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LETTER TO THE EDITOR

SARS-CoV-2 seroprevalence in the Vatican City State

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The ongoing Coronavirus Disease 19 (COVID-19) pandemic caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has affected so far 218 countries with over 94 million cases, about 2 million deaths and over 67 million recovered [1], with dramatic effects on communities and healthcare systems [2]. The beginning of mass vaccination campaigns in late 2020 in the USA and in the UK, and from early 2021 in other countries, will help controlling the infection spread and limiting its consequences, also providing indirect protection to non-vaccinated individuals through the mechanism of "herd immunity" [3-5].

In the first eleven months of the pandemic, 42 COVID-19 cases were tracked in the Vatican City State, an enclave of the City of Rome, Italy, with about 800 residents and 5000 employees. During this time, the Directorate of Health and Hygiene of the Governorate of the Vatican City State, the entity deputed to provide internal healthcare assistance to residents, employees, retirees and their families, underwent several changes in its ordinary activities and introduced multiple prevention and control measures to limit SARS-CoV-2 spread within the State [6].

A few months after the first wave of the pandemic, the Directorate of Health and Hygiene started a serological evaluation of anti-SARS-CoV-2 antibodies in residents and employees of the Vatican City State, regardless of symptoms or contacts with positive cases. The analysis begun on June 8, 2020 and, as of January 4, 2021, included 1539 subjects. One serological test per subject was considered for this study; repeated tests over time on the same subject were not included. Serological tests were performed on peripheral blood using the SARS-CoV-2 Total Assay, Atellica IM COV2T method (Siemens Healthineers AG, Germany), a fully automated 1-step sandwich immunoassay that uses acridinium ester chemiluminescence technology, designed to detect the spike protein receptor-binding domain on the surface of SARS-CoV-2. This method has shown a high sensitivity (97.48%) and specificity (99.80%). A test was considered positive when had an index equal or higher than 1 (measuring interval: 0.05–10.00). Data analysis was performed using Prism GraphPad Software version 9 (GraphPad Software LLC).

Sixty-seven serological tests were performed in June, 100 in July, 105 in August, 514 in September, 339 in October, 209 in November, 188 in December 2020 and 17 in January 2021. A total of 67 subjects had positive antibodies for SARS-CoV-2 out of 1539 with a positivity rate of 4.35%, calculated as positive tests/total tests x 100. Of these, 44 (65.67%) subjects were males and 23 (34.32%) were females; the median age was 50.23 years. The percentage of positive cases / total exams varied over time, being 5.97% in June, 1% in July, 3.81% in August, 3.11% in September, 2.06% in October, 7.66% in November, 9.57% in December 2020 and 5.89% in January 2021.

Fig. 1A shows the antibody index in the study population. The average antibody index was 6.43 (SD= 3.754, SE= 0.5016) for positive subjects and 0.44 (SD= 0.1902, SE= 0.0052) for negative subjects.

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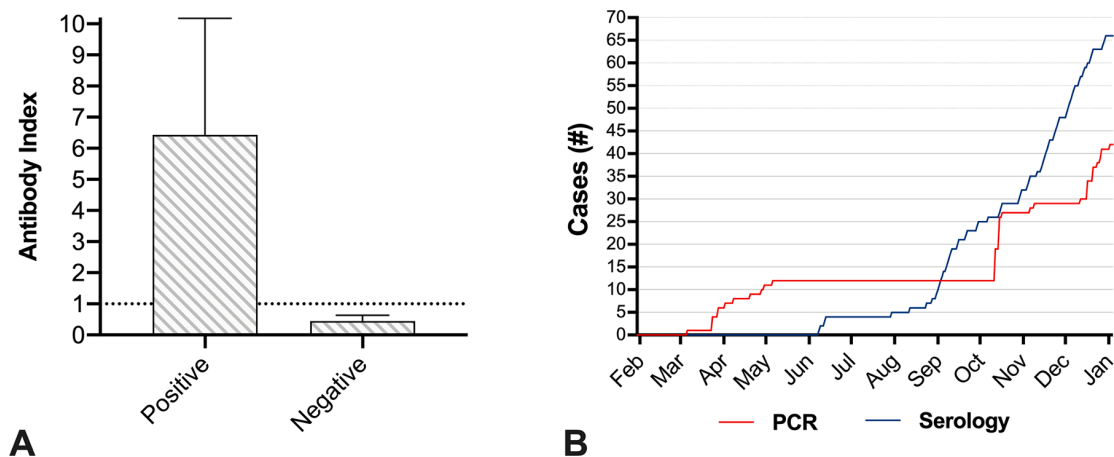
Fig. 1. A) Total antibody index in the study population. The average antibody index was 6.43 for positive subjects and 0.44 for negative subjects. Dotted line indicates threshold for positive antibody index. B) Comparison of the total COVID-19 cases both at nasopharyngeal swab test (PCR) and serological test (Serology) in the Vatican City State from February 21, 2020 to January 4, 2021.

Fig. 1B compares the total COVID-19 cases diagnosed in the Vatican City State from February 21, 2020 to January 4, 2021 using Real-Time Reverse Transcription–Polymerase Chain Reaction (rRT-PCR) on clinical specimens obtained from the upper respiratory tract by nasopharyngeal swabs with positive results found at serological tests. As expected, the positivity rate of serological tests was preceded by positive cases at rRT-PCR tests and increased over time especially during the second wave (October-December 2020), demonstrating an increasing immunization of the population.

The results of this seroprevalence analysis showed a positivity rate among individuals assisted by the internal healthcare system of the Vatican City State lower than that found in other studies on similar samples [7-10]. This may be due to the small sample size and to the low number of COVID-19 cases tracked in the Vatican City State thanks to the control and prevention measures taken by the Directorate of Health and Hygiene. These measures were applied uninterruptedly through the first and second waves and included preventive measures such as hand disinfection, social distancing, use of face masks, body temperature measurement and symptom screening, as well as clinical surveillance, isolation protocols for symptomatic individuals and careful evaluation of all potential contacts [6].

This study has several limits. The main is that our analysis only focused on the cumulative seroprevalence of anti-SARS-CoV-2 antibodies without dividing between Immunoglobulin M (IgM) and Immunoglobulin G (IgG). In addition, the correlation of the antibody index with the result of a nasopharyngeal RT-PCR test was not available. Last, this methodology had a measuring interval between 0.05 and 10; the value of cases with an index $\langle$ 0.05 and $\rangle$ 10 were considered as 0.05 and 10, respectively, in the evaluation of means and standard deviations and errors.

Future epidemiological studies may be necessary to evaluate the changes in SARS-CoV-2 seroprevalence in the Vatican City State over time. Furthermore, additional analyses will be important to study the effects of the COVID-19 vaccine. At this regard, the introduction of a mass vaccination campaign in the Vatican City State, starting on January 13, 2021 and aiming to vaccinate a large portion of the total population assisted by the healthcare services of the Vatican City State over 18 years of age, will be of utmost importance in the control of infection spread.

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Author contributions

MR: conceptualization, writing original draft; AA: conceptualization, critical revision, supervision; PMS: data collection; CV: data analysis; FDG: critical revision, supervision.

Declaration of Competing Interest

The authors declare they have no conflict of interest.

Acknowledgments

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