Early SARS-CoV-2 Reinfections within 60 Days and Implications for Retesting Policies

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Illustrated by a clinical case supplemented by epidemiologic data, early reinfections with SARS-CoV-2 Omicron BA.1 after infection with Delta variant, and reinfection with Omicron BA.2 after Omicron BA.1 infection, can occur within 60 days, especially in young, unvaccinated persons. The case definition of reinfection, which influences retesting policies, should be reconsidered.

The sequential emergence of SARS-CoV-2 variants of concern (VOCs), characterized by an antigenic drift and higher transmissibility, has been observed in countries around the world at least 3 times during the past 13 months (*1*). Although the SARS-CoV-2 Delta variant showed a limited antigenic diversity with previous VOCs, Omicron differs more notably from other VOCs than any previous VOC did at the time it emerged (K. Van der Straten et al., unpub. data, https://www.medrxiv.org/content/10.1101/2022.01.03.21268582v2). The resulting decrease of antibody efficacy in both convalescent and vaccinees' serum samples drives the high number of reinfection and vaccine breakthrough cases observed with Omicron compared with observations made during previous waves (*2*,*3*).

To date, reinfections with SARS-CoV-2 are defined by the European Centre for Disease Prevention and Control as a positive PCR or rapid antigen test ≥60 days after previous positive PCR, rapid antigen test, or serologic test (*4*). This definition has influenced testing strategies in several countries, and many countries consider a person protected for 180 days after an initial positive test result (*5*). We suggest that this reinfection definition should be revised.

To illustrate our point, we report a case of an immunocompetent unvaccinated 10-year-old boy with no noteworthy medical history who tested positive for SARS-CoV-2 Delta variant (≥7.0 log copies/mL, sublineage AY.43) on December 3, 2021, concomitant with an outbreak at the patient's school. The patient's brother and mother, both vaccinated, were infected as well. All 3 persons experienced mild COVID-19 symptoms. Because of a sports-related trauma, the patient was admitted for surgery on January 11, 2022. Preprocedural SARS-CoV-2 screening detected a strong positive result (5.1 log copies/mL) with Omicron BA.1 variant, only 39 days after the patient's infection with Delta. The patient remained pauci-symptomatic. High-risk contact screening of the patient's brother detected a low viral load; the mother tested SARS-CoV-2–negative (Appendix Table, https://wwwnc.cdc.gov/EID/article/28/8/22-0617-App1.pdf).

To put this clinical case into a wider epidemiologic context, we estimated the incidence of early reinfection with Omicron BA.1 after Delta infection and reinfection with Omicron BA.2 after BA.1 infection in a community setting (Flemish Brabant, Belgium). During December 1, 2021–February 7, 2022 (n = 9 weeks), a period characterized by the full viral replacement of Delta by Omicron BA.1 (Appendix Figure 1) (*6*), a total of 59,515 ambulatory patients tested SARS-CoV-2–positive at the federal testing platform located in Leuven, Belgium (positivity rate 36.5%). Among these patients, the spike (S) gene was detected in a first sample in 0.15% (91/59,515 persons) by using the TaqPath PCR test (ThermoFisher Scientific, https://www.thermofisher.com), which suggests Delta infection. S gene target failure was reported in a second positive sample within this period (nucleocapsid gene cycle threshold <27.8), indicating a reinfection with Omicron BA.1 briefly after Delta infection (*7*).

Similarly, during January 1, 2022–March 10, 2022 (n = 9 weeks), a period characterized by the emerging viral replacement of Omicron BA.1 by BA.2 but declining disease prevalence (Appendix Figure 1) (*6*), a total of 58,166 patients tested SARS-CoV-2–positive (positivity rate 48.3%). Among these, 0.01% (5/58,166) demonstrated S gene target failure in a first sample but an S gene was detected in a second positive sample, indicating a reinfection with Omicron BA.2 after BA.1 infection in these patients.

