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RESEARCH ARTICLE

The speed of Sars-CoV-2 infection in employees of an academic hospital before vaccine access

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ABSTRACT

Objective. Study aimed to estimate the speed of SARS-CoV2 infection according to healthcare workers' jobs at hospital.

Methodology. A prospective cohort study was conducted. The ANOVA procedure was used to evaluate the differences among three different hospital job types and the Kaplan-Meier procedure to estimate the median speed of infection.

Results. There was difference between the frequency of Sars-CoV-2 infection between women's cumulative incidence rate of 27.7% compared to that of men at 22.3%, $\text{Chi}^2 = 4.24$ $\text{DF} = 1$, $p = 0.04$. The average age of the three work groups (Clinicians, administrative staff, and maintenance workers) showed also difference (F Snedecor = 19.2 $\text{DF} = 2$, $p = 0.000$). There was no statistically significant difference regarding the speed of SARS-CoV-2 infection according to sex (Log Rank = 0.02 $\text{DF} = 1$, $p = 0.89$). In addition, there was no difference regarding the speed of infection according to the hospital job performed (Log Rank = 3.74 $\text{DF} = 2$, $p = 0.15$).

Conclusions. Infection tends to be more frequent among women. There is no difference in infection speed among sexes, nor among jobs performed. Infection prevention measures must be reinforced, to avoid contagion and prevent its spread within the hospital.

Keywords: SARS-CoV-2 virus, infection speed, healthcare workers, ANOVA, Kalpan-Meier procedure.

Introduction

A year and a half after the first coronavirus case (COVID-19) appeared in Latin America and the Caribbean, a health crisis was unleashed that has continued alongside persistent deterioration in social development. During this period of crisis, the region accumulated more than 44 million cases and almost 1.5 million deaths from COVID-19. This is disproportionate to other regions of the world, given that, with only 8.4% of the world's population, in Latin America and the Caribbean, COVID-19 cases and deaths from the virus represent almost 20% and 30%, respectively, of the worldwide recorded totals. The vulnerable conditions that characterize Latin America and the Caribbean have made it especially sensitive to the effects of the pandemic¹.

According to the Colombian National Institute of Health (INS), since the beginning of the SARS-CoV-2 pandemic and until January 2022, there were 70,468 infections recorded among health care workers, of which 3,019 were asymptomatic and 341 died. Among the 28,977 cases directly related to health care workers, 137 died from COVID-19. In order of frequency, nursing assistants were the leading occupational group with 17,087 cases, followed by doctors with 12,030, professional nurses with 7,272 and health students with 4,368 cases of COVID-19².

Healthcare workers were considered to be at an increased infection risk of SARS CoV-2, and cases of COVID-19 among health care workers were reported since the beginning of the outbreak^{3, 4}.

Some studies pointed out that healthcare worker have a seven-fold increased risk of developing a severe form of COVID-19 and those who work

in social assistance and patient transportation have a two-fold risk, compared to the community at large⁵.

The Center for Disease Control (CDC), in 2022, reported 907,003 cases of COVID-19 in health care workers in the United States out of which 2,302 resulted in death⁶.

Healthcare workers, especially clinicians, are at increased risk of contracting SARS-CoV-2 due to their occupational functions; however, at the beginning of the outbreak, there was not enough data on the epidemiological behavior of infection among health care workers.

In an effort to slow the speed of spreading Covid-19, governments around the world closed schools and other settings and moved to online learning and working. Even though, there are not many reports of the impact of this effort on the health system and public health services.

This study aimed to estimate the speed of Sars-Cov-2 infection among healthcare workers in an academic hospital, prior to vaccine access. in Colombia.

Methodology

A prospective cohort study was conducted, at the Tomas Uribe Uribe Departmental Hospital (HDTUU) a medium and high complexity academic hospital in Tuluá, Colombia, with its health care workers (HCWs) as the study's subjects, prior to vaccine access.

Due to a previous lack of immunological exposure, all workers were considered equally susceptible to contracting SARS-CoV-2 and therefore 1,100 workers were monitored using epidemiological surveillance and laboratory

tests during the study period from April 2020, when the first case of Covid-19 was reported in the hospital until March 2021. The vaccination program began in April 2021.

