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.

in a 46-year-old man in Ecuador.[1] As reported elsewhere,[2] Prado-Vivar and colleagues describe a more severe symptomatic course during the second infection than during the first. Understanding factors associated with potential reinfection might enable early decision-making for the clinical management of suspected cases. Reporting of such cases, supported by sequencing, including whole-genome sequencing (WGS), as presented by Prado-Vivar and colleagues, or Sanger sequencing, and preferably viral cell culture, is necessary to identify reinfection rather than prolonged viral shedding. Although a vital step, WGS requires retention of the initial sample and a biosafety 3 laboratory, is resource intensive,[2] and samples with very low viral loads might not be successfully sequenced, limiting its use as a high-throughput tool.

By comparison, serological testing is increasingly widely available, yet in cases of reinfection has so far provided little insight into whether the risk of reinfection correlates in any way with an inability to produce an effective humoral response. Prado-Vivar and colleagues' patient was IgM-reactive, IgG-negative on a lateral flow assay, with presumably an assigned significance of at least an initial response to SARS-CoV-2.[1] Other reported cases of reinfection have likewise described serology at initial presentation as IgM only, negative, or not tested.[2] Our experience with lateral flow assays suggests that early IgM-only positive results should be interpreted with caution: six of 12 health-care workers tested in a delayed case identification programme[3] underwent retesting with both an anti-nucleocapsid (anti-NP) IgG and an anti-receptor binding domain (anti-RBD) IgG assay and had a seronegative result (appendix pp 3–4). Conversely, among patients who had a documented IgG response (both anti-NP and anti-RBD), we found three cases of possible reinfection, albeit they were not substantiated by WGS (appendix pp 3–4).

We therefore strongly advocate use of a structured approach to reporting serological data alongside WGS when exploring reinfection. When high Ct values, as reported by Prado-Vivar and colleagues, are thought to correlate with low viral burden, it is possible that the initial infection could simply lack sufficient stimulation of germinal centre reactions to generate isotype-switching and lasting, detectable antibody production.[4] To delineate any relevance of primary infection viral burden on isotype switch, we must allow for inter-IgG class variability and consider the impact on assay selection; anti-NP IgG assays can identify previous exposure, but it is anti-RBD IgG assays that might provide further information through correlation with neutralising activity, and expression of these antibodies might be discordant.[5] Standardising reporting of serological data for reinfection cases might help characterise the role of the humoral response in cases of reinfection, and it would appear doing so with an anti-RBD IgG assay could have greater utility.

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Regulatory approval of COVID-19 vaccine for restricted use in clinical trial mode

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Covaxin is India's first indigenous vaccine against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), developed through a collaboration between Bharat Biotech and the National Institute of Virology, which is a branch of the Indian Council of Medical Research, the Indian official authority for medical research. The development team isolated a strain of SARS-CoV-2 from patients with asymptomatic infection and developed a vaccine on a Vero cell-line manufacturing platform to deliver the inactivated coronavirus strain. On Jan 3, 2021, the vaccine was granted approval "for restricted use in emergency situation in public interest as an abundant precaution, in clinical trial mode",[1] which raised several concerns across the scientific society.[2]

There is an urgency and a feeling of moral obligation to get the vaccine to the public as early as possible, based on large-scale evidence on its safety and efficacy. However, the approval of a partly studied vaccine through an accelerated process on the basis of results from phase 1 and 2 clinical trials[3] and incomplete data on the

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vaccine's efficacy for peer review has raised more questions than answers.

Emergency-use authorisation can be given only after confirmation of safety and efficacy in a phase 3 clinical study that is usually designed and conducted to meet requirements of subject-expert committees and regulatory authorities. In exceptional circumstances, approval might be considered when the ongoing trial is based on strong evidence of safety and efficacy.

It is difficult to understand the term restricted use when applied to vaccines, as it is ordinarily applicable to drugs. Even greater confusion arises with use of the phrase clinical trial mode since its meaning is ambiguous. It is understood that clinical trials are yet to be completed and need consent and follow-up. It is unclear which factors will guide the selection of individuals for vaccination. In clinical trials, volunteers are usually not aware of whether they have been given the vaccine or a placebo.[2]

India's innovation in vaccine development might be considered a giant leap and source of pride for its scientists, but there is a need to clear the air and gather public trust through transparency. When public trust in an indigenous vaccine is low, manufacturers, their academic partners, and regulators must disclose protocols and results data. Lack of desirable diligence and conscientiousness in conducting confirmatory clinical trials is a matter of concern for citizens. Once public trust in Covaxin is compromised through the public media, it is difficult to revive. This distrust in the vaccine can fuel apprehension and lead to a vaccine-hesitancy chain reaction, which could contribute to resurgences in the virus and lack of control of the pandemic.

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Seroprevalence of anti-SARS-CoV-2 antibodies after the second pandemic peak

After the first pandemic wave in Europe, seroprevalence surveys revealed that roughly one in ten individuals had been infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] Our Geneva-based seroprevalence study revealed that infections were less common in young children (<9 years) than in older children and adults, but at the time of the study individuals were confined and schools were closed.[2] Since autumn, 2020, Europe has experienced a rapid increase in reported infections, with SARS-CoV-2 incidence in some countries largely surpassing that of the first wave. Due to changes in test availability, policy, and care-seeking behaviours, it is unclear how to compare current case reports with the first wave and how these relate to undetected infection rates.

To estimate SARS-CoV-2 seroprevalence in the general population and determine whether age disparities have persisted through the second wave, we repeated a representative serosurvey of the Geneva population using a stratified random sample (based on age, sex, and education level) of individuals aged 18–64 years from our previous study[2] and an independent random sample of individuals aged 0–18 years and 65 years and older who were identified from resident registers of the Swiss Federal Office of Statistics. We tested participants for anti-SARS-CoV-2 total immunoglobulins targeting the spike protein (Elecsys anti-SARS-CoV-2 S; Roche Diagnostics, Rotkreuz, Switzerland) following manufacturer's recommendations (≥0·8 U/mL considered seropositive). We used a previously published Bayesian model accounting for household clustering, test performance, and age distribution in the Geneva population.[2]

Between Nov 23, and Dec 23, 2020, we recruited 4000 participants aged 0–96 years (53·4% women; 25·4% <18 years), of whom 820 were seropositive, yielding a seroprevalence of 21·1% (95% credible interval [CrI] 19·2–23·1). We found similar seroprevalence among men and women, but large differences across age groups (appendix p 2). Compared with adults aged 25–34 years, children aged 6 years and older and adolescents had similar seroprevalence, whereas children aged 0–5 years were 43% less likely to be seropositive, and adults aged 65–74 years and those aged 75 years and older were 42% and 64% less likely to be seropositive, respectively (appendix p 2). We estimated that each virologically confirmed SARS-CoV-2 infection represented 2·7 infections (95% CrI 2·3–3·1; appendix pp 3–5) in the community, substantially lower than in the first wave (11·6),[2] probably due to changed testing practices.

Despite seroprevalence doubling in Geneva since the end of the first wave, most of the population remains unexposed, including more than 90% of adults aged 75 years and older, who have very high mortality risk.[3,4] Although children aged 6 years and older have a similar infection risk as adults, younger children have a lower infection risk. These results should inform policy-makers worldwide,