We noted the age and vaccination status of these 96 patients with documented early reinfection and compared that with the vaccination rate for the same age groups in the same geographic region (Flanders, Belgium) (Figure) (*8*). Early reinfections were most frequently observed among young unvaccinated patients (<12 years of age). Compared with the

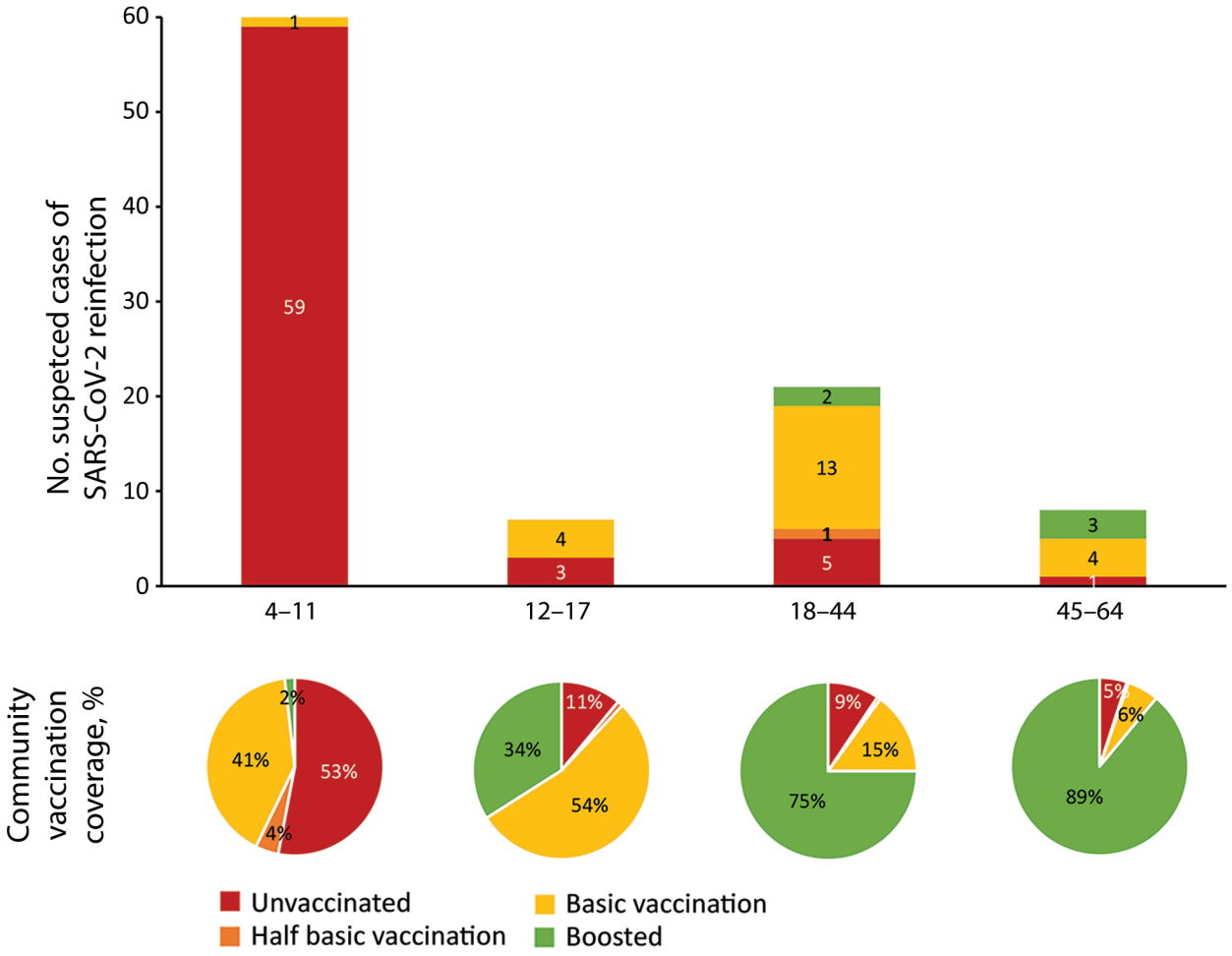

Figure. Number of patients with presumed SARS-CoV-2 reinfection including vaccination status compared with age-corresponding vaccination coverage in the community, Flanders, Belgium. Consecutive infections were detected during December 1, 2021–February 7, 2022 (reinfection with Omicron BA.1 shortly after Delta infection, n = 91 patients) and during January 1–March 10, 2022 (reinfection with Omicron BA.2 shortly after Omicron BA.1 infection, n = 5 patients). Half basic vaccination indicates 1 vaccine of ChAdOx1 nCoV-19 (AstraZeneca, https://www.astrazeneca.com), BNT162b2 (Pfizer-BioNTech, https://www.pfizer.com), or mRNA-1273 (Moderna, https://www.modernatx.com); basic vaccination indicates 2 vaccines of ChAdOx1, BNT162b2, or mRNA-1273 or 1 vaccine of Ad26.COV2.S (Johnson & Johnson/Janssen, https://www.janssen.com); boosted indicates basic vaccination followed by 1 vaccine of BNT162b2 or mRNA-1273.

