SARS-CoV-2 Antibody Prevalence in Health Care Workers of Lodi Hospital, the COVID-19 Italian Epicentre

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Summary Box

What's already known on this subject? PubMed, SSRN, medRxiv and bioRxiv were searched on May 28th 2020 using the following terms: “Sars-Cov-2” “COVID-19”, “antibody”, “seroprevalence”, “healthcare workers”. We identified studies assessing seroprevalence in local and regional communities, but studies are lacking on seroprevalence in healthcare workers and comparison with global population seroprevalence. Moreover, no evidence on the effectiveness of a risk-management protocol to protect healthcare workers for Covid-19 exposure was investigated..

What does this study add? SARS-CoV-2 serology tests with robust performance characteristics are critical in determining the spread of COVID-19 infection during the current pandemic. This study provides the estimate of COVID-19 seroprevalence among healthcare workers in Lodi Hospital, the

epicentre of Italian Covid19 outbreak, as a indicator of effectiveness of risk-management measures adopted in order to protect front-line Health care workers during the COVID-19 pandemic.

Abstract

Background: The prevalence of specific antibodies against SARS-CoV-2 could be regarded as a surrogate measure of effectiveness of infection prevention and control strategies (IPC) for healthcare workers during Italian pandemic outbreak. This paper reports on a survey carried out in April 2020, to assess the prevalence of Sars-Cov-2 IgG-specific in Health Care Workers (HCWs) at Lodi Hospital, a public healthcare centre located in the area of the first epicentre of Italian Covid-19 outbreak, as compared to a sample from the general population from the same area.

Method: The IgG title has been determined by the Liaison® DiaSorin® SARS-CoV-2 S1/S2 IgG test in peripheral blood samples of 2415 HCWs and in 1792 people resident in the same area. Socio-demographic variables and job tasks related to the exposure determinants have been considered.

Results: The prevalence of HCWs with IgG-specific antibodies was 16.8%. IgG positivity showed correlation with age, job title (healthcare assistant and medical technician), occupational risk exposure (high vs low risk). IgG prevalence among HCWs was significantly lower than in the sample of the Lodi general population (29.8%) (OR= 0.469; 95% CI: 0.405-0.544), $p<0.001$.

Conclusion: In spite of the potentially higher risk of contacts with the SARSCoV2 virus in healthcare setting, the HCW population showed a lower prevalence of IgG-specific antibodies as compared to a representative sample of people living in the same area. A possible explanation of such unexpected finding is that the likelihood of intense, continuous and effective contacts is higher in the general population than in trained and protected people. This highlights the need, at the onset of epidemics, to implement an early and multidimensional system of protection of the working population, pointing out to an increasing awareness of healthcare workers towards the SARS-COV-2 transmission pathways.

Introduction

On January 2020 the World Health Organization (WHO) declared a public health emergency and on 11th March defined it as a global pandemic [1] due to more than 118,000 cases of the coronavirus illness in over 110 countries and the risk of further global spread. Report from affected countries during the former SARS-Cov1 pandemic outbreak (2003) have revealed that about 22% of HCWs

were affected in hospitals across Hong Kong with the initial wave managing to infect 80% of the staff working in the medical wards of Prince of Wales Hospital. [2]

It is thought that the risk of infection for hospital workers is greater than that of general population, and that medical personnel is a potential vehicle for spreading of SARS-CoV-2 [3]; this is supported by evidences of super-spreading events in medical institutions that have treated patients suffering from COVID-19. In Italy, by May 28th, 28.686 HCWs resulted infected (12% of total cases reported), representing about 3,6% of HCWs workforce in Italy), with129 eaths. These data seem to confirm a higher risks of SARS-CoV-2 infection among professionals who work in close physical proximity to patients [4]. Additionally, some procedures such as non-invasive ventilation, high-flow nasal cannula and bag-mask ventilation may generate higher aerosol volumes [5]. In all settings, patients who have unspecific symptoms of COVID-19 or very mild flu-like symptoms might pose considerable risk to healthcare workers who may not adopt adequate protective measures. Moreover, living in an epidemic area increases the likelihood of effective contacts than the general population; hence keeping the level of risk as close as possible to that of the general population of the same territory would be a desirable outcome.

However, risks of infection in healthcare worker can be mitigated with adequate precautions within health facilities [6-10]. Primarily, this involves the use of personal protective equipment (PPE) including a gown, gloves, facemask, and a face shield or goggles. Careful donning and doffing of this equipment remains a key defence, but requires considerable training and supervision. Infection control training and education were consistently associated with decreased infection risk [11-15]. Risks for infection may also be higher at the beginning of the outbreak as healthcare workers may not yet be familiar with PPE use and to adopt specific safety procedures [16].

