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Utilisation of SARS-CoV-2 rapid antigen assays in screening asymptomatic hospital visitors: mitigating the risk in low-incidence settings

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ABSTRACT

Retrospective contact tracing, enabled by the use of automated visitor-management systems and digital contact tracing, together with rapid antigen detection (RAD) for SARS-CoV-2 among visitors staying ≥ 30 minutes, identified COVID-19 cases in $< 0.01\%$ (6/72 605) of hospital visitors to a large hospital campus over an 8-week study period. The potential for nosocomial transmission of SARS-CoV-2 from hospital visitors was thus very low, and could be further mitigated by universal mask-wearing among staff and visitors.

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Introduction

During the COVID-19 pandemic, while mandatory point-of-entry screening of hospital visitors for respiratory symptoms/fever has been widely implemented (Wee et al., 2021a), asymptomatic visitors may escape detection and have been implicated in nosocomial clusters (Passarelli et al., 2021). However, screening for COVID-19 among hospital visitors poses significant challenges. Polymerase chain reaction (PCR) is unsuitable for testing visitors, with long turnaround preventing real-time processing of results (Passarelli et al., 2021). Faced with these challenges, hospitals have adopted no-visitor policies; however, this poses risks of social isolation and psychological distress (Weiner et al., 2021). Rapid antigen detection (RAD) offers the potential for point-of-care testing; however, RAD testing in low-incidence scenarios, such as asymptomatic individuals, may result in low detection rates and a high number of false-positives (Kanji et al., 2021). Our study evaluated the utility of RAD testing for SARS-CoV-2 among visitors to a large hospital campus over an 8-week period in a low-incidence setting.

Methods

At our institution, a multi-pronged infection-prevention strategy was utilized for hospital visitors during the COVID-19 pandemic. This included symptomatic screening and automated thermal screening, with entry denied to visitors with fever/respiratory symptoms or significant travel/epidemiological history, as well as compulsory masking for all visitors (Wee et al., 2021b). Our campus comprised the largest tertiary hospital in Singapore (1735 beds), a 545-bed community hospital, and four subspecialty centers. A second wave of community transmission in May 2021 prompted tightening of visitor-management strategies. Usage of the national digital contact-tracing tool (Huang et al., 2021) to register entry/exit to/from hospital premises was made compulsory for all visitors. Linkage to the national test registry allowed retrospective contact-tracing of potential exposures arising from visitors who entered during their infectious period, and who subsequently tested positive for COVID-19 elsewhere.

Over an 8-week period from June 22 to August 17, 2021, all visitors intending to visit for ≥ 30 minutes had to first present a negative RAD test on the day of visit, as stipulated by our local Ministry-of-Health (MOH). RAD testing had to be performed by an MOH-approved provider or by our institution. PCR confirmation was required for all positive RAD results. Our institution used the

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Table 1
Epidemiological details of asymptomatic visitors at a large hospital campus in Singapore who subsequently tested positive for COVID-19, over a 6-week period

Case number	Visit reason	Duration of potential exposure during infective period	SARS-CoV-2 RAD done?	Number of HCW who came into significant contact with cases [†]	Number of HCW deemed to have significant unprotected contact requiring quarantine [‡]	Number of patients who came into significant contact with cases [†]	Number of patients deemed to have significant unprotected contact requiring quarantine [‡]
Case 1	Family member of patient	0.5 hours	Not done (visit duration < 30 minutes)	5	5	2	2
Case 2	Family member of patient	4 hours (2-hour visits on two consecutive days)	Not done (self-declared short visit duration)	4	0	5	5
Case 3	Family member of patient	1 hour (0.5-hour visits on two consecutive days)	Not done (visit duration < 30 minutes)	20	1	9	9
Case 4	Family member of patient	0.5 hour (single visit)	Not done (visit duration < 30 minutes)	4	0	5	5
Case 5	Family member of patient	0.5 hour (single visit)	Not done (visit duration < 30 minutes)	12	0	4	4
Case 6	Caregiver of patient	2 hours (1-hour visits on two consecutive days)	SARS-CoV-2 RAD positive on 3rd visit	7	0	0	0

[†] Risk stratification was conducted based on the duration of contact, nature of activity, and personal protective equipment (PPE) utilized at the time of contact. Significant contact was defined as having had contact within 2 m of the index case for a cumulative time of ≥ 15 minutes.

