Magnitude and Factors Related to SARS-CoV-2 Infection in the Elderly Population of Four Municipalities in the Cordoba Department, Colombia

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Abstract

Background: The older adult population has biological and social conditions that increase their susceptibility to health events, such as infection by the new coronavirus. The aim of this study is to analyze the magnitude and factors related to SARS-CoV-2 infection in the older adult population of four municipalities in the Cordoba Department.

Methods: A descriptive study was designed, whose population consisted of all the inhabitants of the four selected municipalities who agreed to participate in the study, to whom a questionnaire of sociodemographic data, symptoms, vaccination, and an RT-PCR test to evaluate the infection were applied. From the secondary source of information, data were extracted from people over sixty years of age. A uni- and bivariate analysis of the information was performed.

Results: The prevalence of infection was estimated at 2.4%. The factors associated with the presence of infection were sex, area of residence, and reported travel to a place with a high prevalence of infection. Vaccination coverage of at least one dose was about 82%. The most commonly reported symptom was cough.

Conclusion: The prevalence of SARS-CoV-2 infection in the elderly population in the four prioritized municipalities is low (2.4%). Being a migrant and having health insurance under the subsidized system were associated with a higher prevalence of infection.

Keywords: Elderly, Coronavirus, SARS-CoV-2, Vulnerability, Infection.

1. INTRODUCTION

The absolute number of people over 60 years of age is growing at a faster rate than the other age groups, as is their percentage share of the total population [1]. It is estimated that by 2025, the older population will increase by 223%, while fertility rates will continue to fall below replacement or substitution level [2]. In Latin America and the Caribbean, approximately 94 million older adults are expected by 2025, and by 2050, there will be 86 million more, mainly located in Brazil, Mexico, Argentina, Colombia, Peru and Venezuela [3].

Since the beginning of the SARS-CoV-2 pandemic, which causes COVID-19 disease, adults over sixty years of age have been considered a high-risk group for infection and severe disease, based on scientific evidence supporting the fact that in this age group there are biological mechanisms of chronic low-grade inflammation, alterations in the immune system and changes in the angiotensin converting enzyme (ACE 2) [4-6]. On the other hand, a high presence of comorbidities in older adults alerted to an increased risk of hospitalization, persistent post-infection complications and worse outcomes [7, 8].

In addition to the biological mechanisms that increase susceptibility to infection and negative outcomes in older adults, there is also social vulnerability and limited access to health services [9, 10]. In conjunction with the biological processes derived from aging, such as deterioration of the state of health, presence of disabilities and increased dependency, there are also social and economic processes; retirement, decrease in income, loss of support networks, widowhood, etc., which would explain the greater vulnerability of older adults to any external threat [11, 12].

Worldwide evidence on the magnitude and factors associated with SARS-CoV-2 infection is scarce, especially in Colombia, specifically in the Cordoba Department, identified as one of the regions that has registered a significant increase in the elderly population in its territory, representing 12.8% of the total population [13].

The objective of this study is to determine the magnitude and factors related to SARS-CoV-2 infection in the population over 60 years of age in four municipalities of the Cordoba Department.

2. METHODS

2.1. Design: A descriptive, analytical, secondary source study was carried out.

2.2. Reference population: The reference population consisted of all the inhabitants of the four municipalities selected within the framework of the royalties' project entitled: "Strengthening the Department of Córdoba with mechanisms to manage the diagnosis and handling of SARS-COV-2 through the implementation of a direct RT-PCR molecular test in the municipalities of Sahagún, Tuchín, Chinú, and San Andrés de Sotavento".

2.3. Sample: A convenience sample was taken from the inhabitants of the four selected municipalities, for a total of 18,000 RT-PCR tests performed.

2.4. Sampling: Stratified sampling was carried out by municipality and township using proportional or fixed allocation, according to the size of the population, based on data from the DANE 2020 population projection, as follows:

Initially, the populations of the four municipalities in the study were added together and the percentage weight of each of them was determined; subsequently, this percentage was extracted from the total sample.

Similarly, for the municipalities of Tuchín and San Andrés de Sotavento, the percentage weight of the population of the townships was identified based on the total inhabitants of each municipality and this percentage was extracted from the sample size chosen for each municipality.

For the municipalities of Sahagún and Chinú, for which the names of the townships are known but not their population, fixed affixation was carried out, taking the size of the urban case from the DANE data, 2020.

Finally, the data collection for the unit of analysis, which was each of the inhabitants of the populations included in the study, was done at convenience, ensuring that they met the eligibility criteria. Table 1.

Subsequently, from the secondary source of information where demographic data, history, symptoms, vaccination status, and RT-PCR test result were consolidated, all participants from the four municipalities that participated in the study and who were older than 60 years of age at the time of the study were selected.