WHO interim guidelines [19] highlight that PPE is one of effective measure within a package that comprises administrative and environmental and engineering controls. These controls consisted of: a) Administrative controls ensuring the availability for infection and prevention control measures, such as appropriate infrastructure, the development of clear infection prevention and control polices, facilitated access to laboratory testing, appropriate triage and placement of patients, adequate staff-to-patient ratio and training staff; b) Environmental and engineering controls aim at reducing the spread of pathogen and the contamination of surfaces. They include providing adequate space to allow social distancing.

Organizational measures have been adopted early at Lodi Hospital [17, 18]. These included case definition, reorganization of hospital in the event of Covid-19 pandemic, and pathways for suspicious or confirmed patients and Healthcare for each sector (including OSH). An Occupational

health surveillance system has been rapidly activated, and quickly reached its full strength. A Crisis Unit was established to properly manage the emergency, with a 24/7 uptime. A summary of this reorganization based on the level of intensity of care (4 areas) for COVID19 created at the Lodi Hospital is reported in Table 1S (Supplementary material).

The actual risk of exposure for HCWs was clearly influenced by the area in which health care workers operated. Accordingly, different levels of PPD and protection measures have been defined for each area., An Infection Control Group (ICG) has been established with the following tasks: i) Identify correct PPD for the specific area; ii) Create the filter zones; iii) Train all the workers for specific procedures and instrumental practises according to the area risk exposure. Until this time, HCWs had been trained for the ordinary biological risk and not for the extraordinary situation created by the epidemic; iv) Check dressing and undressing activities before entering or leaving the area by a tutor.

The present study is aimed at evaluating the prevalence of SARS-CoV-2 IgG positivity in the HCW population of the Lodi Hospital that was first exposed to the pandemic in Italy, as a surrogate measure of effectiveness of infection prevention and control strategies (IPC) for the protection of healthcare workers that have been introduced in the hospital during the epidemic outbreak. This study describes the main characteristics of HCWs positive to seroprevalence test, highlight the relationships between positive (confirmed) cases and independent variables such as gender, age and occupational variables (professional profile and SARS-Cov-2 professional risk of exposure in Hospital), It also compares the prevalence of IgG in HCWs population with the prevalence in the local population (subjects from the general population living in the Lodi Area, the epicentre of Italian COVID 19 outbreak)

MATERIALS AND METHODS

Context and setting

A cross-sectional survey was carried out in the Lodi Hospital (A.S.S.T. LODI), a Socio-Sanitary Public Company located in a rural area in Lombardy (Northern Italy), close to Milan. The study population included all health care workers (medical personnel and non medical personnel) regardless of the type of employment contract. Data on the study population have been extracted from Human Resources database and coded in an anonymous dataset. No exclusion criteria were applied. HCWs (N= 2415) have been recruited on the basis of compulsory by the law health examination which was established in Lombardy (Regional Decree, 23th April 2020). People

belonging to the general population were recruited on a voluntary basis following the pubblication of a Regional decree (23th April 2020) indicating the launch of a screening campaign compulsory. A sample from Lodi general population (N=1792) has been selected on a random basis from ATS (Health Protection Local Agency) database.

The variable "Patient Contacts" has been derived from the intensity of HCWs contact with Covid-19 positive patients in different working areas. Professional risk Exposure estimates the actual level of exposure to the virus.

Serological tests

Serological tests were performed from 23 th April 2020 till 5th May 2020, both in HCWs and in Local population. ASST Lodi Lab Test processed them.

Subjects have been screened with using The Liaison® DiaSorin® SARS-CoV-2 S1/S2 IgG test (DiaSorin). This is a fully automated quantitative serology test to detect solution for the detection of IgG antibodies against virus on a peripheral blood sample. The detection of Neutralizing antibodies has 94.4% positive agreement to Plaque Reduction Neutralization Test (PRNT). Positive or Negative results were established by the following cuts off: <12: Negative; >= 15: positive.

Statistical Analyses

The Statistical Package for Social Sciences v.26 (IBM SPSS Statistics, Armonk, NY) was used for all analyses. Arithmetic means and standard deviations were used to describe continuous variables. Proportions and prevalence rates were used to describe categorical variables. Chi-square tests and multinominal logistic regression were performed to assess the association between SARS-CoV IgG positivity and the sociodemographic characteristics of the healthcare workers. To test the differences between HCW and general population a Binary Logistic Regression was used. Statistical significance was set at $p<0.05$ and $p < 0.01$.

