Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Published Online
June 22, 2022
https://doi.org/10.1016/
S1473-3099(22)00409-1

Statistically, the term stable trend means that a 95% CI includes zero or a p value above 0·05. However, we try to avoid such so-called dichotomania by focusing on the distribution of the 95% CI,[5] which mostly lies below zero. Therefore, it is more compatible with a slight decreasing trend. The estimated annual percent changes were calculated separately for the global, regional, and national levels to quantify the overall trend within 29 years, fitting a linear regression model. The incidence rate data for the 10–24 age groups were not directly available when the study was conducted, and we calculated these rates on the basis of 5-year age groups. The relatively high rate in adolescents (aged 10–24 years) and young adults (aged 25–44 years) was supposed to be connected with both behavioural and physiological factors.

Sustained epidemiological studies, including both congenitally and sexually transmitted infections, are warranted to better characterise the global burden of STIs, particularly in low-income and middle-income countries.

We declare no competing interests.

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Duration of effectiveness of vaccination against COVID-19 caused by the omicron variant

We recently conducted a systematic review and meta-regression of the duration of effectiveness of primary series COVID-19 vaccination against clinical outcomes before the predominance of the omicron (B.1.1.529) SARS-CoV-2 variant.[1] Here we assess the duration of vaccine protection, after a primary vaccine series and after the first booster dose, against omicron, the current predominant variant, using the same methods.[1]

We systematically reviewed published and preprint literature from Dec 3, 2021, to April 21, 2022, by searching for studies assessing absolute vaccine effectiveness over time during an omicron-dominant period. We estimated the mean change in vaccine effectiveness from 1 month to 6 months after primary vaccine series completion and from 1 month to 4 months after booster vaccination, using random-effects meta-regression (appendix p 22).

Of 15 887 studies screened, 409 underwent full-text review, 18 of which met inclusion criteria (appendix pp 4–14). Seven vaccine effectiveness studies assessed primary series vaccination only, one assessed booster vaccination only, and ten assessed both, yielding 99 vaccine-specific evaluations over time since final dose (48 primary series, 51 booster).

1 month after primary vaccine series completion, vaccine effectiveness against severe COVID-19 disease was lower for omicron (figure) than for pre-omicron variants (reported previously[1]), but the mean decrease in vaccine effectiveness from 1 month to 6 months after the primary vaccine series was negligible (1·0 percentage point [95% CI −3·9 to 6·6] during omicron *vs* 10·0 percentage points [6·1 to 15·4] pre-omicron). Primary vaccine series effectiveness against symptomatic disease was also lower for omicron than pre-omicron variants, but unlike severe disease, vaccine effectiveness against omicron decreased more rapidly from 1 month to 6 months after primary vaccine series completion (47·6 percentage points [36·6 to 60·2] during omicron *vs* 24·9 percentage points [13·4 to 41·6] pre-omicron; figure).[1] By 6 months after the primary vaccine series, little protection against symptomatic disease remained. Only five studies evaluated any omicron infection after the primary vaccine series, which showed a mean decline from 1 month to 6 months of 26·8 percentage points (16·5 to 38·6; appendix p 18).

1 month after booster vaccination, vaccine effectiveness against omicron was generally higher than after the primary vaccine series for all outcomes. As after the primary vaccine series, decreases in vaccine effectiveness after the booster vaccination were small for severe disease (5·3 percentage points [95% CI 2·4 to 8·7] from 1 month to 4 months after booster vaccination and 8·2 percentage points [3·7 to 14·3] projected out to 6 months after booster vaccination; appendix p 19). The mean decrease in vaccine effectiveness against symptomatic disease from 1 month to 4 months after booster vaccination was 24·3 percentage points (19·9 to 29·1), smaller than that observed after the primary vaccine series, and it was 28·5 percentage points (18·3 to 40·5) projected out to 6 months after booster vaccination. Only five vaccine-specific evaluations of effectiveness against any infection after booster vaccination were available, showing a 15·8 percentage point (−0·3 to 38·2) decrease from 1 month to 4 months (appendix p 18).

Limitations of our systematic review included potential biases in evaluating duration of vaccine effectiveness as described previously,[1] scarce data for non-mRNA vaccines,

