ambulatory endoscopy centre was identified with rhinovirus infection on respiratory virus PCR testing.
- Of the 13 staff identified to be COVID-19 positive, **2 of the staff within the medical social worker cluster were diagnosed with COVID-19 infection.**

Departments	Week 1 (23/2 - 29/2/20)	Week 2 (1/3 - 7/3/20)	Week 3 (8/3 - 14/3/20)	Week 4 (15/3 - 21/3/20)	Week 5 (22/3 - 28/3/20)	Week 6 (29/3 - 4/4/20)	Week 7 (5/4 - 11/4/20)	Week 8 (12/4 - 18/4/20)	Week 9 (19/4 - 25/4/20)	Week 10 (26/4 - 2/5/20)
Central operating theatre			183%		144%	32%		79%		
Ambulatory endoscopy centre					250%			67%		
Radiology			8%	31%	88%				17%	
Outpatient pharmacy			67%	20%	67%	10%				
Physiotherapy				86%	23%					
Medical social services			950%	14%		11%				
DEM		200%		33%						

Table 3. Heatmap demonstrating percentage change of staff at-risk compared to previous week for departments with clusters identified

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Utilizing the electronic health records to create a syndromic staff surveillance system during the COVID-19 outbreak

Jean Xiang Ying Sim MBBS, MRCP^{a,b,*}, Edwin Philip Conceicao BSc (nursing)^b,
 Liang En Wee MBBS, MRCP, MPH^{a,c}, May Kyawt Aung MPH^b, Sylvia Yi Wei Seow BE (Bioengineering)^d,
 Raymond Chee Yang Teo MBA (Healthcare Specialisation)^d, Jia Qing Goh MSc (Statistics)^e,
 Dennis Wu Ting Yeo^e, Benjamin Jyhhan Kuo MD^f,
 John Wah Lim MB Bch (Hons), MPH, Dip (Family Med), FAMS^g,
 Wee Hoe Gan MBBS (S'pore), MPH, MRCP (UK), DAvMed (Lond), FRCP (Edin), FAMS^g,
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^d Department of Organization, Planning and performance, Singapore General Hospital, Singapore


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^g Department of Occupational and Environmental Medicine, Singapore General Hospital, Singapore

Original Article

Containment of COVID-19 cases among healthcare workers: The role of surveillance, early detection, and outbreak management

Liang En Wee MPH^{1,2} , Xiang Ying Jean Sim MRCP^{2,3}, Edwin Philip Conceicao BSc(Nursing)³, May Kyawt Aung MPH³, Jia Qing Goh MSc(Statistics)⁴, Dennis Wu Ting Yeo BSc(Hons)⁴, Wee Hoe Gan FAMS(OM)⁵, Ying Ying Chua MRCP², Limin Wijaya MRCP², Thuan Tong Tan PhD², Ban Hock Tan FRCP², Moi Lin Ling FRCPA³ and Indumathi Venkatachalam MPH^{2,3}

¹Singhealth Infectious Diseases Residency, Singapore, ²Department of Infectious Diseases, Singapore General Hospital, Singapore, ³Department of Infection Prevention and Epidemiology, Singapore General Hospital, Singapore, ⁴Department of Clinical Quality and Performance Management, Singapore General Hospital, Singapore and ⁵Department of Occupational and Environmental Medicine, Singapore General Hospital, Singapore