corresponding age groups in the general population, patients with early reinfections tended to be unvaccinated, partially vaccinated, or vaccinated but not boosted. Median time between the 2 positive samples with different VOCs was 47 days (range 17–65 days) (Appendix Figure 2).

Previous retrospective cohort studies (2) showing a prolonged maintenance of protection against reinfection should be questioned after the emergence of Omicron. Our data confirm that early Omicron BA.1 reinfection (<60 days) after Delta infection and BA.2 reinfection after BA.1 infection can occur, especially in young, unvaccinated persons. In older patient groups, unvaccinated persons and persons who had received basic vaccination but no booster might be more vulnerable to reinfections than patients who received a first booster vaccine. Data from Denmark (M. Stegger et al., unpub. data, https://www.medrxiv.org/content/10.1101/2022.02.19.22271112v1) suggest reinfection usually results in mild disease not requiring hospitalization, as demonstrated by the case we report here.

The occurrence of a full viral replacement in a matter of weeks will continue to affect the duration and efficacy of immunity in the future. For this reason, in cases of sustained variant circulation, indications for retesting persons after a previous SARS-CoV-2 infection within 180 days are limited.

However, in cases of cocirculation or switch of VOC with antigenic drift within this period, this minimum retesting interval should be omitted to adequately detect SARS-CoV-2 reinfections.

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Household Secondary Attack Rates of SARS-CoV-2 Omicron Variant, South Korea, February 2022

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We studied the effect of booster vaccinations on reducing household transmission of SARS-CoV-2 B.1.1529 (Omicron) variant in a February 2022 sampling of contacts in South Korea. The secondary attack rate was lower for vaccinated versus unvaccinated contacts, and booster vaccination resulted in a lower incidence rate ratio.

Since its initial detection in November 2021, the SARS-CoV-2 B.1.1.529 (Omicron) variant has become the dominant strain in South Korea. Its emergence led to a large increase in the number of COVID-19 cases, mainly through household transmission (*1*,*2*). In this study, we sought to estimate the effect of booster vaccinations on reducing the household transmission of COVID-19 to guide current COVID-19 mitigation strategy.

This national, retrospective cohort study included all residents in South Korea with laboratory-confirmed SARS-CoV-2 infection reported during February 1–10, 2022. The background population was estimated as 53 million persons according to the 2021 census. Booster vaccinations with mRNA vaccines were provided in October 2021, reaching ≈30 million doses (60% of the total population) by February 2022. We retrieved epidemiologic data, merged with the national immunization registry of household contacts of persons infected with SARS-CoV-2, to describe the difference in secondary attack rates (SARs) by vaccination status. Details of the surveillance system, vaccination program, and dataset employed in this study are described in a previous study (*3*). Persons who had household contact with laboratory-confirmed SARS-CoV-2–positive patients underwent mandatory PCR testing, regardless of the presence of symptoms, and were put under active surveillance for 10

[1]These first authors contributed equally to this article.