RESULTS

From 23th April till 5th May 2020, 2415 HCWs have been tested for SARS-CoV IgG seropositivity. Their sociodemographic characteristics are summarized in Table 1. The mean age was 48.0 (SD 10.0 years), 72.7% were women. Nurses were the most represented job profile, medical personnel was 83.9% of the total population. HCWs have been almost equally exposed to low, medium and

high intensity of contacts with patients positive to SARS-CoV-2. The professional risk evaluation showed a smaller number of workers exposed to lower risk categories then higher ones (34.3% vs 65.7%).

Details of their sociodemographic characteristics of the sample from the Lodi population that have been tested for SARS-CoV IgG seropositivity are presented in Table 2. The mean age of the general Lodi population investigated was 44 years (SD 16.0 years); 64.7% were women.

Among healthcare workers the prevalence of IgG against SARS-CoV-2 was 16.8%.

The distribution of positive cases sorted by sociodemographic characteristics is shown in the Table 3. Chi square test was used to measure the association between the different categorical variables gender, age, job profile, intensity of contacts, risk exposure and the seroprevalence. The results do not show differences in seroprevalence between males and females between IgG positive and negative people. However, the seroprevalence of anti-SARS IgG in HCWs aged <44 is significantly lower than expected, whereas older (>55 years of age) people is higher than expected on the basis of the results of analysis of people working in No Risk Area ($p < 0.01$). Health assistants have a higher positive seroprevalence than expected ($p < 0.05$), medical technicians have a lower positive seroprevalence than expected; risk of exposure confirmed a higher prevalence of positive cases than expected among HCWs exposed to High professional risk, and less positive cases than expected in those who have been employed in No Risk Area ($p<0.01$).

Odd Ratios were estimated by using a Multinomial Logistic Regression. Table 4 summarizes the IgG positivity odds ratio and 95% confidence intervals distinguished by sociodemographic characteristics in HCW.

Age was positively associated with an increase in the odds of being positive of 1.029 times/year. The job profile of healthcare assistant shows an increased risk for IgG positivity (OR = 1.649; 95% CI 1.012-2.687). The intensity of patient contacts does not show any significant association. The risk of being IgG positive was significantly associated with the high risk category (OR=2.298; 95% CI 1.360-3.885) with a risk-related trend.

The sample from the general population of Lodi, comparable as for socio-demographic characteristics to the HCW showed a 29.8% of people positive for SARS-CoV-2 IgG. The distribution of positive cases by sociodemographic characteristics is shown in the Table 5. No association was found between gender and positive result for SARS-CoV-2 IgG positivity. A positive association was evident between age and IgG positivity,

The difference between the number of HCWs that resulted positive for SARS coronavirus 2 immunoglobulin G antibody (16.8%) and the positivity found in the Lodi general population (29.8%) was statistically significant. The HCW group showed a significant lower risk for IgG positivity compared to the general population (OR = 0.469; 95% CI 0.405-0.544).

DISCUSSION

Healthcare workers are particularly vulnerable to infection in relation to the peculiar characteristics of their work. The risk of infection for HCWs is considered greater than the risk for the entire population and medical personnel is a potential vehicle for spread of SARS-CoV-2.

Establishing a survey on seroprevalence in a population of HCW should help better understanding about the actual risk of infection within specific “target” populations and, secondly, the efficacy of the measures of protection adopted. Knowing the prevalence of seroconversion of the population from which the HCW come from, it is possible to verify whether the seroconversion rates of the HCW are superimposable on the baseline population or if those seroconversion rates are characterized by an additional characteristic risk deriving from the profession carried out. If the risk has been mitigated it should be possible to detect seroconversion rates equal to or less than the general population if such measures also have an impact outside the workplace.Unfortunately, the seroprevalence investigation may be burdened by some pitfalls that mainly depend on the type of inclusion (voluntary or otherwise), the type of test used, the time elapsed between the spreading of the virus and the carrying out of the test. Even though the time to seroconversion and the antibody levels elicited are not well known yet, studies on past coronavirus have shown that circulating antibodies against MERS-CoV last for at least 1 year [23]. IgG levels were maintained for more than 2 years after SARS-CoV infection[24]. A recent studies showed that SARS-CoV-2 antibodies could have a shorter persistence, with IgG levels and neutralizing antibodies in individuals who recovered from SARS-CoV-2 infection decreasing within 2–3 months after infection [25].