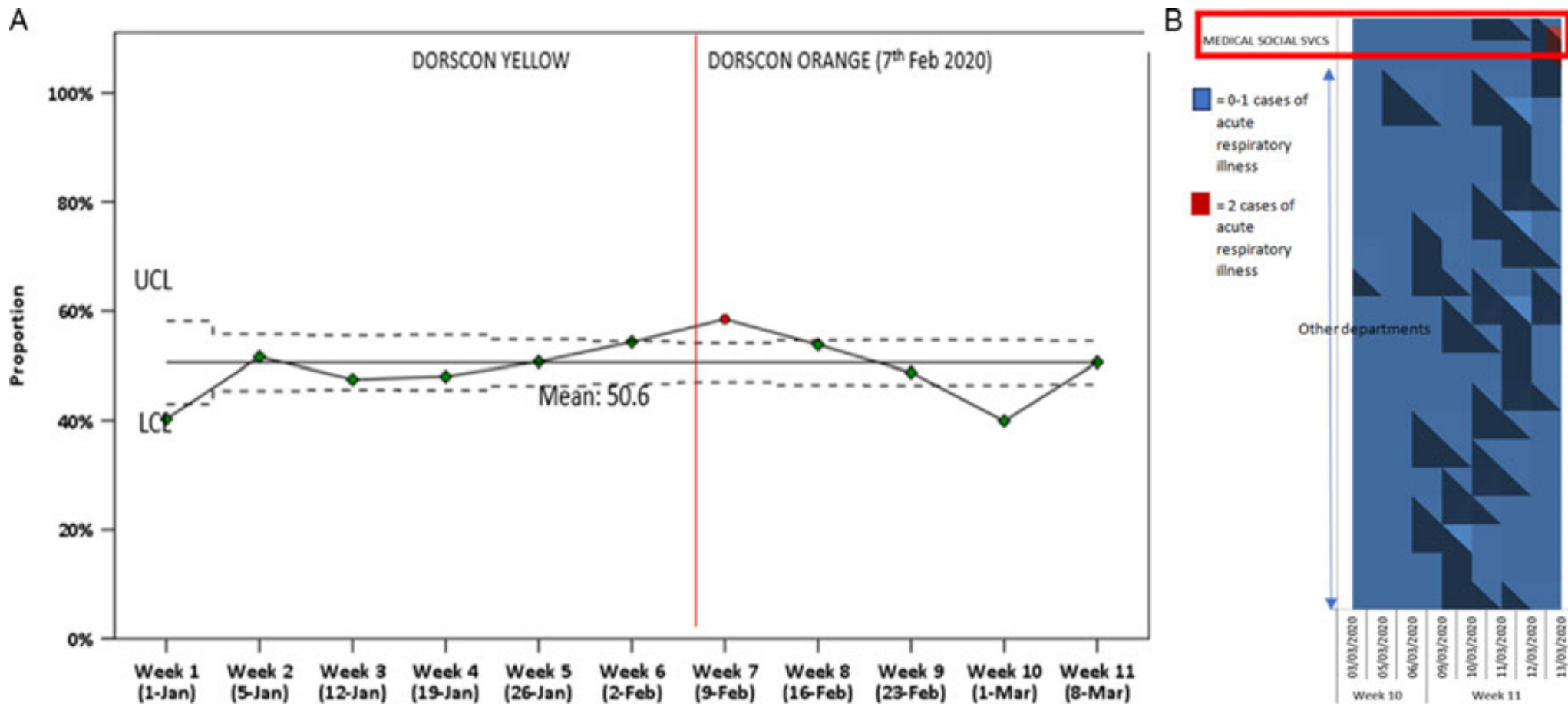


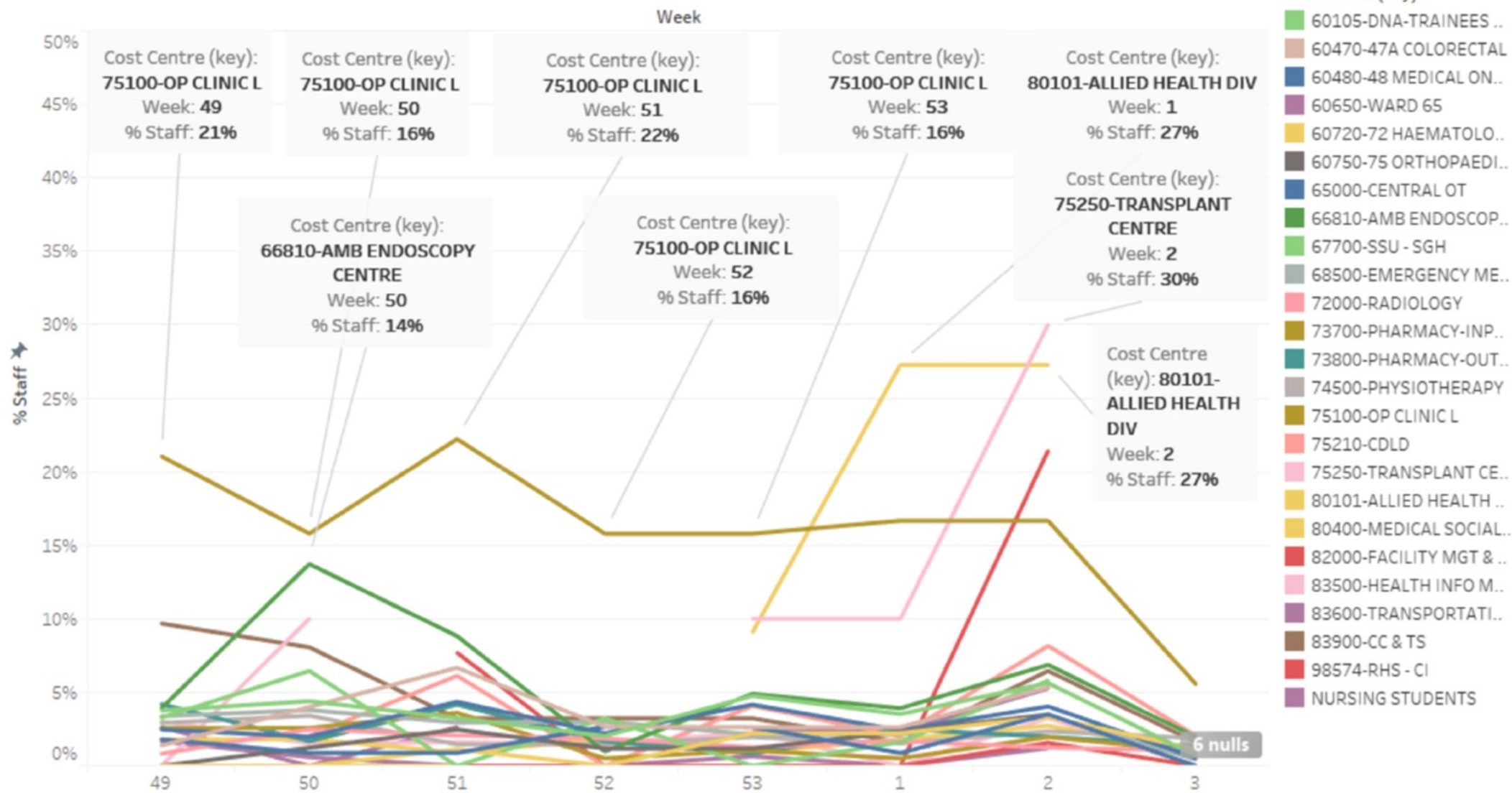
Fig. 1. Surveillance for acute respiratory illness among healthcare workers (HCWs) at an acute- and tertiary-care hospital during a COVID-19 epidemic, prior to the detection of a cluster of COVID-19 cases among HCWs. (A) Among HCWs, percentage of staff clinic and emergency department visits attributed to acute respiratory illness over an 11-week period. (B) Heat maps illustrate clustering of HCWs with symptoms of acute respiratory illness, clustered by duration of symptoms and by reporting location (departments), with a focus on the medical social work department over weeks 10 and 11 of the study period, prior to the detection of a staff cluster among medical social workers. The disease outbreak response system condition (DORSCON) is a color-coded framework used by our local ministry of health to indicate the severity of the current outbreak situation and to activate a series of interventions. DORSCON yellow indicates that disease is severe but is occurring outside Singapore, and DORSCON orange indicates that disease is severe, with ongoing local transmission, but it is currently being contained. Note. UCL, upper limit of confidence; LCL, lower limit of confidence.



Fig. 2. Distribution of healthcare workers (HCWs) with significant contact history, symptomatic HCWs, and office layout, during detection of a cluster of COVID-19 cases among HCWs. (A) Main medical social services office layout. (B) Series of single-room offices used by senior medical social workers located on the same floor. (C) Off-site medical social services office located in another office tower. (D) Typical layout in main medical social services office at the time of the outbreak. [†]A total of 49 staff were placed on quarantine (home isolation) based on significant unprotected contact with the 2 cases. Of these 49 staff, 10 had significant unprotected contact with both case 1 and case 2; 23 staff had significant unprotected contact with case 1 only; and 1 had significant unprotected contact with case 2 only. An additional 15 staff did not report significant unprotected contact, but because they shared an enclosed office space with case 1 (dotted line), they were deemed to be at higher risk of exposure and were also placed under quarantine.

Staff surveillance - Limitations

- The need for presentation of staff to our institutional health services such as SC and DEM, those who report sick outside of institution were not captured by this surveillance system.
- Asymptomatic infection will not be picked up
- Lack of other respiratory virus testing in view of cost limitations limit the validation
- Due to initial studies suggesting that a gastroenteritis illness may be an atypical presentation of COVID-19, to increase data capture this was included as an at-risk presentation. Based on our institutional data, the percentage of HCW presenting with such symptoms were low and this will be revised moving forth.