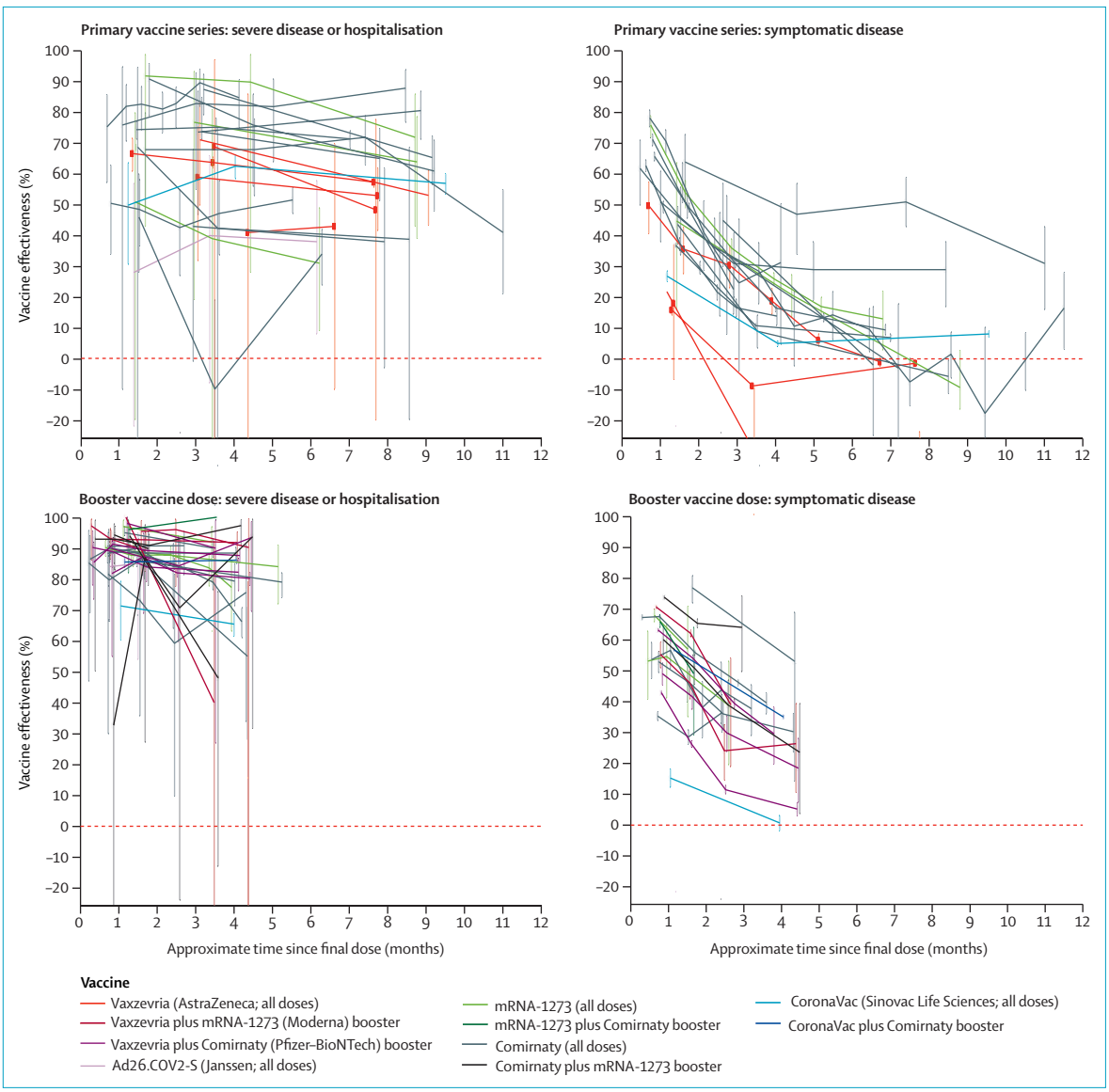

***Figure*: Duration of COVID-19 primary series and first booster dose vaccine effectiveness against the omicron variant**
Mean percentage point decrease in vaccine effectiveness from 1 month to 6 months after vaccination from meta-regression (see appendix p 22).

and short follow-up after booster vaccination. Also, most studies of severe disease assessed vaccine effectiveness against hospitalisation. Given the high prevalence of the omicron variant, omicron infection might have been incidental rather than causal among some hospitalised people, which would have resulted in underestimated vaccine effectiveness against severe disease.[2]

Vaccine effectiveness of primary series COVID-19 vaccines against severe disease when the omicron variant was predominant was lower than that observed pre-omicron but showed little decline after vaccination. Booster vaccination increased vaccine effectiveness against omicron severe disease, which remained high 4 months after vaccination. Vaccine effectiveness against symptomatic disease decreased faster for omicron than pre-omicron variants, with protection from primary series vaccination nearly eroded by 4–6 months; protection after booster vaccination also decreased quickly, although less than after primary series vaccination.

MMH reports research grants from WHO, Coalition for Epidemic Preparedness Innovations (CEPI), Asian Development Bank (ADB), Bill & Melinda Gates Foundation, and Pfizer (all paid to the institution). AB and KKW report research grants from WHO and CEPI paid to the institution. EE reports stock ownership in GlaxoSmithKline. MDK reports research grants from WHO, CEPI, ADB, and Pfizer (all paid to the institution) and consultancy fees from Merck. All other authors declare no competing interests. DRF and MDK contributed equally. All data included were derived from publicly

available documents cited in the references. Extracted data are available on request to the corresponding author. The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated.