In this study the enrolment of HCWs has been almost complete, laboratory test had a very high sensitivity and specificity, and the time between the diagnosis of the first CoViD-19 case and the time since running of the tests was short. The first Italian case was diagnosed right in the Lodi Hospital on 19th February afternoon, when a 38-year-old male accessed ER with aspecific fever and asthenia and tested positive for SARS-CoV-2.

Among healthcare workers of Lodi Hospital the prevalence of IgG against SARS-CoV-2 was 16.8%. Many studies have evaluated the prevalence of current infection as determined by a positive

RT-PCR, but studies of seroprevalence of antibodies against SARS-CoV-2 are still limited, due to methodological limitations. Many studies on the burden of SARS-CoV-2 infections are case series and evaluations of clinical cohorts of exposed HCWs are at their early stage [26].

Wang and coll [27] evaluated a large series of 25 961 patients with PCR-confirmed COVID-19 diagnosed in Wuhan, China, through 18 February 2020. Health care workers accounted for 5.1% (1316 of 25 961) of cases. The overall estimated COVID-19 incidence, using epidemiologic data for denominators, was higher in HCWs than the general population (144.7 [95% CI, 137.0 to 152.8] vs. 41.7 [CI 41.2 to 42.2] per 10^6 people).

McMichael and coll [28] found that 29% (50 of 167) of cases in a U.S. long-term care facility were HCWs. Folgueira e coll. [29] found 11.6% RT-PCR positive cases of all hospital workers. Madsen and coll [30] examined IgG prevalence in 341 Emergency Department employees working at University of Utah Hospital. Of these employees, 16 (5.9%) were positive SARS-CoV-2 IgG antibodies, 15 (5.6%) had an indeterminate result, and 239 (88.5%) had a negative result.

Dealing with seroprevalence of antibodies in HCW, Garcia-Basteiro and coll. [31] on an HCW population of 578 participants found 9.3% (95% CI: 7.2-12.0) seropositive for IgM and/or IgG and/or IgA against SARS-CoV-2. The cumulative prevalence of SARS-CoV-2 infection was 11.2% (95% CI: 8.9-14.1).

The seroprevalence in HCW populations has a great variability and need to be contextualized in the population of origin. Finding high levels of seroconversion in HCWs belonging to a population in which the virus had a low circulation assumes a different meaning compared to a population in which the virus circulation has been very high, as in our survey.

We investigated a possible association between IgG seroprevalence and sociodemographic characteristics. Among the positive subjects the most represented (frequencies) characteristics are female gender, age group 45-54, nurse job category, high intensity of contacts and high occupational risk.

According to the literature, gender do not show significant association with antibodies to SARS-CoV-2.

A significant association has been found between age and risk for SARS-CoV-2 infection, being aged people at higher risk than younger. This is in agreement with the distribution of the virus in the population already described and would support the need to deserve more attention to these workers omployed in HSE.

Some studies reported SARS-CoV-2 infection incidence by HCW professional role. Infections occurred in HCWs across various clinical and nonclinical (including nonpatient contact) roles. In our survey no association was found between job title and IgG positivity, with the only exception for Healthcare Assistant (OSS), being at higher risk. There was no consistent difference in risk between nurses and physicians[32]. These data suggest that there is no risk specifically linked to the job title but, rather, as evidenced from the variable "risk exposure", from the methods of carrying out one's work activity. This is in contrast to the relief that the higher risk to non medical categories could be explained by the lack of consolidated hygiene habits especially for those working in services that do not have direct contacts with outpatients and visitors [33]. In our study. the positive cases found among HCWs employed in no risk area are significantly less than expected. Organizational strategies adopted (smart-working, social distancing and no front office activities) should have been effective in protecting them. The variability between studies may depend on the period in which different studies have been conducted or different OSH measures, including education and training in infection control measures.

The statistically significant correlation between risk indices and positivity is in agreement with literature and must be related to the prevalence of seroconversion of the population of origin. In the presence of seroconversion rates in HCW higher than those of the general population, it could be concluded that this population is burdened by additional risks not mitigated by the implemented measures.