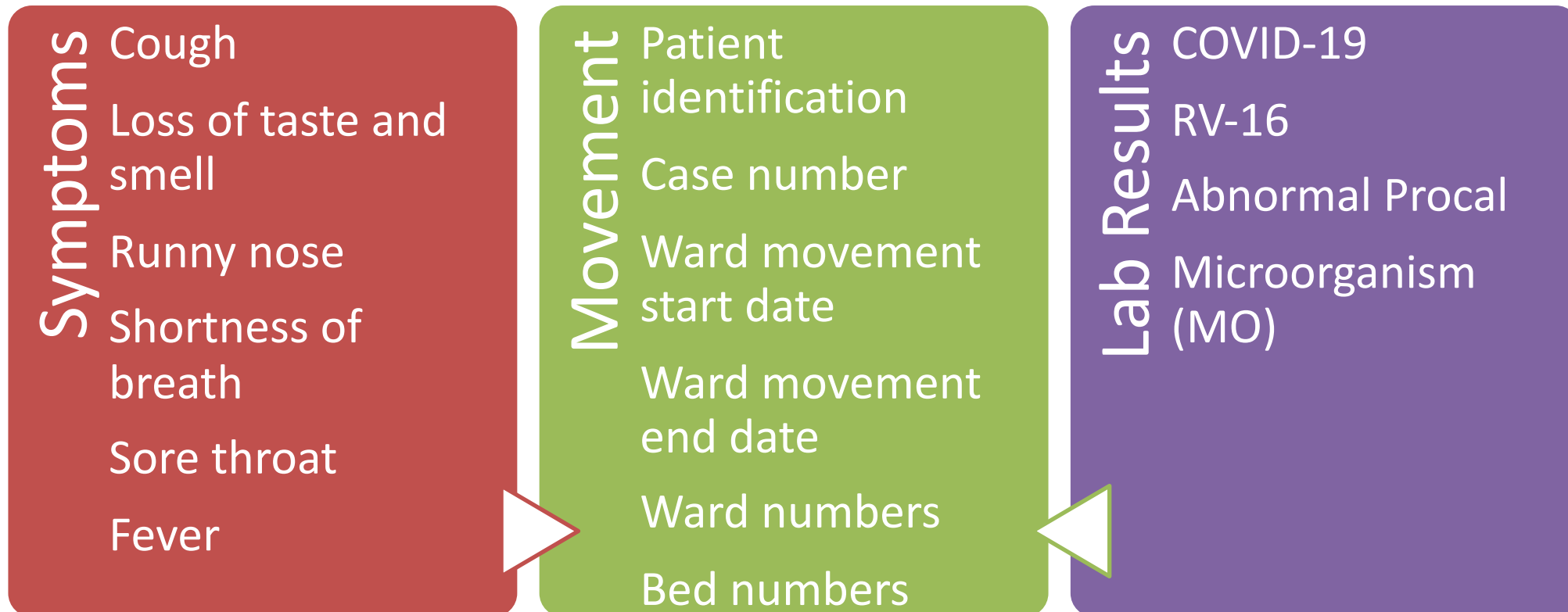
Thakral One

Department of Future Health System, SGH - Matthew Han

Department of Office of Planning & Performance (OPP), SGH – Sylvia Leow Yi Wei

Patient surveillance

Syndromic based on ARI symptoms and fever



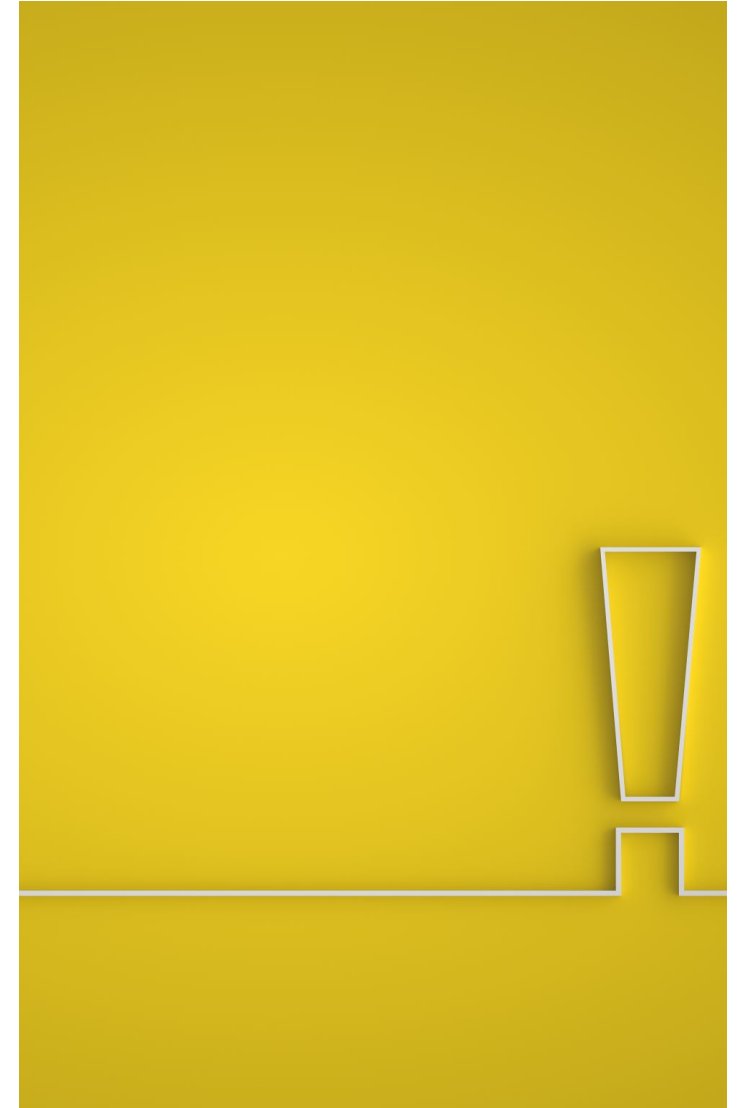
Slide credit: Dr Jennifer Wong Tzu-Jung

Patient surveillance

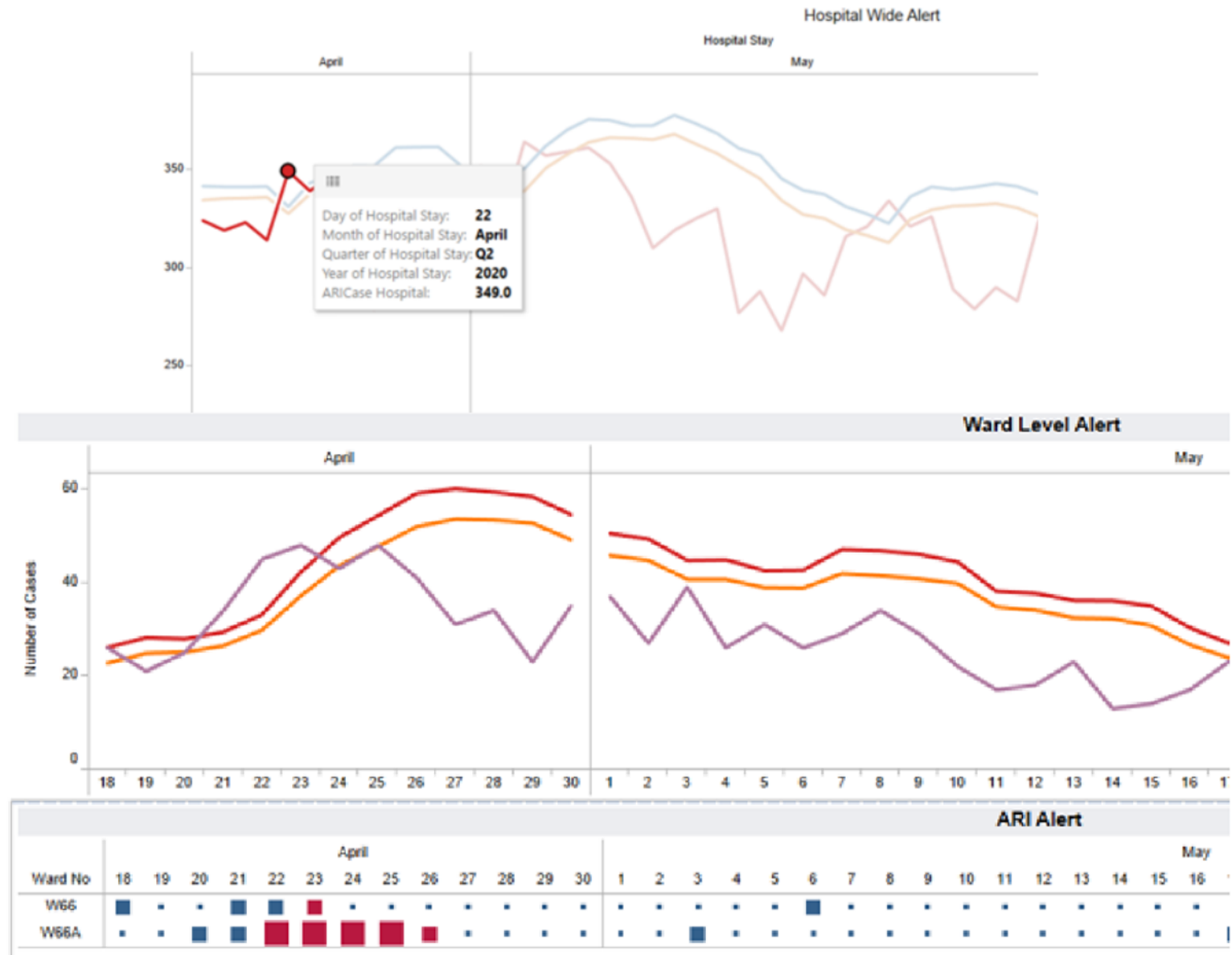
Warnings & Alerts

- Formula: $EDC_t = \frac{\sum_{i=1}^7 ODC_{t-1}}{7}$
 - EDC = The expected daily cases
 - ODC = The number of observed (reported) daily cases
- A threshold for the expected daily cases to detect the **warning** = $EDC_t + SD_t$
- A threshold for the expected daily cases to detect the **alert** = $EDC_t + 2 * SD_t$

Ward level and hospital wide



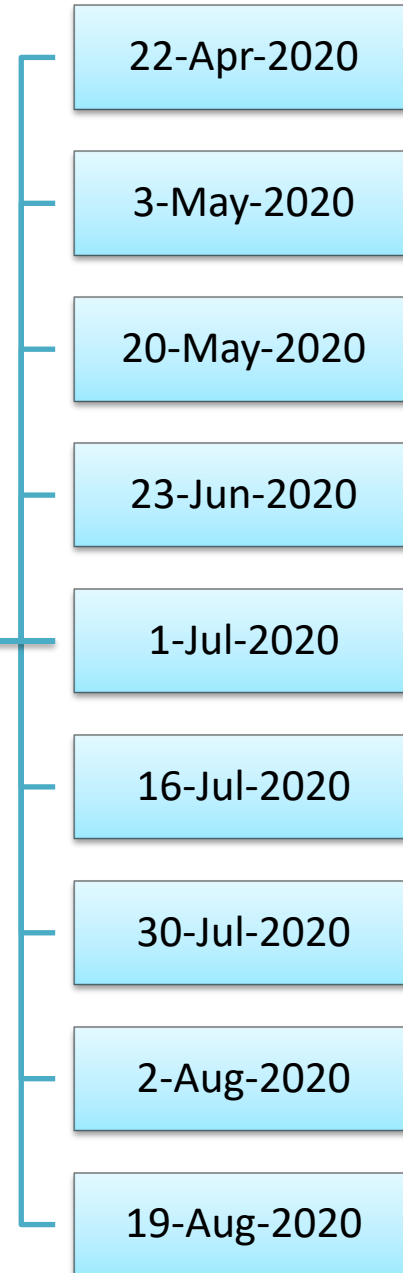
Patient surveillance Visualization



Patient surveillance

