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### Post-vaccination induced-immune response to anti-SARS-CoV-2 IgG antibodies and T-cells surrogate markers by type and vaccination regime: a retrospective cohort study

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#### Abstract

**Background and aims:** Induction of and the speed of producing anti-SARS-CoV-2 immune biomarkers might vary by the type and number of vaccine doses received. This study explores variation in post-vaccination concentration of anti-SARS-CoV-2 anti-spike IgG (anti-S IgG), anti-nucleocapsid IgG (anti-N IgG), neutralizing IgG antibodies, and T-cells reactivity by type of and number of anti-SARS-CoV-2 vaccine doses received.

**Methods:** In SARS-CoV-2 naturally exposed and anti-SARS-CoV-2-vaccinated labor workers, we quantified the anti-S IgG, anti-N IgG, neutralizing IgG antibodies concentration and assessed T-cells reactivity. Information on sociodemographics, medical history, history of PCR positivity to SARS-CoV-2, and type and number of received anti-SARS-CoV-2 vaccine doses was collected. Differences in antibodies concentration and T-cells reactivity by the measured characteristics and number of and type of vaccines received were investigated.

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Nasal swabs were also collected at the same time of blood collection. Adjusted association between having more than a median concentration of the three IgG antibodies and T-cells response by number and type of the inoculated vaccines was quantified.

**Results:** 952 labor male workers (mean age of 35.5 years  $\pm$  8.4 SD) were surveyed, and their blood samples collected. Regardless of the number of doses, 92.1% of the workers were vaccinated with Sinopharm only, 1.5% received only Sputnik V Gam-COVID-Vac, 0.3% received only Pfizer/BioNTech, 4.0% primed with Sinopharm and boosted with Pfizer/BioNTech, and 0.7% had mixed vaccine types. Seropositivity to anti-S, anti-N, and neutralizing IgG antibodies was detected in 99.7%, 99.9%, and 99.3% of the workers, respectively. Of the 925 workers tested for their T-cells reactivity, 38.2% had their T-cells reactive. Every additional vaccine dose was significantly associated with increased odds of having more than a median concentration of anti-S (aOR 1.34, 95% CI: 1.02–1.76), anti-N (aOR 1.35, 95% CI: 1.03–1.75), neutralizing IgG antibodies (aOR 1.29, 95% CI: 1.00–1.66), and with having T-cells response (aOR 1.48, 95% CI: 1.12–1.95). Compared to boosting with only one dose, boosting with two doses was significantly associated with increased odds of having more than the median concentration of anti-S (aOR, 13.8, 95% CI: 1.78–106.5), neutralizing IgG antibodies (aOR, 13.2, 95% CI: 1.71–101.9), and T-cells response (aOR, 7.22, 95% CI: 1.99–26.5) but not with anti-N (aOR, 0.41, 95% CI: 0.16–1.08). Compared to priming and then boosting with Sinopharm, all participants who were primed with Sinopharm and then boosted with Pfizer//BioNTech had more than the median concentration of anti-S and neutralizing IgG antibodies and 14.6-time increased odds of having T-cells response (aOR, 14.63, 95% CI: 1.78–120.5). Compared to priming with two doses, boosting with a third dose was not while boosting with two doses was significantly associated with having more than the median concentration of anti-S (aOR: 14.2, 95% CI: 1.85–109.4), neutralizing IgG (aOR: 13.6, 95% CI: 1.77–104.3), and T cells response (aOR: 7.6, 95% CI: 2.09–27.8).

### **Conclusions**

Boosting with only one dose or with only Sinopharm after priming with Sinopharm was not enough while boosting with two doses, particularly boosting with mRNA-based vaccine, was shown to be associated with having a high concentration of anti-S, anti-N, and neutralizing IgG antibodies and producing efficient T-cells response.

**Keywords:** SARS-CoV-2; COVID-19; Vaccination; Vaccines