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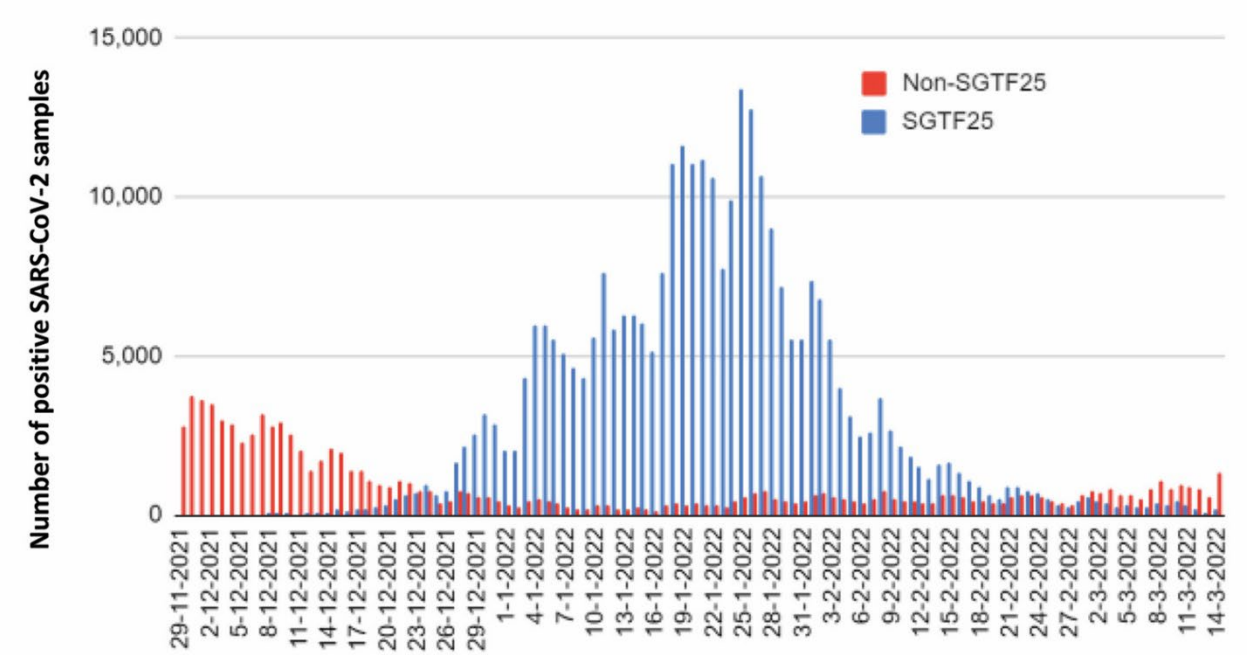
Appendix

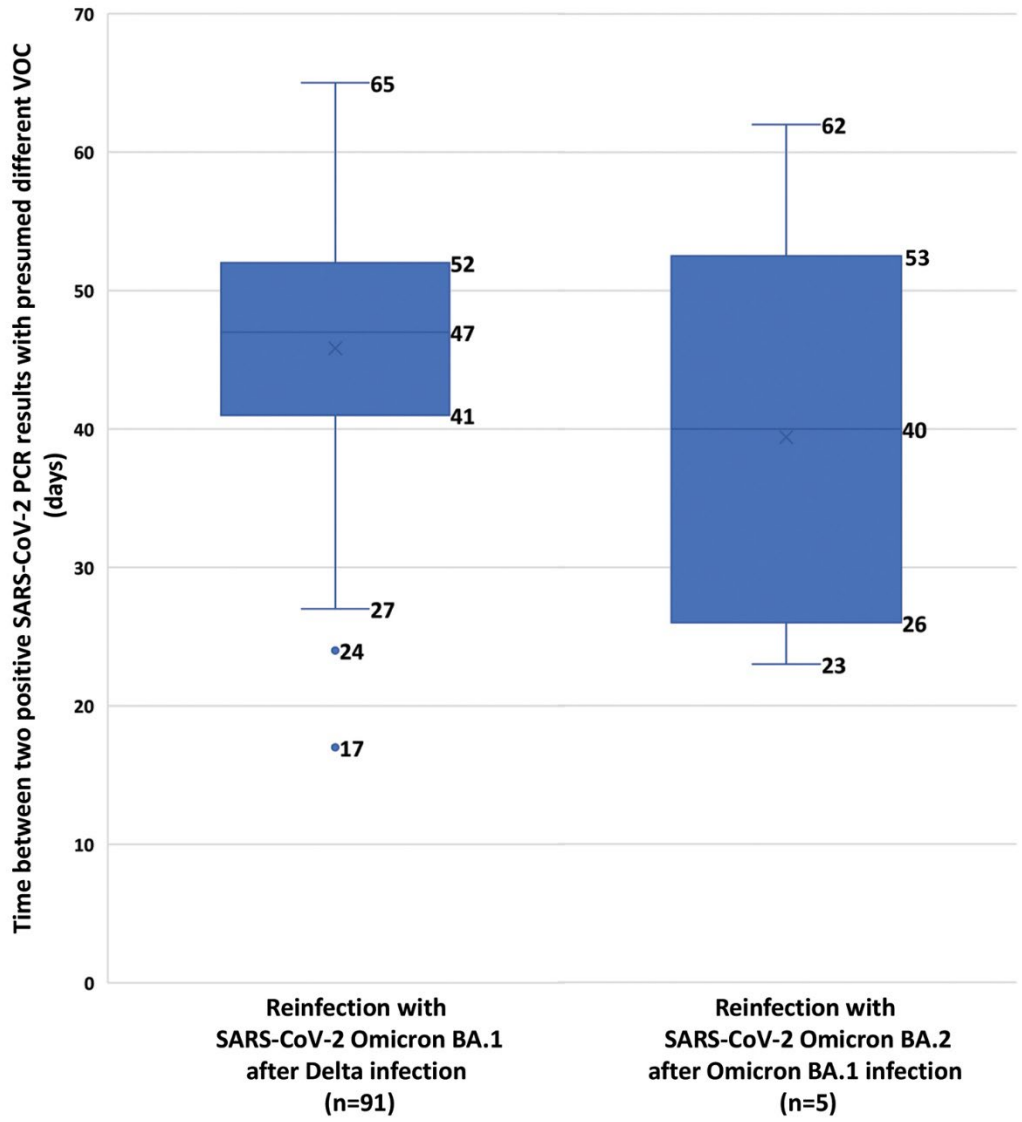
Appendix Table. Results of SARS-CoV-2 screening tests and vaccination status in reinfection patient and family, Belgium*