Although job titles overall do not pose a higher risk, the statistically significant differences between risk categories highlights how the actual risk is linked to actual and relevant contacts with the infected people. This data is further supported by the lack of significance of the parameter relating to the intensity of contacts, demonstrating a greater weight of the type of contact compared to the frequency of contacts. According to the literature, intensity of contact with patient and the Area in which HCWs were employed during pandemic are low related to serology positive results. In most studies direct patient contact has been associated with in-creased risk compared with less direct contact[34-37]. Conversely, evidence of an association between of contact with patient and risk for infection was inconsistent [38,39].

There is consistent and robust evidence on the association between use of masks and decreased infection risk [40,41,42]. PPE use (gloves, mask, gown, and eye protection) have been associated with reduced infection risk versus partial PPE use [43]. Some other studies found a dose–response relationship between more frequent or consistent PPE use and decreased risk [44]. Many other

measures have been evaluated and associated with a decreased risk of infection (e.g. handwashing, infection control training and education, HSE and administrative measures).

HCWs showed a significant lower risk for IgG positivity compared to a sample of the general population living in the same area and comparable for socio-economic status (OR = 0.469; 95% CI 0.405-0.544). In spite of limitations deriving from the few matching factors (gender and age), still gives relevant insights. The HCW population is characterized by a lower seroconversion rates than the population from which it originates. Taken together, these findings suggest the efficacy of protective measures adopted towards the operators.. Nevertheless the correlation with risk offers an interesting base in supporting the reliability of the assessment methods used and in the graduation of the prevention measures to be implemented.

The current study presents some limitations. Since other parameters other than IgG prevalence were not included in the study, it is not possible to define the precise number of asymptomatic subjects that could have contributed to the spread of the infection. However, the number of asymptomatic HCW, given that the HCW population is taken from the same general population, should be superimposable and this effect should be negligible. A further issue derives from the correct pairing between HCW and the reference population. A selection of subjects with overlapping age and gender was made, but for better matching it would have been appropriate to add other factors such as, for example, the mode of exposure to the virus.

Conclusion

Lodi ASST was the first Italian hospital which faced COVID19 outbreak. Italian COVID19 pandemic started in on 19th February. Comprehensive preventive measures were rapidly adopted and a new organization of the hospital was established. Considering the novelty of the event, it has been interesting to evaluate the prevalence of IgG antibodies against SARS-CoV-2 in the HCWs operators involved. The present survey can help answering important questions about the risk of infection within a specific populations and the efficacy of the measures of protection adopted. With a prevalence of 16.8% tis sensitive groups showed a lower seroprevalence that a representative group of people living in the same area.

A possible explanation is that, given the rapid implementation of a multidimensional system of protection that included OSH risk graduation and management in the study population, an increase in the attention of health workers towards the SARS-COV-2 problem has led to a paradoxical effect of reduction risk in the population most at risk.

This study also highlight significant difference in age, level of professional risk; No difference between job profile was found, but Healthcare Assistants shows an increased risk for IgG positive results; moreover among medical technician positive cases are less than expected. Significant differences between high risk area compared to low risk highlight how the actual risk is linked to actual and relevant contacts with the virus. This data is further supported by the non-significance of the parameter relating to the intensity of contacts, demonstrating a greater weight of the type of contact compared to the number of contacts.

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Compliance with ethics guidelines

This article contain data extracted from health surveillance records and lab test files. It does not involve a protocol which requires approval by the relevant institutional review board or ethics committee. It is not allowed or possible conduct or report or dissemination plans of this research. General Directorate approved use of these data.

Conflicts of Interest and Financial Disclosures

The authors Baracco Alessandro, Perotti Gabriele Mario, Fillipin Andrea, Anesi Adriano, Beccarini Vittorio, Raimondi Lucio, Galvani Silvia, Bosio Davide, e Bergamaschi Enrico declare no conflicts of interest. The authors whose names are listed certify that they have no affiliations with or involvement in any organization nor entity with any financial interest or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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Table 1: Sociodemographic characteristics of Lodi Health Care Workers

		Lodi Hospital HCWs	
		Frequency	%
Sex (n=2415)	Female	1754	72.6
	Male	661	27.4
Age (n=2378)	<44	736	31.0
	45-54	1036	43.6
	55-65	588	24.6
	>66	18	0.8
Job profile (n=2371)	MD	417	17.6
	Nurse	1014	42.8
	Healthcare Assistant	257	10.8
	Healthcare Executive	45	1.9
	Medical Technician	256	10.8
	Technician	188	7.9
	Administrative	194	8.2
Contacts with patients (n=2371)	0 – High	1431	60,3
	1 – Medium	513	21,6
	2 – Low	427	18
Risk Exposure (n=2378)	0 – High Risk	704	29.6
	1 – Medium Risk	856	35,9
	2 – Low Risk	538	22.6
	3 – No Risk	280	11.7