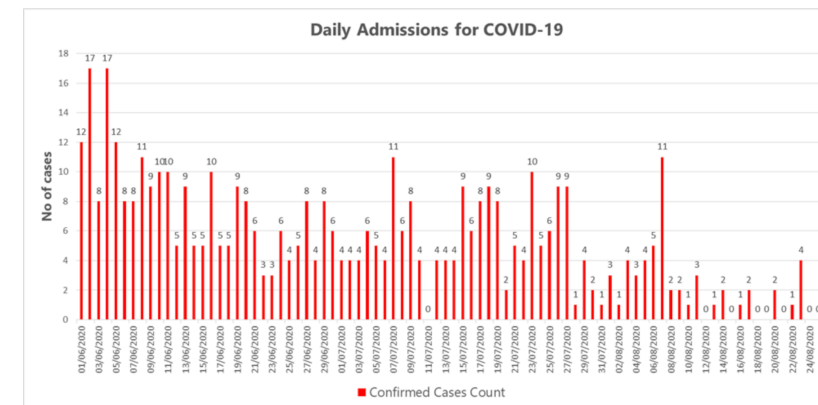
Patients admitted from 8 Apr – 26 Aug
(20 weeks)

**Hospital Wide
9 Alerts Generated**



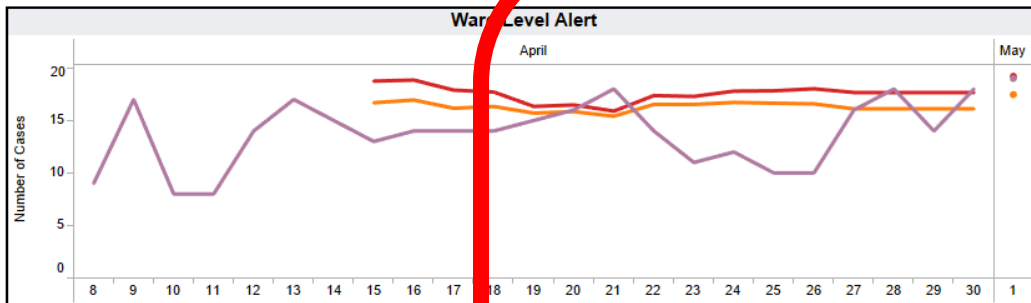
Patient surveillance

Results – Alerted Wards



COVID-19	22-Apr-20 (n=143)	3-May-20 (n=146)	20-May-20 (n=124)	23-Jun-20 (n=23)	1-Jul-20 (n=22)	16-Jul-20 (n=25)	30-Jul-20 (n=13)	2-Aug-20 (n=7)	19-Aug-20 (n=8)
Number of wards with alert	12	6	5	8	11	10	5	10	7
Total number of cases from Alerted Wards	381	193	101	209	383	254	250	301	298
Total number of COVID-19 cases from Alerted Wards	94	33	0	0	1	22	1	0	0

Movement



RV16

Ward No
(All)

Alert ARI
(All)

RV16
(All)

Ward No	April								25
	16	17	18	19	20	21	22	23	
W73A	52 0.98	43 1.00	44 1.00	53 0.98	63 1.00	64 1.00	59 1.00	51 0.98	58 1.00

Hospital Stay
8/4/2020 30/6/2020

Patient ID

Patient ID

Ward No
W73A

ARI Symptoms
(Multiple values)

Rv16
(All)