Table 1. Sample size by municipality

Municipality	Total population evaluated	Sample of elderly population	Percentage of the analyzed population
Chinú	2924	819	20.8%
Sahagún	8167	1948	49.4%
San Andrés de Sotavento	3583	723	18.3%
Tuchín	3218	439	11.1%
Total	**17892**	**3945**	**22.04%**

2.5. Data collection process:

2.5.1. Identification of the elderly population: All study participants were asked their age and date of birth, which allowed the selection of older adults.

2.5.2. Demographics: The information was collected by the study field staff, trained for this purpose, using the individual notification form for basic data from the SIVIGILA information subsystem of the National Institute of Health, and in the event of finding a patient with respiratory symptoms, the Acute Respiratory Infection by new virus format was also filled out. Cod INS 346. These instruments were used to obtain information comparable to that reported at the national level. The data collection process was carried out between January and July 2022.

2.5.3. Lab tests: the assay known as "DirectDetectTM SARS-CoV-2 Detection Kit (PCR-Fluorescence Probe)" was used. The technology platform on which Coyote Bioscience designed the DirectDetectTM SARS-CoV-2 Detection Kit is based on the Free qPCR Assay technology, which allows the release of nucleic acids from the clinical sample, reverse transcription and nucleic acid amplification reaction in the same tube. This technology allows DNA and RNA samples to be analyzed in the same tube shortening the overall reaction time compared to other platforms where the reactions must be run in separate processes. The "DirectDetectTM SARS-CoV-2 Detection Kit (PCR- Fluorescence Probe) assay is being evaluated by the WHO to be used as an IVD for the detection of SARS-CoV-2 virus genome with the EUL mechanism. The DirectDetectTM SARS-CoV-2 Detection product is a real-time PCR (RT-PCR) test designed to qualitatively detect SARS-CoV-2 virus nucleic acids in a nasopharyngeal/oropharyngeal swab or sputum sample from individuals who meet the criteria for COVID-19 as dictated by the Center for Disease Control. This test targets the ORF1ab gene and N gene of SARS-CoV-2 virus, which offers an additional aid for diagnosis of SARS-CoV-2 genome in infected patients, and can be used for epidemiological surveillance. This test adopts combined rRT-PCR methods with fluorescent probes to detect conserved regions of the SARS-CoV-2 ORF1ab and N genes, using specific primer pairs and fluorophore-labeled probes, respectively for each gene.

2.5.4. Data on vaccination: at the time of the evaluation of the sociodemographic data of the study participants, the vaccination status was inquired with the question: Have you received any vaccination against COVID19, if yes, the brand and number of doses received were inquired, in all cases in which the participants had their vaccination card with them, these data were contrasted with those of the document. If there were differences, the information on the card was used.

2.6. Statistical analysis:

Continuous variables are presented according to their distribution as mean ± standard deviation or median ± interquartile range and categorical variables as percentages. The Chi-square test was used to calculate associations between the probability of having a positive test and sociodemographic, background, and health insurance conditions. A value of $p<0.05$ was taken as significant. The data were processed in SPSS version 25.

2.7. Ethical considerations:

The Research and Ethics Committees of the Remington University Corporation evaluated and endorsed the study and all its procedures.

3. RESULTS

Out of a total of 18,000 people surveyed in the framework of the macroproject entitled: Strengthening the Department of Córdoba with mechanisms to manage the diagnosis and handling of SARS-COV-2 through the implementation of a direct RT-PCR molecular test in the municipalities of Sahagún, Tuchín, Chinú, and San Andrés de Sotavento", a total of 3945 people over 60 years of age were surveyed, which corresponds to 21.91% of the population studied.

According to their sociodemographic characteristics, it was found that the majority of the people analyzed were female, with a predominance of the 60-69 age group, mostly from the municipalities of Sahagún and Chinú. Nearly 56% live in dispersed rural areas and a smaller proportion in population centers. Ninety-two percent of the older adults reported being insured under the subsidized health care system. Twelve percent of the older adults participating in the study self-identified as indigenous population. Table 2.

Table 2. Sociodemographic characteristics of the elderly population analyzed.

Characteristic	**Frequency (%)**
Age group	
60 to 69 years old	1998 (50.6)
70 to 79 years old	1245 (31.6)
80 to 89 years old	619 (15.7)
Over or equal to 90 year	83 (2.1)
Sex	
Male	1765 (44.7)
Female	2171 (55)
Municipality	
San Andrés de Sotavento	723 (18.3)
Tuchín	439 (11.1)
Chinú	819 (20.8)
Sahagún	1948 (49.4)
Zone of residence	
Dispersed rural	2180 (55.3)

Municipal capital	1174 (29.8)
Population center	402 (10.2)
No information	189 (4.8)
Health Regime	
Subsidized	3657 (92.7)
Contributory	153 (3.9)
Special	65 (1.6)
No asegurado	26 (0.7)
Ethnicity	
Indigenous	485 (12.3)
Roma, Gypsy	2 (0.1)
Afro-Colombian	1 (0.0)

When analyzing the history for SARS-CoV-2 infection in older adults, it can be seen that the most frequently reported comorbidity is diabetes (4.2%). None of the participants referred HIV infection. 0.7% of the people reported working in the health sector. About 8% reported having traveled to areas of high prevalence of infection. Contact with another sick person or with a confirmed case was reported by 2.4% and 0.4%, respectively. Table 3.

