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Contact tracing of staff in the emergency department during the COVID-19 pandemic

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Singapore Med J 2021, 1–11

<https://doi.org/10.11622/smedj.2021013>

Published ahead of print: 12 March 2021

Online version can be found at
<http://www.smj.org.sg/online-first>

INTRODUCTION

COVID-19 was characterised as a pandemic by the World Health Organization on 11 March 2020.⁽¹⁾ Despite the implementation and tightening of control measures such as social distancing and border controls, the number of people getting infected worldwide has increased exponentially. As of 14 October 2020, there were 57,889 cases of COVID-19 in Singapore, with 28 reported deaths.⁽²⁾ In order to limit community transmission of COVID-19 in Singapore, all patients who test positive for the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are either admitted to hospitals or community care facilities. The latter are healthcare facilities that were set up outside hospitals during the pandemic for the purpose of providing care to COVID-19 patients who have mild symptoms and are at low risk for deterioration.⁽²⁾ COVID-19 patients are not sent home for self-isolation due to concerns about clinical deterioration and non-compliance to isolation requirements.

Contact tracing, an important step in managing emerging infectious diseases and pandemics, is mandatory for all patients with COVID-19 in Singapore.⁽³⁾ The process involves activity mapping to determine the movement and activities of the patient with COVID-19 from the incubation period before the onset of symptoms to diagnosis and isolation, identification of the close contacts, risk assessment of the close contacts and implementation of follow-up measures such as quarantine order or phone surveillance, as required, to prevent the further spread of COVID-19.⁽⁴⁾ Contact tracing in the community is performed by the Ministry of Health (MOH), Singapore, while contact tracing in the hospital is undertaken by the hospital.

In this commentary, we documented our emergency department's experience with using a real-time location system (RTLS) as an innovative way to facilitate contact tracing among healthcare workers during the COVID-19 pandemic.

RATIONALE FOR CONTACT TRACING OF STAFF IN THE EMERGENCY DEPARTMENT

Our institution is an academic tertiary hospital in an urban setting with 1,000 beds and an annual emergency department attendance of 120,000. Since the pandemic, the emergency department, which is at the frontline of the nation's healthcare response, has seen a surge in attendances. Contact tracing in the emergency department is therefore important, as many staff (e.g. doctors, nurses, radiographers, pharmacists, clerks, housekeepers, porters and security) will interact with patients who may be infected with COVID-19 when they move through the emergency department. All staff identified as contacts of a confirmed COVID-19 case after activity mapping are required by the MOH to undergo risk assessment, which takes into consideration the type of personal protective equipment (PPE) used, the type of procedure performed on the patient, and the duration and proximity of contact with the patient. This is important because it allows appropriate follow-up measures to be taken to prevent the spread of infection by exposed staff to other staff and patients in the emergency department. It also preserves precious manpower, allowing staff who are deemed to be at low risk of infection to continue to provide essential services in the emergency department.

PROCESS OF CONTACT TRACING

To facilitate activity mapping, identification of contacts and risk assessment during contact tracing, we make use of an RTLS that detects the location of staff and patients within the hospital. All staff working in the emergency department are assigned RTLS tags to carry with them while they are on shift, and all patients attending the emergency department have RTLS tags on the identification bands that are placed on their wrist at the point of triage (Fig. 1). The RTLS tags on staff and patients automatically interact with each other to provide information about actual contact within 2 m and the duration of contact. The RTLS tags on staff and patients

also automatically interact with the installed RTLS detectors (Fig. 2), thus providing information about their location and movement within the department as well as the duration spent in each area. As a safety net for situations such as staff forgetting to wear their RTLS tags or malfunctioning RTLS tags, which can affect the contact tracing process, we also created a form for our staff to manually log their contact with a patient (Appendix). This form remains with patients during their stay in the emergency department and is kept in their case files.



Fig. 1 Photograph shows the real-time location system tag (left) carried by staff when working in the emergency department and the tag attached to an identification band on a patient's wrist (right).



Fig. 2 Photograph shows real-time location system detector installed at the ceiling of the entry and exit points of different areas in the emergency department.

When a patient tests positive, the contact tracing team first extracts data from the RTLS for activity mapping. The patient's movement in the emergency department is plotted and then verified with the patient. Staff who were in close proximity with the patient or in the same location at the same time as the patient are identified. This information obtained from the RTLS is checked against the manual forms. Staff who had confirmed contact with the patient then receive a phone call to notify them of their contact with a positive case, and a brief interview is conducted to understand the nature of exposure and assess the risk of being infected. The staff are asked questions about the duration of the interaction, activity performed during the interaction, proximity of less than 2 m to the patient during the interaction, use of PPE during the interaction, and if they are experiencing any symptoms or feeling unwell.

With this information, the staff member's risk of exposure during the contact is assessed. High-risk contact is defined as contact without the use of eye shields, N95 respirators

or powered air-purifying respirators, gowns and gloves during aerosol-generating procedures regardless of duration of exposure, or contact without the use of at least a surgical mask during non-aerosol-generating procedures for more than 30 minutes. All other exposures are considered low-risk contact. If the risk is high, the staff member is placed on quarantine order, which is a legal order issued to close contacts of COVID-19 cases under Singapore's Infectious Diseases Act, with severe penalties for non-compliance.⁽⁵⁾ Contacts are not allowed to return to the workplace and need to be quarantined at home for 14 days from their last exposure to the patient. Conversely, if the risk is low, staff can return to work but will be placed on phone surveillance, whereby they are contacted daily to monitor their health status for 14 days from their last exposure to the patient for development of any symptoms of acute respiratory illness. This proactive approach to monitoring our staff is intended to allow infection among exposed staff to be detected promptly so that further spread to other staff and patients can be prevented. In addition, low-risk contacts are to limit their daily activities to essential ones to minimise contact with other individuals.