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Published **Online** June 20, 2022 https://doi.org/10.1016/S1473-3099(22)00410-8

Omicron subvariants escape antibodies elicited by vaccination and BA.2.2 infection

The BA.1, BA.2, and BA.3 omicron subvariants of SARS-CoV-2 showed similar but substantial resistance to vaccine-induced and infection-induced serum neutralising activity.[1,2] The new BA.2.12.1, BA.2.13, BA.4, and BA.5 omicron subvariants containing Leu452 substitutions show more infectious potential than BA.2.[3] We examined neutralising activity against the BA.1, BA.2, BA.2.11, BA.2.12.1, BA.2.13, BA.4, and BA.5 omicron subvariants in serum from people who received BBIBP-CorV (Sinopharm) primary immunisation, people who received BBIBP-CorV or ZF2001 (Anhui Zhifei Longcom) boosters, and people with omicron breakthrough infections (appendix pp 4, 7).

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25 individuals received two doses of BBIBP-CorV. Using an in-house pseudovirus neutralisation assay we found that two BBIBP-CorV doses induced detectable neutralising antibodies against spike protein mutation D614G in 21 (84%) individuals, but neutralising activity against omicron subvariants (BA.1, BA.2, BA.2.11, BA.2.12.1, BA.2.13, and BA.4/BA.5) was not or only minimally detectable (appendix pp 2–3, 8).

Geometric mean titres (GMTs) of neutralising antibodies against D614G in the 25 individuals who received a BBIBP-CorV booster were 3·1-times higher than in people who received two doses of BBIBP-CorV; the 30 people who received a ZF2001 booster had a 2·9-times higher GMT than individuals who received two doses of BBIBP-CorV (appendix pp 2–3, 8). Neutralising activity against omicron subvariants was observed in 24–48% of people who received a BBIBP-CorV booster and 30–53% of people who received a ZF2001 booster (appendix pp 2–3, 9). Moreover, serum samples with neutralising antibody titres higher than the limit of detection (limit of detection was 30) against the omicron subvariants had lower neutralising activity, with a 4·6–17·1-times lower GMT than the GMT against D614G (appendix pp 2–3). The BA.2.12.1 subvariant showed significantly more resistance than the BA.2 subvariant to a BBIBP-CorV booster (appendix p 9), and the BA.2.11, BA.2.12.1, and BA.2.13 subvariants showed significantly more resistance than the BA.2 subvariant to a ZF2001 booster (appendix p 9). The serum neutralising antibody titres against all tested pseudoviruses did not differ between people who received a BBIBP-CorV booster and those who received a ZF2001 booster (appendix pp 8–9).

18 people had BA.1 breakthrough infection and 15 people had BA.2.2 breakthrough infection (appendix pp 2–3, 7). People with BA.1 breakthrough infection had neutralising titres against omicron subvariants similar to neutralising titres against D614G except for BA.4/BA.5, which had a 2·8-times lower titre compared with D614G-mutated variants (appendix pp 2–3). Antibody titres against omicron subvariants BA.2, BA.2.11, BA.2.12.1, BA.2.13, and BA.4/BA.5 were similar to antibody titres against BA.1 (appendix pp 2–3). Additionally, neutralising antibodies against omicron subvariants above the limit of detection accounted for 88–100% of infections. By contrast, BA.2.2 breakthrough infections had small increases in GMTs against BA.1 compared with BA.1 breakthrough infections (appendix p 10), and neutralising titres against all omicron subvariants, except BA.2, were significantly decreased (3·5–7·4 times) compared with the titres against D614G (appendix pp 2–3). BA.2.2 breakthrough infection resulted in 73–87% of individuals having neutralising antibodies against omicron subvariants higher than the limit of detection (appendix pp 2–3), but neutralising antibody titres against BA.2 were significantly higher than other omicron subvariants (appendix pp 2–3). People with BA.1 breakthrough infections had significantly higher neutralising antibody titres against the BA.1 and BA.2.13 subvariants than people with BA.2.2 breakthrough infections (appendix p 10). Of note, compared with the people with a BA.1 breakthrough infection, people with BA.2.2 breakthrough infections included a substantially higher number of individuals who were triple vaccinated (appendix p 7).

Completion of the primary BBIBP-CorV vaccination schedule induces neutralising antibodies in most individuals against SARS-CoV-2 variants with a D614G mutation, which is consistent with previous studies.[4–6] However, the spike protein mutation enables the escape of omicron subvariants from neutralisation, which can be partly restored by a booster vaccination. Breakthrough omicron infections enhance sera neutralising potential specifically against the omicron subvariants, which is