

Research in context

Evidence before this study

To evaluate previous data on SARS-CoV-2 viral loads related to age, we performed a Pubmed (including MedRxiv) search without language restrictions on Jan 14 2020 including search terms ("SARS-CoV-2" OR "nCoV") AND "age" AND ("viral load" OR "Ct-value" OR "Cp-value"), yielding 126 results. Studies were used when they compared viral load, Cp- or Ct-values of SARS-CoV-2 between individuals of different ages. The largest studies showed mixed results, with some showing no correlation with age, while others showed higher loads only in one older age bracket, a lower load in a bracket of younger patients, or a higher mean age in a selection of tests with high load (Ct<25) compared to tests with a low load (Ct>30). These studies did not consistently find significant differences in viral load between all age groups, while all had low numbers of (pediatric) patients and heterogeneity in sampling method, test indication and symptom duration which could have further diluted correlations.

Added value of this study

This is the first large study to describe SARS-CoV-2 viral load distribution in various patient / health care worker populations, based on 278,455 tests performed with a uniform PCR technique, with patients from all age categories. These data were first to show differences in viral loads between tested populations as well as between the first and second wave of COVID-19 patients in The Netherlands. In a subset of 211,914 patients tested by Public Health Services (thus guaranteeing a uniform sampling technique) we found that SARS-CoV-2 viral loads increase with age, with children < 12 years old having the lowest loads, also after correction for symptom duration. Interestingly, the median Cp-values between the oldest (>79 years) and youngest (<12 years) population had over 4 Cp-values difference, suggesting around 16 times difference in viral load. The proportion of children aged < 12 years with a low viral load (Cp-value > 30) was much higher compared to the other patients (31.1% vs. 17.2%).

Implications of all the available evidence

The finding that SARS-CoV-2 loads increase with age could be relevant to understanding why elderly age is one of the most important risk factors for mortality by COVID-19. Also, children having lower loads might (in part) explain their suggested lower role in transmission, which is a subject of great discussion in the light of school closures. Importantly, as rapid antigen tests are rolled out worldwide, but less sensitive than PCRs when viral loads are low, it is important to note that the lower viral loads in children might indicate a reduced sensitivity of these tests.