A health questionnaire, delivered to HCWs, was applied weekly to identify new cases, regardless of whether they had respiratory symptoms compatible with Covid-19 or not. The questionnaire included socio-demographic data, aspects of the event-exposure relationship such as date, work location, length of exposure, type and length of job performed, and data about the contact person, if and when known. A telephone hotline was available 24 hours a day to receive reports from employees who suspected they had been exposed to infection. Simultaneously, epidemiological surveillances were carried out to identify "clusters" of cases or groups of workers exposed to a known case and a contact-tracing program was implemented.

Laboratory tests were available to all personnel, taking as a reference what the Ministry of Health established.⁸

The laboratory tests used to detect the infection were 90.6.2.70 SARS-CoV-2 (Covid-19), IgG antibodies, registered in the Instituto de Vigilancia de Medicamentos y Alimentos (INVIMA), and the SD BIOSENSOR Standard Q COVID19 IgM/IgG DUO Test; both compliant with the quality requirements demanded by the Instituto Nacional de Salud (INS). HCWs with doubtful results had the test repeated and when the PCR test became available, they were evaluated only through this test.

A health worker was defined as any person who had a contractual relationship with the hospital and fulfilled a daily work schedule. The staff were classified as follows: clinicians were those

with direct contact with patients, administrators those with office work and operatives those in charge of maintaining hospital tasks.

Statistical analysis plan

The Chi square test was applied for contrast analysis when comparing two groups and Analysis of Variance to evaluate quantitative variables among the three job groups. The Kaplan-Meier procedure was used to estimate the speed of infection using the log-Rank test, pointing out the median time until infection among variables of interest for the study. An alpha level less than 0.05 was used to determine statistical significance^{7, 8,9,10}.

Data were recorded prospectively during the study period and informed consent was not required as it was a mandate from the Ministry of Health to follow up on all health care workers, however, the data was anonymous and no personal identifiers were collected.

Statistical procedures were performed with the statistical packages SPSS®¹¹ version 26 and SAS™¹² version 9.0.

Ethical considerations

National ethical standards established for studies like this one were taken into account.

Results

Women contributed to the 63.5% of staff working at the hospital, and sex difference was statistically significant $\chi^2 = 60.8$ DF = 1, $p = 0.000$. Among clinicians and administrators, women predominate with 68.5% and 66.5%, respectively. Among operatives, men predominate with 70.8%. Table 1.

Table 1. Health care workers distribution, by sex and job performed.

Type of job		Sex		Total
		Females	Males	
Clinicians		445	207	652
		68.3%	31.7%	100.0%
	Administrators	127	64	191
		66.5%	33.5%	100.0%
Operatives		31	75	106
		29.2%	70.8%	100.0%
Total		603	346	949
		63.5%	36.5%	100.0%

Source: own estimation.

There was a difference between the cumulative incidence infection rates of SARS-CoV-2 by sex, 27.7% in women and 22.3% in men. This difference was statistically significant, $\text{Chi}^2 = 4.24$ DF = 1, $p = 0.04$. Table 2.

Table 2. Cumulative incidence rate of SARS-CoV-2 infection, by Sex.

Sex		Infection		Total
		No	Yes	
Females		465	172	637
		73.0%	27.0%	100.0%
Males		287	77	364
		78.8%	21.2%	100.0%
Total		752	249	1001
		75.1%	24.9%	100.0%

Source: own estimation.

No difference was found in terms of the cumulative incidence rate of SARS-CoV-2 infection, according to the type of work performed, $\text{Chi} = 5.7$ DF = 2, $p = 0.057$. Table 3.

