

# COVID-19 vaccination is highly effective to prevent SARS-CoV-2 circulation

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## Short Report

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# **COVID-19 vaccination is highly effective to prevent SARS-CoV-2 circulation**

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## **Abstract**

**Background:** We provide here an analysis of effectiveness of primary coronavirus disease 2019 (COVID-19) vaccination and COVID-19 vaccine booster doses in preventing severe acute respiratory syndrome coronavirus 2 (COVID-19) infection.

**Methods:** We retrieved information on COVID-19 vaccination and newly diagnosed cases of SARS-CoV-2 infection from the weekly official report of the Italian National Institute of Health (Istituto Superiore di Sanità, ISS; Last available update, January 1, 2022).

**Results:** At the time of our analysis, 39.9 million people completed a primary COVID-19 vaccination cycle, of whom 13.6 million (34.0%) <5 months from the last dose, whilst 5.7 million had also received COVID-19 vaccine booster doses. The risk of SARS-CoV-2 infection was 71% (OR, 0.29; 95%CI, 0.29-0.29) and 86% (OR, 0.14; 95%CI, 0.14-0.14) lower in people who received primary vaccination <5 months and booster doses <5 months compared to the unvaccinated population, but was also half (OR, 0.49; 95%CI, 0.48-0.49) in those who received booster doses <5 months compared to those who completed the primary vaccination <5 months.

**Conclusions:** These results attest that COVID-19 vaccines not only reduce the risk of developing severe illness in patients with SARS-CoV-2 infection, but shall also be considered reliable and effective means to limit virus circulation within the general population.

**Key words:** COVID-19; SARS-COV-2; Vaccination; Booster

## **Introduction**

Several lines of evidence now attest that coronavirus disease 2019 (COVID-19) vaccination should necessary complement the widespread adoption of physical measures such as lockdowns, social distancing, mask-wearing, contact tracing and hand hygiene for preventing and/or limiting the dramatic medical, social and economic impact of SARS-CoV-2 on the worldwide population [1]. Several studies and meta-analyses have now concluded that the efficacy of COVID-19 vaccines is considerably high in preventing development of severe illness [2-4], even better than that achievable by influenza vaccination [5], although vaccine effectiveness has been clearly described to wane over time, typically within 5-7 months after completing the primary vaccination cycle [6]. The administration of vaccine “booster” doses is hence a possible and feasible solution for restoring effectiveness against the risk of developing symptomatic illness [7], even if the capacity to effectively reduce virus circulation within the community remains speculative, as recently highlighted by Alshamrani and co-authors [8]. This study was hence aimed to define the extent of protection from SARS-CoV-2 infection conferred by both primary COVID-19 vaccination and administration of COVID-19 vaccine booster doses.

## **Methods**

We retrieved update information on the rate of COVID-19 vaccination and newly diagnosed cases of SARS-CoV-2 infection from the weekly official report of the Italian National Institute of Health (Istituto Superiore di Sanità, ISS; Last available update, January 1, 2022) [9]. At the time of our analysis, 39.9 million people had completed a primary COVID-19 vaccination cycle (69.7% with Pfizer/BioNTech, 18.5% with AstraZeneca, 10.2% with Moderna and 1.6% with Johnson & Johnson, respectively), of whom 13.6 million (34.0%) within 5 months from the last dose, whilst

an additional 5.7 million Italian citizens had already received a COVID-19 vaccine booster dose (all with one of either mRNA-based Pfizer/BioNTech or Moderna vaccines).

The epidemiologic data were transcribed into Excel (Microsoft Excel; Microsoft, Redmond, WA, US), and the odds ratio (OR) with 95% confidence interval (95%CI) of SARS-Cov-2 infection were calculated with MedCalc (Version 20.015; MedCalc Software Ltd., Ostend, Belgium). Statistical significance was set at  $p < 0.05$ . The study was carried out in accordance with Helsinki Declaration, under terms of relevant local legislation. The research was based on public ISS data, so that Ethical Committee approval was unnecessary.

## **Results**

The rate of SARS-CoV-2 infections in the non-vaccinated, vaccinated with primary cycle within 5 months and in those who received a booster vaccine dose within 5 months is summarized in table 1 (i.e., 2.5%, 0.7% and 0.4%, respectively). Overall, the risk of SARS-CoV-2 infection was 71% (OR, 0.29; 95%CI, 0.29-0.29;  $p < 0.001$ ) and 86% (OR, 0.14; 95%CI, 0.14-0.14) lower in the cohorts of people who received the primary vaccination within 5 months and the booster dose within 5 months compared to the unvaccinated population, but was also found to be nearly half (OR, 0.49; 95%CI, 0.48-0.49) in those who received the booster dose within 5 months compared to the population who only completed the primary vaccination cycle within 5 months.

## **Discussion**

The results of our analysis on data generated by the ongoing nationwide COVID-19 Italian vaccination campaign attest clearly that the use of COVID-19 vaccines not only decreases the risk of developing severe illness in patients with SARS-

CoV-2 infection, but shall also be considered a reliable and effective means to limit virus circulation within the general population. Even more importantly, we also found that the administration of vaccine booster doses amplifies their effectiveness, by reducing further (by nearly 50%) the risk of SARS-CoV-2 infection compared to a recent primary vaccination cycle. This aspect has a pivotal importance, not only for reducing the medical, social and economic burden of COVID-19, but also for lowering the risk that new and highly mutated variants (such as Omicron B.1.1.529) will continue to emerge in areas with lower herd immunity and larger SARS-CoV-2 circulation [10].

*Conflicts of interest:* None declared.

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**Figure 1.** Efficacy of primary coronavirus disease (COVID-19) vaccination cycle and administration of COVID-19 vaccine booster doses in preventing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections in the general population.

*OR, odds ratio; 95%CI, 95% confidence interval*

