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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

Table S1 Rates and trends in monthly CNS-active and comparison medication use among long-stay nursing home residents with dementia

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Reduction in respiratory viral infections among hospitalized older adults during the COVID-19 pandemic

INTRODUCTION

Respiratory viral infections (RVI), such as influenza, carry significant morbidity and mortality in older individuals.¹⁻⁴ Hospitalization for RVIs are associated with significant functional decline⁵ and greater need for assistance in activities of daily living upon discharge.⁶ All-cause mortality attributed to RVIs also increases with advancing age; reaching approximately 6%–7% in individuals aged ≥ 85 years.⁷ Vaccination has been the mainstay of public health measures aimed at lowering the risk of influenza among older adults⁸; however, vaccines do not currently exist for other significant common RVIs, such as parainfluenza and respiratory syncytial virus.^{3,4} The COVID-19 pandemic provided the impetus for widespread introduction and adoption of public health measures intended to mitigate community transmission of SARS-CoV-2. These public health measures maintained over a sustained time period allowed us to assess their potential impact on

reducing hospitalizations for other common RVIs among older adults.

METHODS

At our institution (Singapore General Hospital), patients presenting with respiratory symptoms and clinical features compatible with a RVI (e.g., normal serum procalcitonin) were tested for common RVIs at the discretion of the managing physician, using a multiplex polymerase chain reaction (PCR) assay for 16 common respiratory viruses. We defined community-onset RVI as a positive result on multiplex PCR within 72 h of admission. We compared rates of PCR-positive community-onset common RVIs (influenza and noninfluenza) among hospitalized older individuals (aged ≥ 65 years) during the pandemic (February 2020 onwards) with figures from the preceding 2 years (2018–2019), using the incidence-rate-ratio (IRR) methods and χ^2 test.