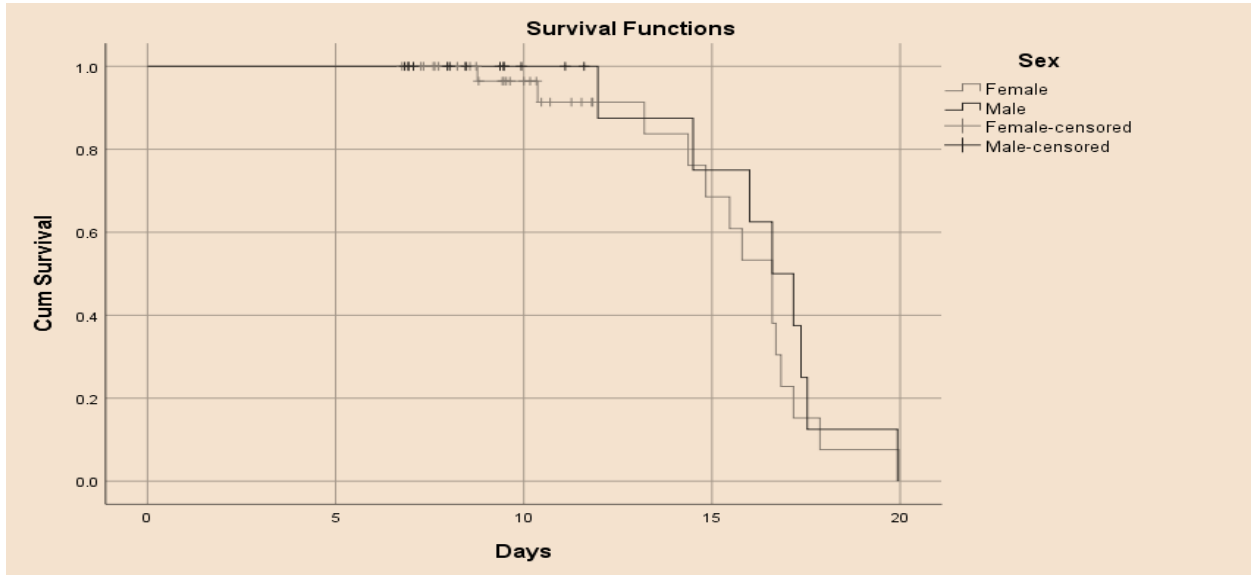
Table 3. SARS-CoV-2 infection, according to hospital type of work.

Type of job		Infection		Total
		No	Yes	
Clinicians		472	180	652
		72.4%	27.6%	100.0%
Administrators		145	46	191
		75.9%	24.1%	100.0%
Operatives		88	18	106
		83.0%	17.0%	100.0%
Total		705	244	949
		74.3%	25.7%	100.0%

Source: own estimation.

The median speed of infection in men was 16.0 weeks with 95% confidence interval (95%CI) (14.8 and 18.4), and 16.0 (16.1 and 17.1) for women. There was no statistically significant difference regarding the speed of SARS-CoV-2 infection according to sex, Log Rank = 0.02 DF = 1, $p = 0.89$. Graph 1.

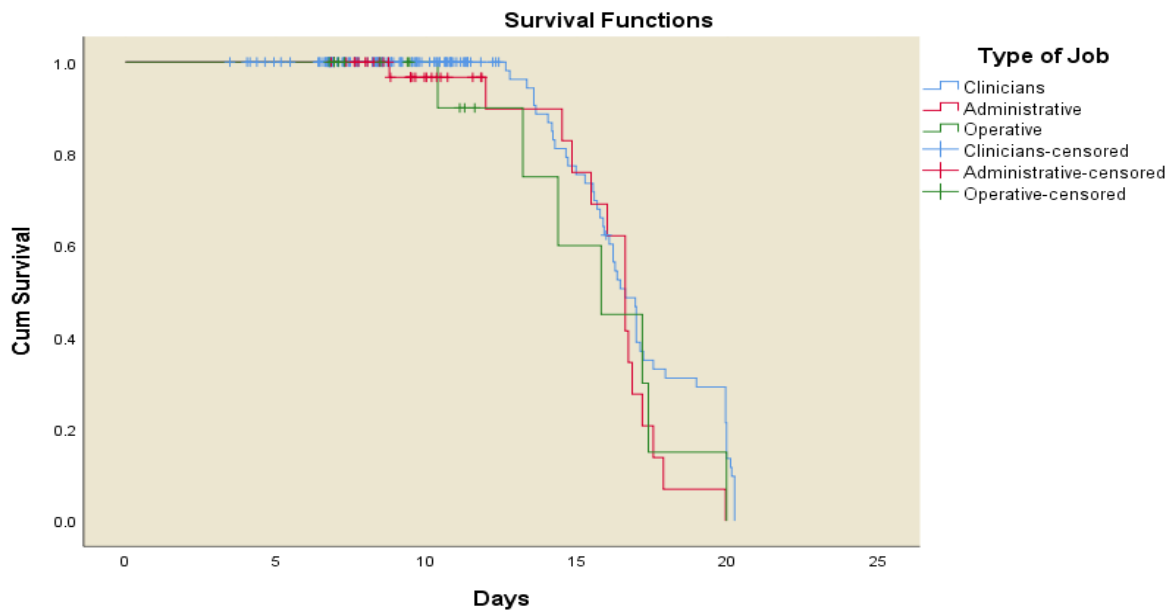
Graph 1. Speed of SARS-CoV-2 infection, according to Sex.