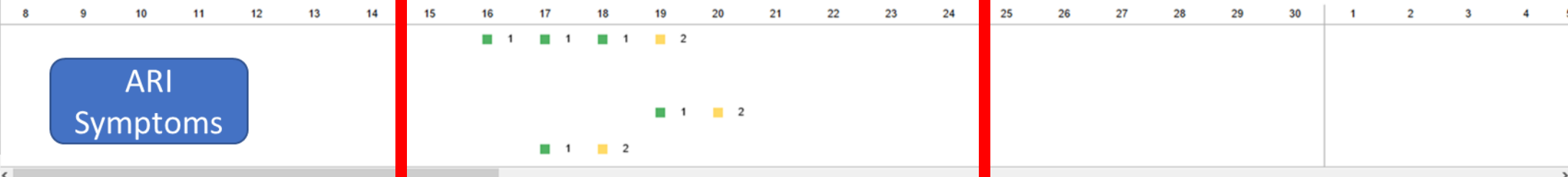
ARI Symptoms
1
2
3
4
5
6

Rv16
0
1

ARI Alert

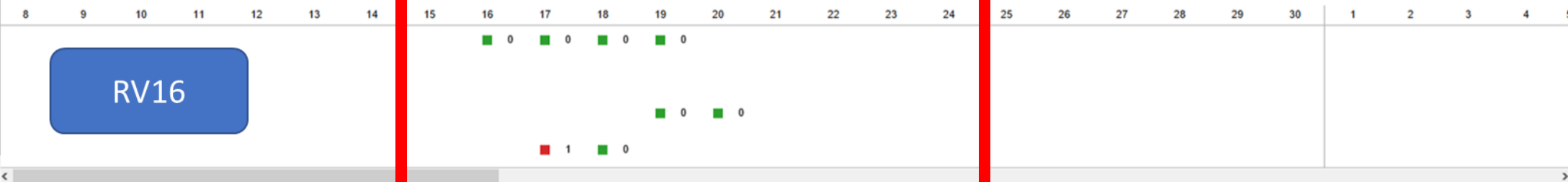
Ward No	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	
W73A																									

ARI Symptoms



ARI Symptoms

RV16



RV16

Covid-19D

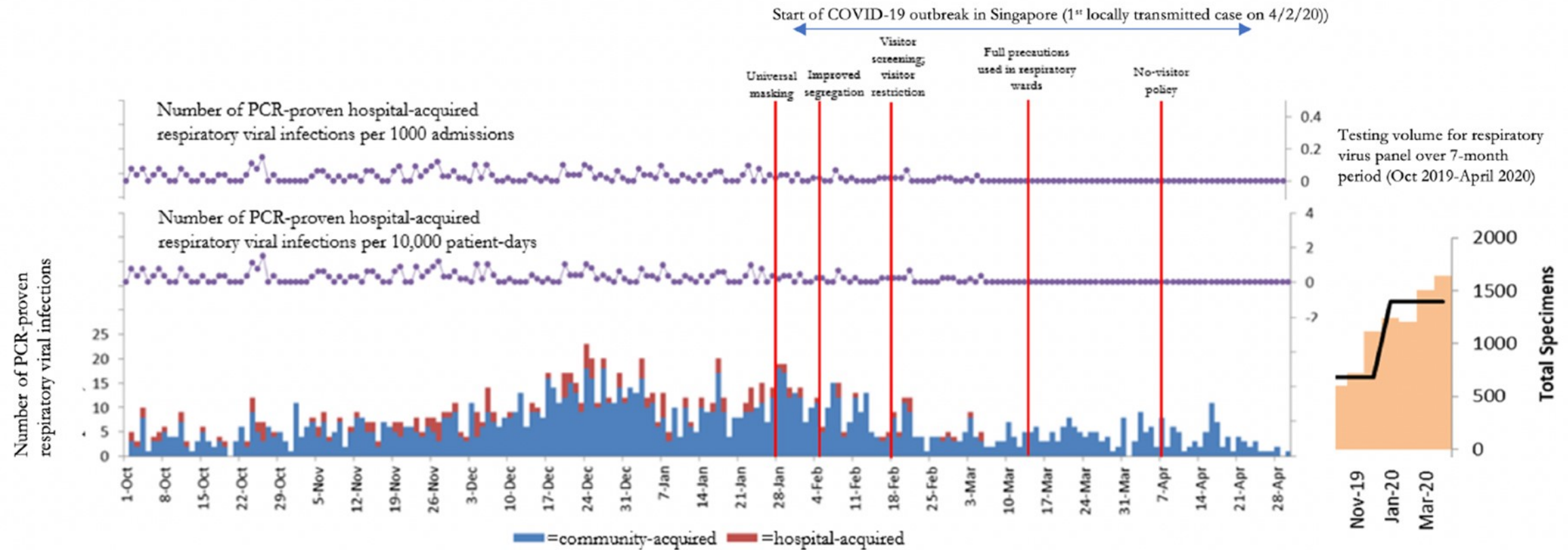
Covid-19D

3D Geosentinel mapping of disease outbreak surveillance



Patient surveillance

Figure 1: Trend of common respiratory viral infections (excluding SARS-CoV-2) at a tertiary hospital in Singapore over a seven-month period, after sequential implementation of infection control measures during a COVID-19 outbreak

