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## Letter to the Editor

## Awareness, acceptance, and adoption of the national digital contact tracing tool post COVID-19 lockdown among visitors to a public hospital in Singapore

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## To the Editor

Coronavirus disease 2019 (COVID-19) was first imported into Singapore on 22nd January 2020 by a tourist from Wuhan, China. Since 4th February 2020, local clusters of COVID-19 emerged, rapidly progressing to multiple unlinked clusters over the subsequent months [1]. A partial lockdown—including restrictions on social activities and activities involving close physical proximity (e.g. employment)—was implemented from 7th April to 1st June 2020 to curb local transmissions. These restrictions were gradually lifted as cases of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections in the general community decreased [2].

A good contact tracing system that enables rapid identification and quarantine of COVID-19 close contacts is crucial for outbreak management in the early phase of an outbreak [3]. However, manual contact tracing is laborious, time-consuming, and non-scalable in a pandemic. Therefore, Singapore developed a national digital contact tracing (DCT) tool—'TraceTogether' (available as a smartphone application (app) and Bluetooth-enabled token)—to augment the nation's manual contact tracing efforts [4]. Since

March 2020, the TraceTogether app has been upgraded to enhance its performance [5]. DCT tools are effective only if adoption consistently attains a critical mass of >60% of the population during activities involving prolonged close contact [6].

As Singapore gradually eased restrictions, substantial media coverage has informed the public on the importance of TraceTogether in complementing Singapore's contact tracing efforts. From 14th September 2020, the Singapore government began distributing TraceTogether tokens to all Singapore residents, in preparation for the further lifting of restrictions (i.e. reopening of bars and nightclubs). On 20th October, an announcement was made on the mandatory use of TraceTogether for entry into public venues (i.e. restaurants, workplaces, schools and shopping malls) [7].

Since awareness and acceptance of (willingness to use) DCT are prerequisites for adoption (actual use) of DCT technologies, understanding the levels of awareness and acceptance of such tools within communities can guide strategies to increase adoption. We interviewed visitors (patients and caregivers) to two busiest ambulatory clinics at Tan Tock Seng Hospital, a large public hospital in Singapore, to assess their awareness of, willingness to use (acceptance), and actual use (adoption) of TraceTogether, from 6th July through 31st December 2020. Up to 160 Singapore residents were purposively sampled weekly and stratified by gender and age categories, giving study samples of 21–50 years ( $n = 818$  males, 793 females) and 51–80 years ( $n = 807$  males, 822 females).

In an interviewer-administered questionnaire, we asked respondents if they were aware of the TraceTogether app or token. Depending on whether the respondent owned a smartphone, we assessed their willingness to use and their actual use of the app or token. Of 3240 respondents surveyed, 92% were aware of TraceTogether and 74% were willing to use the tool, but only 49% adopted the app or token. In July (1 month post lockdown), the awareness, acceptance, and adoption rates of TraceTogether among older adults (aged 51–80) with smartphones were lower than in younger adults (aged 21–50). Among smartphone users, the levels of awareness of TraceTogether increased from 87% in July to 99% in December in younger adults and from 80% to 99% in older adults.

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While acceptance rates increased from 65% to 89% in older adults and 69% to 83% in younger adults, adoption rates increased only moderately to 79% in older adults and 70% in younger adults (Fig. 1). In contrast, the adoption rates among respondents without a smartphone more than doubled from 8% in July to 47% in December after the mass distribution of tokens (Fig. 1).

Although the awareness of TraceTogether was approaching 100%, adoption had prominently lagged behind, suggesting gaps between the user's perception and actual functionality of the DCT tool. The higher acceptance but lower adoption rates of TraceTogether among older adults earlier in the study suggests an intergenerational digital divide with the adoption of DCT tools [8]. As the widespread distribution of TraceTogether tokens occurred only halfway through the study, older adults without smartphones were unable to adopt TraceTogether, while those with smartphones may have faced difficulties in downloading and using the app. Although the distribution of tokens may have addressed adoption barriers for older adults, it may not increase adoption in younger adults who preferred the token less and were also less accepting of DCT tools [8].

The mass distribution of tokens was an appropriate move as adoption rates of TraceTogether among older adults and respondents without smartphones increased substantially after the distribution was implemented. The tokens also served as an alternative for smartphone users who had concerns about the compatibility and battery consumption of the TraceTogether app. We expect the adoption of TraceTogether to increase in the coming months with its mandatory use for entry into public venues. Despite this, users' concerns with the use of DCT (including privacy and technical issues) should be continuously addressed to further increase acceptance and voluntary adoption. Further work to assess pertinent factors surrounding user acceptance of DCT tools is critical to increase adoption and sustained use of such tools during the COVID-19 pandemic. One limitation of the study was its focus on visitors to a public hospital, although a good representation of gender and ages were sampled. Nonetheless, the insights from the study could provide guidance on strategies to enhance contact tracing during the protracted pandemic.