OUTCOMES OF CONTACT TRACING

As of 30 July 2020, contact tracing was performed for all 1,401 patients admitted with COVID-19 to our hospital through the emergency department. Out of these, seven cases had lapses identified or concerns raised during the contact tracing process (Table I). Among these, two cases were hospital staff who were diagnosed with COVID-19, and contact tracing was extended to staff and patients they had come into contact with before the diagnosis was made. Fortunately, none of the contacts subsequently developed COVID-19.

Non-compliance to the use of PPE during patient care was the main lapse identified by the contact tracing process, thereby necessitating a quarantine order to be issued. As it is impossible to know which patient has COVID-19, it is important for staff in the emergency

department to put on appropriate PPE to reduce the transmission of SARS-CoV-2 in the healthcare setting.^(6,7) Despite guidelines in place, compliance to the use of PPE can be fraught with issues of availability, discomfort, inconvenience, negative impact on patient care and perceived effectiveness.⁽⁸⁾ Therefore, it is important for the use of PPE to be clearly communicated to staff, with emphasis on the need for strict compliance.^(9,10)

Table I. Cases with risk of exposure to staff identified by contact tracing.

Case	Interaction between case and contacts	Action taken
1	1 staff member performed swab for SARS-CoV-2 without eye protection	Quarantine order
	3 staff members caring for the case in standard PPE* had prolonged exposure of > 30 min	Phone surveillance
2	1 staff member caring for the case in full PPE had prolonged exposure of > 30 min	Phone surveillance
3	1 staff member performed swab for SARS-CoV-2 on patient without eye protection	Quarantine order
	6 staff members caring for the case in full PPE had prolonged exposure of > 30 min	Phone surveillance
4	1 staff member performed swab for SARS-CoV-2 on patient without eye protection	Quarantine order
5	1 staff took off N95 respirator when speaking to patient's next-of-kin	Phone surveillance
6 [†]	1 colleague had extended interaction with case	Quarantine order
	2 patients were cared for by case and had prolonged exposure of > 30 min	Quarantine order
	1 colleague interacted with case for < 30 min	Phone surveillance
	3 patients and 1 caregiver interacted with case for < 30 min	Phone surveillance
7 [†]	4 colleagues had extended interaction with case	Quarantine order
	1 colleague interacted with case for > 30 min	Phone surveillance

**In our emergency department, the standard PPE for aerosol-generating procedures includes eye shield, N95 respirators or powered air-purifying respirator, gown and gloves. For non-aerosol-generating procedures, standard PPE includes a surgical mask. †Cases 6 and 7 were hospital staff who contracted COVID-19. PPE: personal protective equipment; SARS-CoV-2: severe acute respiratory syndrome coronavirus 2*

LIMITATIONS OF A REAL-TIME LOCATION SYSTEM

The current process of using an RTLS to facilitate contact tracing in our emergency department is not without limitations. The RTLS has been validated for use in contact tracing.⁽¹¹⁻¹³⁾

However, cost is a major consideration, as RTLS detectors and tags have to be purchased, detectors have to be installed, and RTLS tags must be assigned to staff and patients. The setup for RTLS detectors also requires meticulous planning before implementation. Therefore, this method may not be feasible for emergency departments without existing infrastructure for RTLS, and immediate implementation is unrealistic. Staff need to be reminded to bring these tags whenever they are on shift and to ensure they are adequately charged and functioning properly. As a safety net, the form used for manual logging is readily available and easy to fill in. However, it is dependent on the staff's compliance to fill in their details. In a busy emergency department, this can be cumbersome for staff to do so for every patient they come into contact with.

Other reported methods of contact tracing have been described and include continuous direct observation, self-reporting using activity diary, data extraction from administrative and clinical databases such as electronic medical records, and the use of closed-circuit television (CCTV) cameras.⁽¹⁴⁻¹⁸⁾ However, like our process, all these methods have their own limitations: continuous direct observation is labour intensive, self-reporting methods are subject to reporting bias, data extraction is incomplete as it is limited to providers with access, and CCTV systems are costly due to the need for setup and installation. Indeed, as there is no one ideal method for contact tracing, institutions or emergency departments would need to examine their needs and resources before adopting a method or a combination of methods best suited for their setting.

FUTURE DEVELOPMENTS

To further enhance our process of contact tracing in the emergency department, we are exploring the use of CCTV to help fill the gaps when staff or patient are unable to recall certain details about their interaction. In addition, Singapore has also developed the TraceTogether system to aid contact tracing in the community. Based on Bluetooth technology, TraceTogether is available as a wearable token and a downloadable smartphone application. Information regarding the proximity and duration of interaction between an infected person and close contacts can be obtained.⁽¹⁹⁾ TraceTogether can potentially be incorporated into our contact tracing process to enhance the accuracy and efficiency of the process, thereby increasing the effectiveness of disease containment.

CONCLUSION

Emergency departments are high-risk areas in a pandemic; patients with acute respiratory illness are undifferentiated and it is not possible to tell who is infected with COVID-19 without formal testing. Contact tracing in the emergency department is therefore important so that staff who have interacted with infected patients can be identified and measures instituted to prevent them from spreading the infection to others while performing their clinical duties.

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