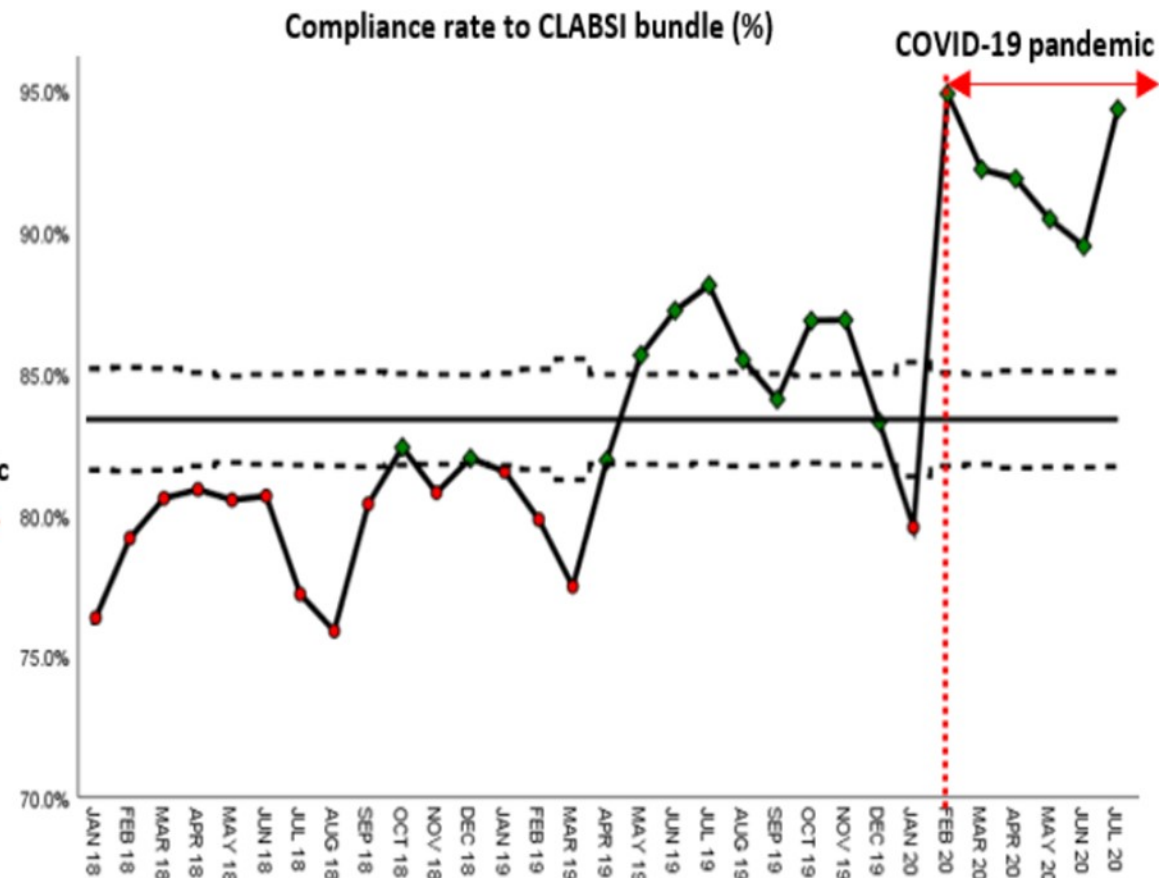
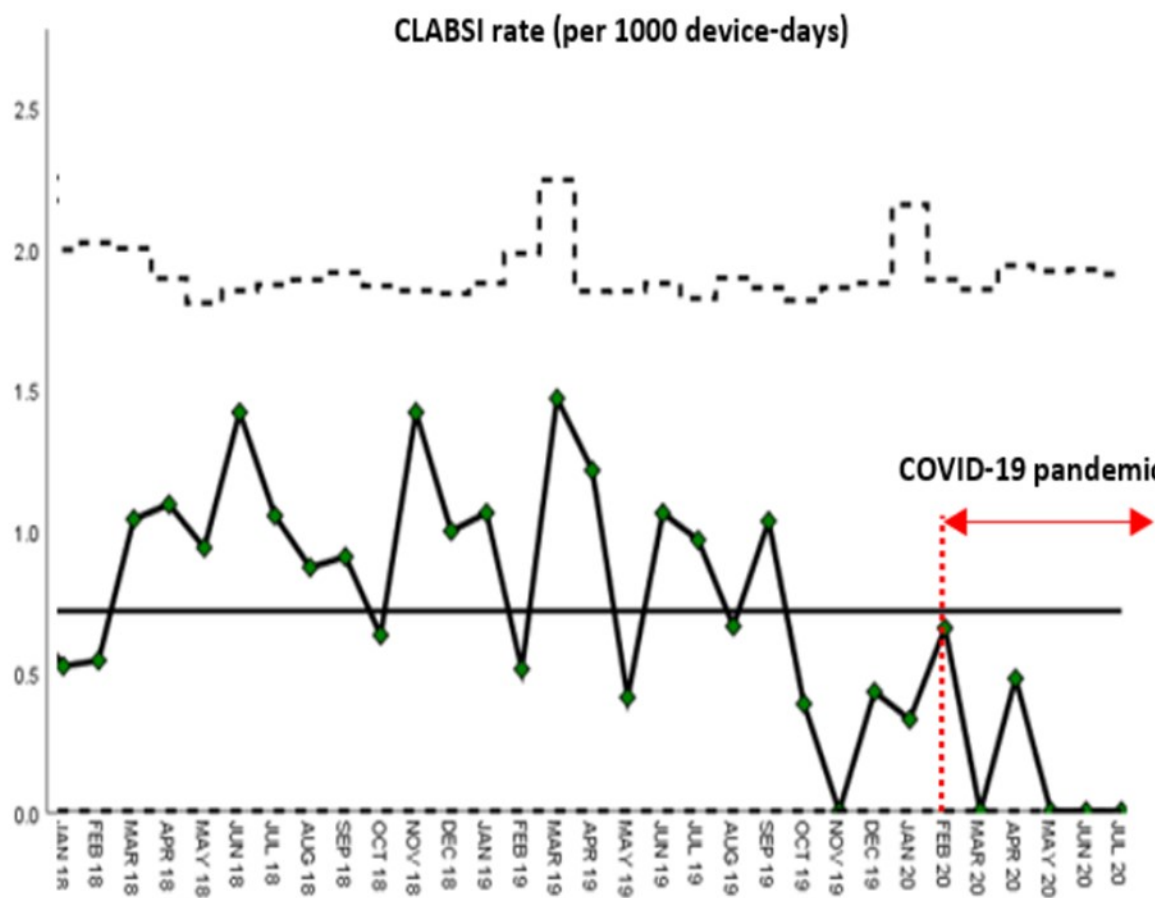


Wee, L. E. et al (2020). Reduction in healthcare-associated respiratory viral infections during a COVID-19 outbreak. *Clinical Microbiology and Infection*.

Patient surveillance - Limitations

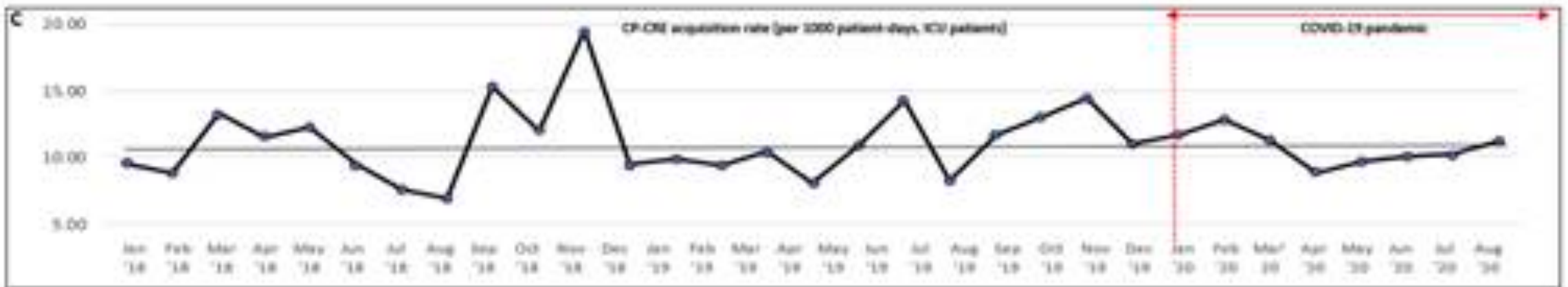
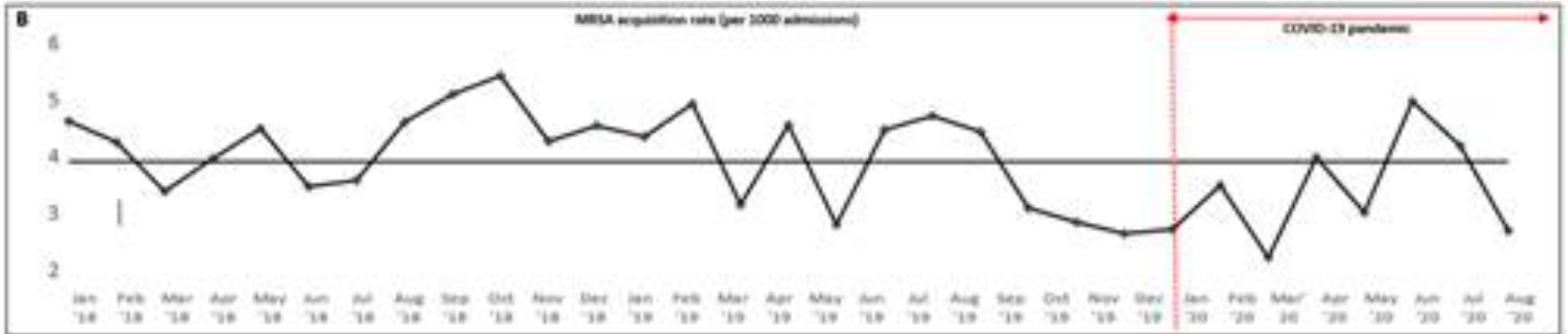
- Dependent on nursing input of symptoms
- Will not be able to detect asymptomatic cases
- Validation has to await end of pandemic due to enhanced clinical workflows and HCW vigilance and testing