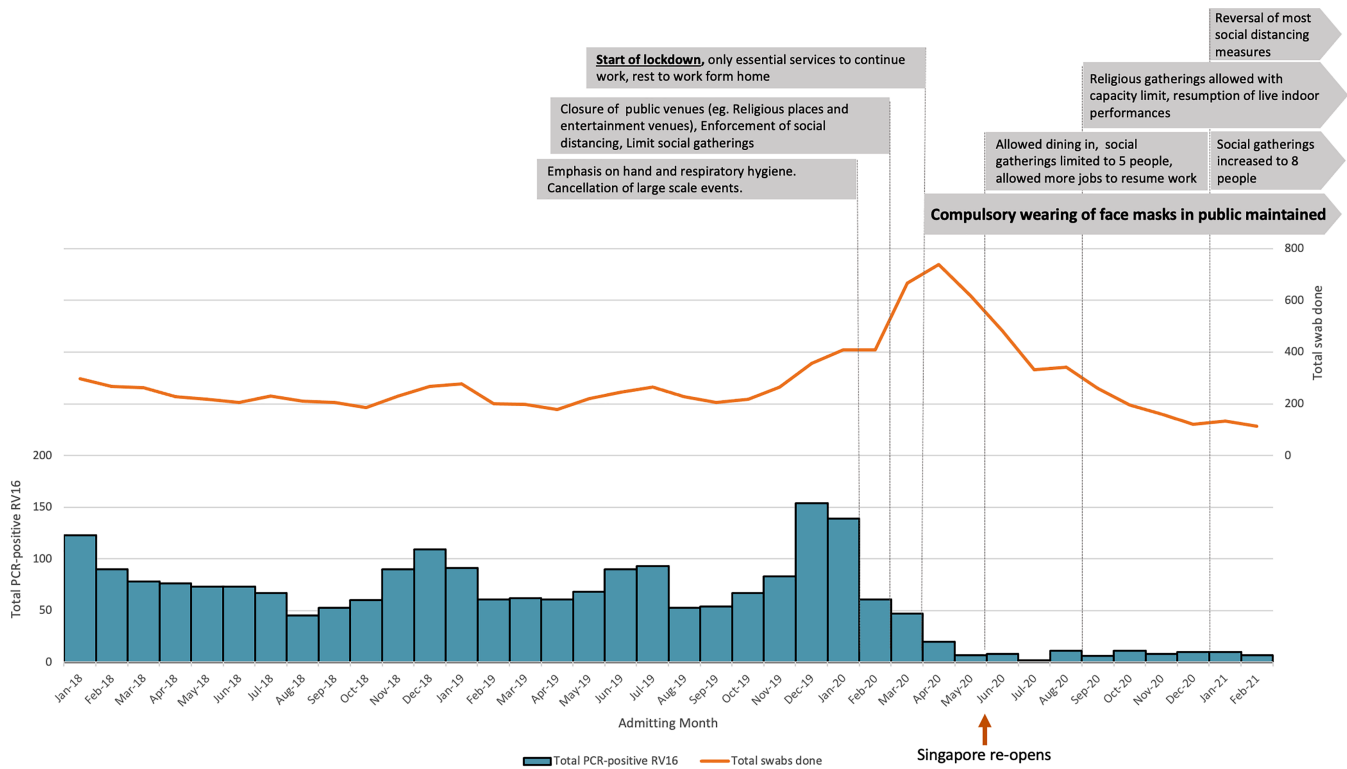


FIGURE 1 Trend of polymerase chain reaction positive RV-16 hospital admissions in the elderly. Line graph depicts the total number of RV-16 swabs done. Standard respiratory virus multiplex panel (RV-16) at our institution included: respiratory syncytial virus A/B, influenza A/B, parainfluenza viruses 1–4, metapneumovirus, rhinovirus A/B/C, human coronavirus OC43/229E/NL63, adenovirus, human enterovirus, and human bocavirus 1–4

RESULTS

Introduction of public health measures to prevent SARS-CoV-2 transmission coincided with a significant reduction in hospitalizations of older adults with PCR-positive community-onset RVI. Prepandemic, our institution saw an average of 80 (SD = 27) cases a month; this decreased substantially ($p < 0.001$) to 18 (SD = 18) cases per month during the pandemic period (Figure 1). This was despite an increase in testing (February–August 2020) in our center due to heightened vigilance for respiratory symptoms during the pandemic. In the prepandemic period, among older inpatients, the incidence of PCR-proven community-onset influenza prepandemic was 9.0 cases per 1000 admissions (858 cases, 94,396 admissions) compared to the pandemic period of 0.9 cases per 1000 admissions (37 cases, 40,810 admissions). The difference was statistically significant (IRR = 0.10, 95% confidence interval [CI] = 0.07–0.134, $p < 0.001$). Similarly, for other common RVIs (excluding influenza), in the prepandemic period, the incidence of PCR-proven community-onset RVI (noninfluenza) prepandemic was 12.2 cases per 1000 admissions (1155 cases, 94,396 admissions) compared to the pandemic period of 4.2 cases per 1000 admissions

(171 cases, 40,810 admissions). This reduction was also statistically significant (IRR = 0.34, 95% CI = 0.29–0.40, $p < 0.001$).

DISCUSSION

The COVID-19 pandemic provided a unique opportunity to observe the potential secondary impact of public health measures on the incidence of hospitalizations due to common RVIs among older Singaporeans. During the SARS pandemic in 2003, a decrease in influenza rates also coincided with an increase in mask-wearing within the community; however, as mask-wearing was implemented as part of a package of multiple public health measures, it was not possible to evaluate its true impact. Nonetheless, mask-wearing was advocated by World Health Organization (WHO) as a potential measure during future pandemics caused by respiratory viruses.⁹ Similarly, the observational nature of our study precluded the evaluation of the individual contribution of each public health measure. However, the phased introduction and sequential relaxation of these measures during the COVID-19 pandemic allowed us to observe if a rebound in common RVIs

(influenza and noninfluenza) would occur in tandem with the relaxation of specific measures. When lockdown was lifted and social distancing measures reversed, mandatory mask-wearing in public remained in-force. The decrease in hospitalizations for common RVIs among older adults remained with no rebound in admissions. Advocating mask-wearing may thus be an effective and simple way to reduce community-based transmission of common RVIs, especially among the vulnerable older population. This bolsters current literature demonstrating the protective effect of mask-wearing against influenza transmission.¹⁰

Our study has several limitations. First, seasonality in the incidence of various RVIs may result in chance variations in the rates of RVIs; however, at our institution, surveillance for common RVIs was maintained over an entire year during the pandemic period, reducing the likelihood that these observations were due to seasonal variation alone. Furthermore, it is possible that a potential increase in uptake of influenza vaccination as a result of public health campaigns during the pandemic period could explain some of these results; however, significant reductions in admissions for community-onset RVI were demonstrated not just for PCR-proven influenza, but also for other common RVIs which are not vaccine-preventable.

CONCLUSION

The significant and sustained decrease in incidence of hospitalizations due to RVIs among older Singaporeans suggests that the role of simple preventive measures, such as the wearing of face-masks, deserves further study in the postpandemic era, given the significant morbidity and mortality attributable to common RVIs in this vulnerable population.

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CONFLICT OF INTEREST

The authors report no conflicts of interest.

AUTHOR CONTRIBUTIONS

Jing Y. Tan had full access to all the data in the study and takes responsibility for the integrity of the data and accuracy of data analysis. Concept and design: Liang E. Wee, Jing Y. Tan, Indumathi Venkatachalam. Acquisition, analysis or interpretation of data: Jing Y. Tan, Liang E. Wee, Edwin P. Conceicao. Drafting of manuscript: Jing Y. Tan. Critical revision of manuscript for important intellectual content: Liang E. Wee, Indumathi Venkatachalam. Statistical analysis: Jing Y. Tan, Edwin P.

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