Source: own estimation.

The median speed of infection was 16.6 weeks (15.8-17.3) for clinicians, 16.6 (15.9-17.3) for administrators and 14.4 (12.0-16.7) for operative workers. There was no statistically significant difference regarding the speed of SARS-CoV-2 infection according to the type of work performed, Log Rank = 3.74 DF = 2, $p = 0.15$. Graph 2.

Graph 2. Speed of Sars-Cov-2 infection, according to job performed.



Source: own estimation.

Discussion

Females predominated among hospital workers, at 63.5%, and this difference was significant, $\text{Chi}^2 = 60.8$ $\text{DF} = 1$, $p = 0.000$. Among clinicians and administrators women, also predominated with 68.5% and 66.5%, respectively, in operative workers, men predominated with 70.8%.

The cumulative incidence rate of SARS-CoV-2, was 27.7% among women and 22.3% in men, the difference was statistically significant. $\text{Chi}^2 = 4.24$ $\text{DF} = 1$ $p = 0.04$.

There was no difference in the cumulative incidence rate of SARS-CoV-2 infection according to the type of work performed, $\text{Chi} = 5.7$ $\text{DF} = 2$, $p = 0.057$.

When evaluating the speed of SARS-CoV-2 infection according to sex, the median speed of infection in men was 16.0 weeks 95%CI (14.8 and 18.4), in women 16.0 (16.1 and 17.1). There was no statistically significant difference, $\text{Log Rank} = 0.02$ $\text{DF} = 1$, $p = 0.89$.

There was also no statistically significant difference regarding the speed of infection according to the type of work performed, $\text{Log Rank} = 3.74$ $\text{DF} = 2$, $p = 0.15$. The median speed of infection was 16.6 weeks (15.8-17.3) for clinicians, 16.6 (15.9-17.3) for administrators and 14.4 (12.0-17.3) for operative workers.

A study conducted in Qatar reported that of the 1,048 (87.4%) infected HCWs belonging to the age group below 45 years of age, 488 (40.7%) were women and 450 (37.5%) were clinicians¹³. In our study, 69.2% (172/249) of infected HCWs were women, 57.7% (130/225) were young people under 37 years of age and 73.8% (180/242) were clinicians.

A study, conducted in Portugal, in which 45% of the participants worked at an outpatient level and 28% in the emergency department, reported that 23% had been exposed to the SARS-CoV-2 virus at the community level and 39% at the occupational level¹⁴. Although our study did not evaluate community exposure, the occupational exposure was 24.9%, lower than that reported by Portuguese colleagues.

In Poland, 1,221 health care workers were tested for anti-SARS-CoV-2 IgM + IgG antibodies. The total seroprevalence was 42.7%. In medical students, it was 25.2%, while in doctors it was 43.4% and in nurses 48.1%. The risk of developing the infection was not related to sex, professional work experience, workplace, or intensity of patient contact. Among the elements studied, only caring for patients with COVID-19 significantly increased the risk¹⁵.

In Italy, a total of 140,782 employees in the health sector were invited to participate in voluntary serological screening for the detection of SARS-CoV-2 infection, 82,961 people were analyzed, 59,839 (72.1%) were women, with median and Interquartile Range (IQR) of 50 and 19-83 years of age, respectively. Among these individuals, 10,115 HCWs had positive results 12.2% (12.0-12.4) % and 7,298 (72.2%) were women. The probability of infection was significantly higher among health care workers compared to administrators¹⁶. In our study, positivity was also higher among women, but it only reached 27.7%, much lower than that reported in the Italian study. The median age in our study subjects was 50 with an (IQR) between 25-75 years of age, meaning that the two HCWs groups were quite similar. Our study also found no statistically significant difference

in the infection according to the type of job performed.

The evidence reviewed indicates that HCWs tend to be young, particularly those who work as clinicians, and women predominate among the HCWs. The infection also tends to be more common among women.