Given the multifaceted factors influencing the use of DCT tools, a tailored approach comprising a mix of engagement,

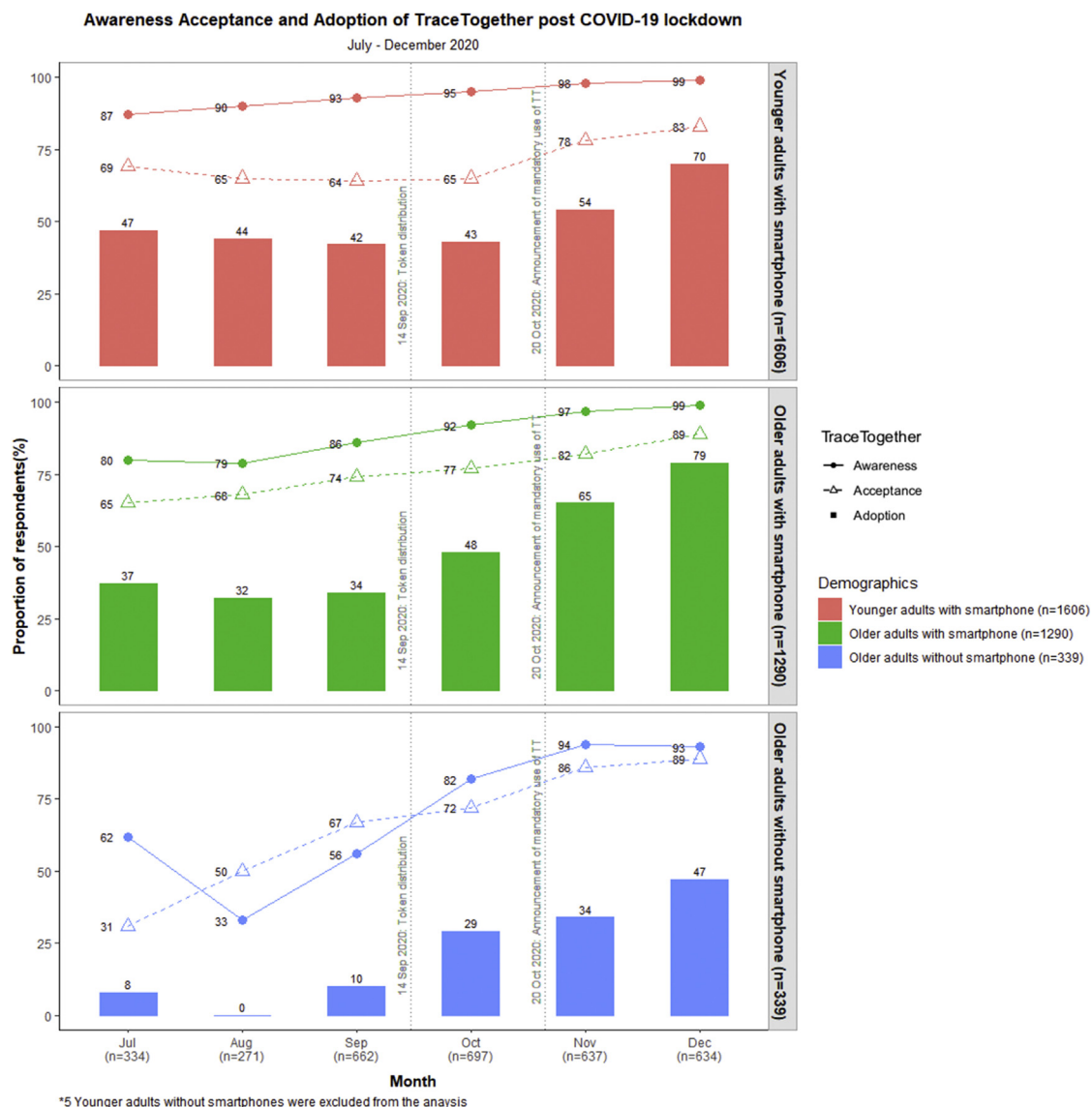


Fig. 1. Awareness, acceptance, and adoption of 'TraceTogether' among visitors to a public hospital in Singapore.

education, enforcement, and tool enhancements targeting different segments of the population would be required to increase and sustain the nationwide adoption rate of TraceTogether at  $\geq 70\%$  [7].

### Ethics approval

This study was approved by the National Healthcare Group Domain Specific Review Board in Singapore. NHG DSRB Ref: 2020/00775.

### Author contributions

ZH, HG and AC conceived the manuscript. ZH drafted the manuscript and interpreted the data. HG analysed the data and provided inputs to the manuscript draft. HYFL and AC provided support for the study and study planning. All authors reviewed and approved the final version of the manuscript prior to submission.

### Transparency declaration

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