CLABSI



MDROs

MRSA acquisition rate (per 1000 admissions)



CP-CRE acquisition rate (per 1000 patient-days, ICU patients)

Wee LE *et al.* Unintended consequences of infection prevention measures during COVID-19 pandemic. Manuscript under review.

Surveillance – COVID-19

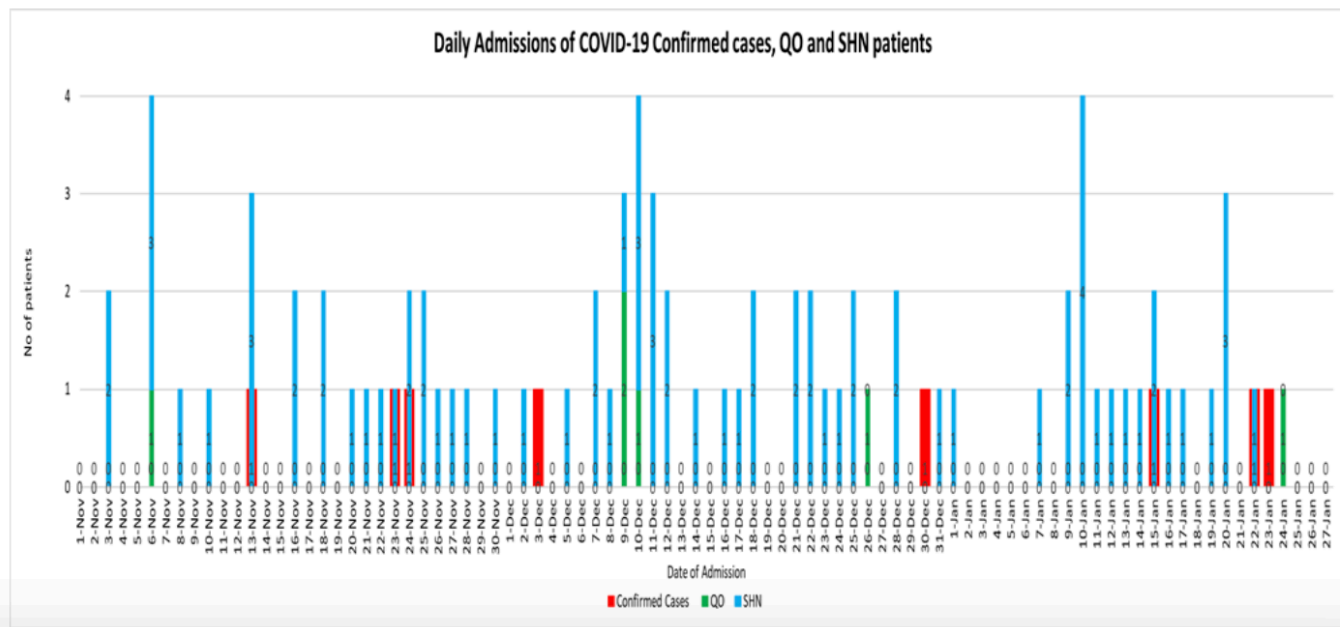
Patient Surveillance

Daily Census: Currently isolated COVID patients as of 27-Jan 2021, 0800HRS				Cumulative Summary From 06/01/2020
Active COVID-19 cases*	Location	Number	Remarks	Total number
		Ward 68 isolation	2	General Ward: 2 Patient ICU: 0 Patient
Total Confirmed Cases		2		

*Does not include suspect/ recovered cases

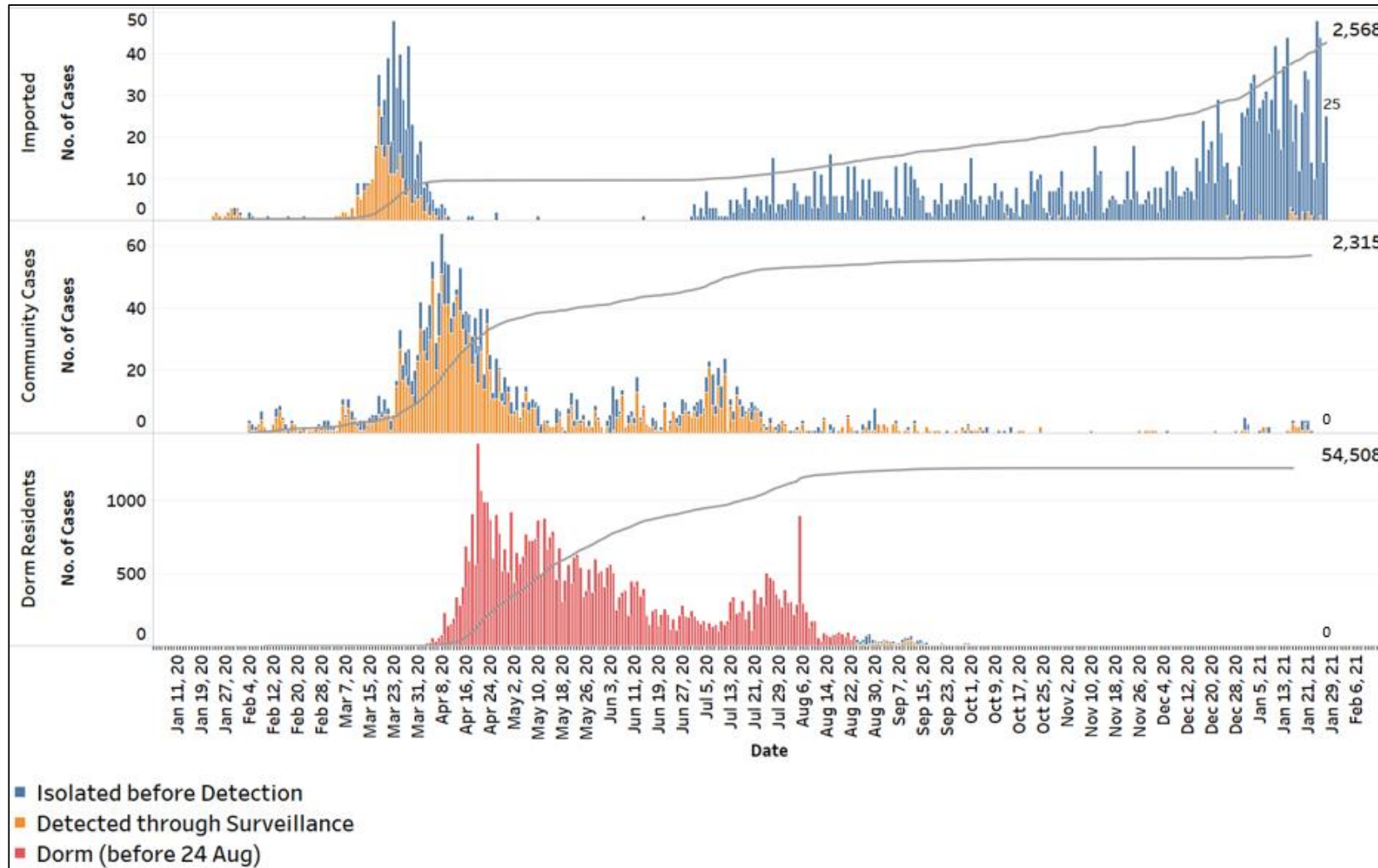
Daily Census: Currently admitted active QO & SHN as of 27-Jan 2021, 0800HRS			Cumulative Summary From 01/08/2020	Travel history (No. of patients)
Status	Location (single room)	No. currently admitted in each ward	Cumulative	
QO	Ward 68	1	23	-
SHN	Ward 68	3	167	Seamen* : Malaysia(3)
	Ward 43A	1		Non-Seamen: India(1)
Total		5	190	-