Table 2: Sociodemographic characteristics of Lodi general population

	Subsets	Lodi general population (N=1792)	
		Frequency	%
Sex (N=1792)	Female	1159	64,7
	Male	633	35,3
Age (N=1792)	<44	819	45,7
	45-54	487	27,2
	55-65	350	19,5
	>66	136	7,6

Table 3: Positive IgG HCW cases distribution by sociodemographic characteristics

		Lodi Hospital HCWs		
		Frequency IgG +	% IgG +	% IgG/tot
Sex	Female	287	71.8	11.9
	Male	113	28.3	4.7
Age	<44	99	**24.8**-**	4.2
	45-54	169	42.3	7.1
	55-65	125	**31.3**+**	5.3
	>66	7	**1.8**+**	0.3
Job profile	Medical Doctor	71	17.8	3.0
	Nurse	182	45.7	7.7
	Healthcare Assistant (OSS)	57	**14.3*** +	2.4
	Healthcare Executive	3	0.8	0.1
	Medical Technician	31	**7.8*-**	1.3
	Technician	26	6.5	1.1
	Administrative	28	7.0	1.2
Patient contacts	0 – High Contact	252	63,4	10,6
	1 – Medium Contact	513	22,1	22,1
	2 – Low Contact	427	14,3	14,3
Risk Exposure	0 – High Risk	149	**37.3**+**	7.1
	1 - Medium Risk	138	34.5	6.6
	2 - Low Risk	81	20.3	3.9
	3 - No Risk	32	**8.0**-**	1.5

* $p<0.05$
** $p<0.01$
- Less than expected (Residual Standardized Adjusted Evaluation)
+More than expected (Residual Standardized Adjusted Evaluation)

Table 4: IgG positivity odds ratio and 95% confidence intervals divided by sociodemographic characteristics in HCW

		OR (95%CI)
Sex	Female	0.938 (0.724-1.214)
	Male	-
Age		**1.029 (1.016-1.041)**
Job profile	Medical Doctor	0.862 (0.634-1.171)
	Nurse	0.987 (0.579-1.682)
	Healthcare Assistant (OSS)	**1.649 (1.012-2.687)**
	Healthcare Executive	0.386 (0.109-1.374)
	Medical Technician	1.399 (0.748-2.618)
	Technician	0.833 (0.460-1.508)
	Administrative	-
Patient contacts	0 – High Contact	1.014 (0.594-1.728)
	1 – Medium Contact	0.715 (0.382-1.337)
	2 – Low Contact	-
Risk Exposure	0 – High Risk	**2.298 (1.360-3.885)**
	1 - Medium Risk	1.527 (0.920-2.535)
	2 – Low Risk	1.404 (0.827-2.394)
	3 - No Risk	-

Table 5: Positive IgG positive cases of the sample from Lodi general population and sociodemographic characteristics

		Lodi general population		
		Frequency IgG +	% IgG +	% IgG/tot
Sex	Female	330	61.8	18.4
	Male	204	38.2	11.4
Age	<44	211	**39.5**-**	11.8
	45-54	129	24.2	7.2
	55-65	122	22.8	6.8
	>66	72	**13.5**+**	4.0

Supplementary Material

Table 1S - Organizational Criteria adopted since the beginning of the local spread of pandemic disease

Professional Risk for SARS-CoV-2	Areas	Biological Risk	PPE for SARS-CoV-2
High	Blue Area (Emergency Room, ICU)	Providing invasive and\or direct cares to COVID19 patients Aereosol-generating procedures on COVID19 patients Sustained Contact < 1 mt.	Gown Respiratory N95 or FFP2\FFP3 Eye Protection, Face shield Glove Surgical Cap Boots or closed work shoes
	Yellow Area	Potential Aereosol-generating procedures on COVID19 Sustained Contact < 1 mt.	
	Orange Area, Department of Pneumology, X-ray Lab, Nasal and Oropharyngeal Swabs Lab, Home healthcare services.	Health care services \contact with COVID19 patients	
Medium	Other Surgeries	Health care services \contact with NO COVID19 patients.	Gown Respiratory FFP2 Glove Face shield
Low	Green Area	Health care Activities in COVID19 free zone	Medical Mask Glove Face Shield
No risk	Administrative and Technician Activities	Social exposure	Medical Mask