Date	Patient, 10 y	Brother, 13 y	Mother, 42 y	Father, 43 y
Vaccination status	Unvaccinated	2021 Aug BNT162b2, 2021 Sep BNT162b2	2021 Jun BNT162b2, 2021 Jul BNT162b2	2021 Feb ChAdOx1, 2021 May ChAdOx1, 2021 Nov BNT162b2
First infection				
2021 Dec 2		SARS-CoV-2 very strong positive, ≥7.0 log copies/mL, Delta (AY.43)	SARS-CoV-2 strong positive, ≥5–<7.0 log copies/mL, Delta (AY.43)	
2021 Dec 3	SARS-CoV-2 very strong positive, ≥7.0 log copies/mL, Delta (AY.43)			SARS-CoV-2–negative
2021 Dec 8				SARS-CoV-2–negative
2021 Dec 19	SARS-CoV-2 weak positive, <3.0 log copies/mL, untypable			
Second infection				
2022 Jan 11	SARS-CoV-2 strong positive, 5.1 log copies/mL Omicron (BA.1)			
2022 Jan 17	SARS-CoV-2–negative	SARS-CoV-2 weak positive, <3.0 log copies/mL, untypable	SARS-CoV-2–negative	
2022 Jan 21	SARS-CoV-2–negative			

*All samples were analyzed by using reverse transcription PCR. Whole-genome sequencing was performed on SARS-CoV-2–positive samples in the Belgian National Reference Center for Respiratory Pathogens.



Appendix Figure 1. Number of samples testing SARS-CoV-2–positive in the federal platform laboratories of Belgium with SGTF (blue) and without SGTF (red) (*1*). SGTF, S gene target failure.



Appendix Figure 2. Boxplots indicating time in days between presumed SARS-CoV-2 infection and reinfection. The consecutive infections were detected during December 1, 2021–February 7, 2022 (reinfection with Omicron BA.1 shortly after Delta infection, n = 91 patients) and during January 1–March 10, 2022 (reinfection with Omicron BA.2 shortly after Omicron BA.1 infection, n = 5 patients). One patient had only 17 days between 2 positive SARS-CoV-2 PCR results with presumed different variants of concern. However, the first sample (2021 Dec 16, S gene detected) had a low viral load (<3.0 log copies/mL), the second sample (2022 Jan 2, S gene not detected) had a very strong viral load (≥7.0 log copies/mL). As such, it can be stated that the time between the 2 positive samples was 17 days, but it cannot be assured when the Delta infection started, because viral remnant can be detected for several weeks after the initial infection and no clinical data was available for this case.

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