*For 'seamen' travel history refers to their last port of call.



MOH Singapore Daily Report, 27 Jan 2021

Figure 1.3: Epidemic Split Curve of the COVID-19 Outbreak by Press Release Date



AS OF JAN 19

POLICE PARA-VET COVID-19 CLUSTER

CASE 59280

POLICE PARA-VET, 32, M

ONSET OF SYMPTOMS: **JAN 11**

CONFIRMED: **JAN 13**

CASE 59347

WIFE, 28, F

ONSET OF SYMPTOMS: **JAN 14**

CONFIRMED: **JAN 15**

CASE 59387

FAMILY MEMBER, 44, F

ONSET OF SYMPTOMS: **JAN 9**

CONFIRMED: **JAN 17**

CASE 59365

POLICE ADMIN OFFICER, 44, M

ONSET OF SYMPTOMS: **JAN 7**

CONFIRMED: **JAN 16**

CASE 59395

FAMILY MEMBER, 66, F

ONSET OF SYMPTOMS: **JAN 9**

CONFIRMED: **JAN 17**

CASE 59393

WIFE, 43, F

ONSET OF SYMPTOMS: **JAN 10**

CONFIRMED: **JAN 17**

CASE 59428

SON, 8, M

ONSET OF SYMPTOMS: **JAN 17**

CONFIRMED: **JAN 18**

Infographic: Kenneth Choy
Source: Ministry of Health



AS OF JAN 21

BS INDUSTRIAL & CONSTRUCTION SUPPLY COVID-19 CLUSTER

CASE 59455

SALES PERSONNEL, 27, M

ONSET OF SYMPTOMS: **JAN 14**

CONFIRMED: **JAN 19**

CASE 59456

SALES PERSONNEL, 29, F

ONSET OF SYMPTOMS: **JAN 16**

CONFIRMED: **JAN 19**

CASE 59429

SALES PERSONNEL, 39, M

ONSET OF SYMPTOMS: **JAN 16**

CONFIRMED: **JAN 18**

CASE 59474

FINANCE PERSONNEL, 28, F

ONSET OF SYMPTOMS: **JAN 19**

CONFIRMED: **JAN 20**

CASE 59513

HOUSEHOLD CONTACT, 46, F

ONSET OF SYMPTOMS: **JAN 19**

CONFIRMED: **JAN 20**

CASE 59512

WIFE, 43, F

ASYMPTOMATIC

CONFIRMED: **JAN 20**

CASE 59516

SALES PERSONNEL, 35, M

ONSET OF SYMPTOMS: **JAN 18**

CONFIRMED: **JAN 20**

Infographic: Kenneth Choy
Source: Ministry of Health



Surveillance – COVID-19

Staff Surveillance

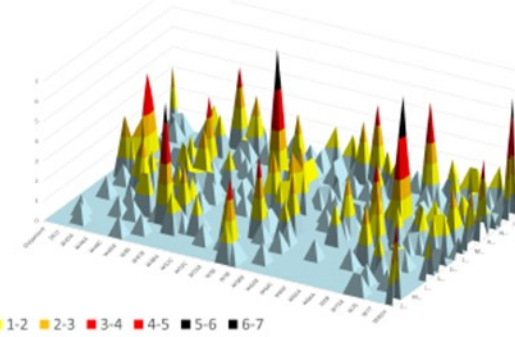
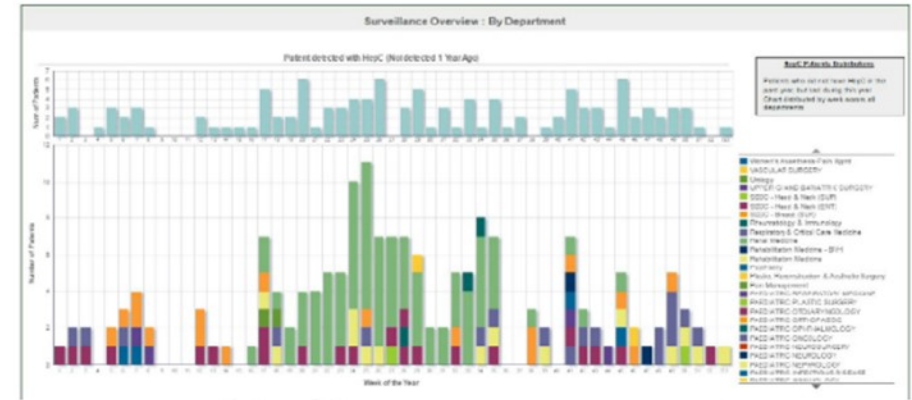
Weekly Census: Staff swabbed as of 18-Jan to 24-Jan 2021			Cumulative
Current Inpatient Admissions (positive)		0	7 (from 06/01/2020)
Outpatient	Staff clinic – swab taken	18/01/2021 (Mon) - 71 not detected 19/01/2021 (Tue) - 30 not detected 20/01/2021 (Wed) - 48 not detected 21/01/2021 (Thurs) - 56 not detected 22/01/2021 (Fri) - 37 not detected 23/01/2021 (Sat) - 08 not detected 24/01/2021 (Sun) - 0 not detected	8626 (from 07/02/2020)

Type of COVID Restriction Orders (Weekly updated as of 22-Jan-2021)	SGH Staff*		Non-SGH Staff*
	On-going	Completed	On-going
MOH Quarantine	0	92	1
Hospital-instituted Home Isolation due to Exposure	0	33	
Stay Home Notice	7	154	-
Leave of Absence	0	92	

*Excluding MOHH doctors

1st COVID-19 patient in SGH: 23 Jan 2020

Surveillance in a pandemic



Acknowledgements

- May Kyawt Aung
- Conceicao Edwin Philip
- Yang Yong
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- Ian Wee Liang En
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- Wong San See
- Lim Lay Keow
- Benjamin Jyhhan Kuo
- Jennifer Wong Tzu-Jung

- Data entry team
- Contact tracer team

- +++ Many others