The main lesson of this study, given that all workers were considered equally susceptible to contracting the infection, is that the higher rate of infection among women can be explained by the fact that there are more women working in the health sector. What's more, the speed of infection was the same for both sexes and the types of work performed in the hospital, despite the difference on the cumulative incidence rates, which led us to conclude that this difference can be explained by the different levels of risk exposure to the infection.

Conclusion

Infection protection measures must be maintained and reinforced to avoid contracting the infection and preventing its spread within the hospital, with the understanding that the SARS-CoV-2 virus is here to stay among us.

Now that the vaccine is readily available, the findings of this study should be taken into account because of the permanent threat of a new outbreak. As such, we need to consider all possible factors that facilitate the spread of the virus, to better prepare a response to possible future public health threats. What is more, several countries around the world are experiencing peaks of new cases of Sars-CoV-2 despite the existing vaccines.

Conflict of Interest Statement:

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References:

1. Informe Covid19. CEPAL-OPS. October 2021.
2. Recuento de casos de Covid-19 diagnosticados en el Personal de la Salud, Colombia, 2020-2022 Boletín del INS, con fecha de corte: 11 de enero de 2022 <https://www.ins.gov.co/Noticias/Paginas/coronavirus-personal-salud.aspx>
3. Koh D. Occupational risks for COVID-19 infection [Editorial]. *Occup Med (Lond)*. 2020; 70:3-5. [PMID: 32107548] doi:10.1093/occmed/kqaa036
4. Chou R, Dana T, Buckley D, et al. Healthcare workers and coronaviruses: epidemiology and risk factors for infection rapid review. World Health Organization. 2020.
5. Mutambudzi M, Niedzwiedz C, Macdonald EB, et al. *Occup Environ Med* 2021;78:307–314
6. CDC COVID-19 Response Team. Characteristics of Health Care Personnel with COVID- 19 - United States, February 12-April 9, 2020. *MMWR Morbidity and mortality weekly report* 2020; 69(15):477-81
7. Elisa T. Lee. *Statistical Methods for Survival Data Analysis*. Second edition. John Wiley & Sons, Inc., 1992.
8. A. Gouveia Oliveira. *Biostatistics Decoded*. John Wiley & Sons, Ltda, 2013.
9. Chap T. Lee. *Introductory Biostatistics*. John Wiley & Sons Publication, 2003.
10. Schoenfeld D. Partial residuals for the proportional hazards regression model. *Biometrika*. 198 2; 69(1):239–41. [http://refhub.elsevier.com/S2667-193X\(22\)00114-4/sbref0024](http://refhub.elsevier.com/S2667-193X(22)00114-4/sbref0024)
11. SAS Institute Inc., SAS 9.4. Applications based on SAS software, 2021.
12. SPSS 26 IBM Inc. 2021.
13. Mohamed Ghaith Al-Kuwari et al. Epidemiology characteristics of Covid19 infection amongst primary health care workers in Qatar: March-October 2020. *Front. Public Health* 9:679254. Doi: 10.3389/fpubh.2021.679254 <https://www.frontiersin.org/articles/10.3389/fpubh.2021.679254/full>
14. Albuquerque MFPM, de Souza WV, Montarroyos UR, Pereira CR, Braga C, Barreto de Araújo TV, et al. Risk of SARS-CoV-2 infection among front-line health care workers in Northeast Brazil: a respondent-driven sampling approach. *BMJ Open* [Online]. 2022 Jun 6; 12(6):e058369. DOI: 10.1136/bmjopen-2021-05836915.
15. Zóltowska, B. Baranska, I. Jachowicz, E, Sydor, W. Maziarz, B. Mydel, K. Rózanska, A. Wizner, B. Rosinski, J. Kossowska, M. et al. The Seroprevalence of SARS-CoV-2 Antibodies among HealthCare Workers in University Hospital in Krakow before the Era of Vaccination. *Int. J. Environ. Res. Public Health* 2022, 19, 4044. <https://doi.org/10.3390/ijerph19074044>
16. Piero Poletti at al. Seroprevalence of and Risk Factors Associated With SARS-CoV-2 Infection in Health Care Workers during the Early COVID-19 Pandemic in Italy *JAMA Network Open*. 2021, 4(7):e2115699. Doi:10.1001/jamanetworkopen.2021.15699