[‡] Risk stratification was conducted based on the duration of contact, nature of activity, and personal protective equipment (PPE) utilized at the time of contact. Significant unprotected contact was defined as not having utilized N95 respirators during a significant contact episode and/or not having donned disposable gowns/gloves during episodes of physical contact with the index case.

BD Veritor antigen rapid test-kit, with a positive-percent agreement of $\geq 80\%$ and negative-percent agreement of 99.5% compared with PCR (Young et al., 2020). Over the same period, our epidemiology team was updated by our local MOH of COVID-19 cases who had visited our hospital campus during their infectious period, based on records of the national digital contact-tracing tool. Retrospective contact-tracing and post-exposure surveillance of exposed staff/patients was subsequently conducted. Our institution maintained surveillance through fortnightly rostered-routine PCR testing of all staff, and weekly testing of all inpatients (Wee et al., 2021c); this expanded surveillance allowed us to assess if any COVID-19 cases could be epidemiologically linked back to positive visitors.

Results

During the study period, 72 605 visitors visited our hospital campus, with an average of 1273.8 visitors/day (SD = 426.8). Less than one-fifth (17.6%, 12 763/72 605) of visitors remained on hospital premises for ≥ 30 minutes, based on automated visitor-management system data; the majority (82.4%, 10 521/12 763) underwent RAD testing. Five visitors (0.05%, 5/10 521) tested positive on RAD; of those, four were false-positives, with a single true-positive confirmed by PCR. Separately, based on records from the national digital contact-tracing tool, five other asymptomatic visitors with PCR-confirmed COVID-19 infection entered our campus during their infectious period; the majority (4/5) stayed < 30 minutes and hence did not undergo RAD testing. The epidemiological details are listed in Table 1. In total, 77 patient and staff close-contacts were identified on contact-tracing; none tested positive

on subsequent 14-day surveillance. The majority of staff (88.4%, 46/52) did not require furlough. No nosocomial COVID-19 clusters were detected over the study period, despite intensive surveillance of staff and patients. Over the same period, 0.3% (31/9679) of admitted inpatients tested positive for COVID-19.

Discussion

Antigen testing for SARS-CoV-2 among asymptomatic visitors in a low-incidence setting is resource intensive and low yielding. Close to 200 asymptomatic visitors were tested daily over an 8-week period, with detection of a single PCR-confirmed case. Retrospective contact tracing enabled by the use of automated visitor-management systems and digital contact-tracing, together with RAD testing for visitors staying ≥ 30 minutes, identified COVID-19 cases among < 0.01% (6/72 605) of hospital visitors. In the same period, RAD testing of all admissions via our hospital's emergency department yielded a positive rate of 0.6% (40/6665), of which the majority (29/40) were true positives (Wee et al., 2021d). However, antigen testing may remain relevant during high ongoing community transmission; increases in rates of antigen positivity among asymptomatic visitors were noted during subsequent pandemic waves (Tischer et al., 2021).

Antigen testing remains logistically challenging for large health-care facilities. During our study, ≥ 1200 visitors entered our campus daily; RAD-testing was thus only feasible if restricted to visitors staying for ≥ 30 minutes. The risk of transmission from asymptomatic visitors was further mitigated by universal masking among visitors and usage of appropriate personal protective equipment among staff.

Declaration of Competing Interest

The authors report no conflicts of interest.

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Ethical approval

As this study was conducted as part of outbreak investigation, ethical approval was not required under our institutional review board guidelines.

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