Table 3. Frequency of antecedents for SARS-CoV-2 infection

History of sarcov-2 infection	Frequency (%)
Comorbidities	
Asthma	12 (0.3)
COPD	10 (0.3)
Diabetes	167 (4.2)
HIV	0 (0)
Work in the health sector	26 (0.7)
Travel to area with high prevalence of infection	293 (7.4)
Contact with sick person	93 (2.4)
Contact with confirmed case	17 (0.4)

Regarding the vaccination status of the elderly in the four municipalities included in the project, it can be stated that about 82% of them had received at least one dose of the vaccine at the time of sampling. Most of the vaccines received were of the Astrazeneca and Sinovac brands. Table 4.

Table 4. Vaccination status in elderly participants

Characteristic	Frequency	Percentage
Have received at least one dose of the vaccine	3225	81.7
How many doses?		
1	336	8.5
2	1562	39.6
3	1279	32.4
4	48	1.2
Vaccine brand		
Astrazeneca	842	21.3
Janssen	203	5.1
Moderna	606	15.4
Pfizer	1	0
Sinopharm	3	0.1
Sinovac	888	22.5

A positive PCR test result was observed in 95 older adults, which corresponds to 2.4% of the total number of participants.

When analyzing the symptoms reported by the participants with positive test results, the majority reported cough, fever and cephalea. Loss of smell and conjunctivitis were not frequently reported. None of the study participants reported fatigue/adynamia or respiratory distress. Table 5.

Table 5. Frequency of symptoms reported by older adults with positive tests

Symptom	Frequency	Percentage

Cough	90	94.74
Fever	56	58.95
Sore throat	45	47.37
Conjunctivitis	1	1.05
Rhinorrhea	7	7.37
Cephalea	67	70.53
Loss of smell	1	1.05

The bivariate analysis for factors related to SARS-CoV-2 infection showed that positivity was higher in men, residents of municipal capitals, and older adults who had reported having traveled to areas with a high prevalence of infection, these differences being statistically significant. Having had contact with a confirmed case, the type of health regimen, or having a history of asthma, COPD, or diabetes were not related to positivity. Table 6.

Table 6. Factors related to test positivity in the older adult

Characteristic	Positive (n(%))	Negative (n(%))	p value
Sex			
Female	48 (2.2)	2122 (97.8)	0.000
Male	46 (2.6)	1719 (97.4)	
Zone of residence			
Municipal capital	48 (4,.1)	1125 (95.9)	0.000
Population center	12 (3.0)	390 (97)	
Dispersed rural	30 (1.4)	2150 (98.6)	
Contact with confirmed case			
Yes	0 (0)	20 (100)	0.613
No	95 (2.4)	3829 (97.6)	
Traveled to area of high infection prevalence			
Yes	13 (4.4)	280 (95.6)	0.034
No	67 (2.4)	2721 (97.6)	

Health Regime			
Contributory	3 (2)	150 (98)	0.806
Subsidized	88 (2.4)	3549 (97.6)	
Special	2 (2.9)	66 (97.1)	
Uninsured	0 (0)	31 (100)	
History of asthma			
Yes	0 (0)	12 (100)	0.746
No	3837 (99.7)	95 (100)	

4. DISCUSSION

The main finding of this study was to determine the prevalence of SARS-CoV-2 virus infection and its related factors in the population over sixty years of age in four municipalities of the department of Córdoba, prioritized within the framework of the project: "Strengthening the Department of Córdoba with mechanisms to manage the diagnosis and handling of SARS-COV-2 through the implementation of a direct RT-PCR molecular test in the municipalities of Sahagún, Tuchín, Chinú, and San Andrés de Sotavento".

According to the sociodemographic characteristics of the participating older adults and in line with what is reported by the National Administrative Department of Statistics for the Cordoba Department, the proportion regarding sex is in favor of women, representing about 55% and men 45% [14].

In contrast to the national proportions of health insurance in the contributory and subsidized regimes, which behave similarly (50% for each), in the elderly population participating in the study, 92% of the elderly reported being insured in the subsidized regime, which is higher for both Colombia and the Cordoba Department (72%) [15].

The number of older adults who recognize themselves as indigenous in the four municipalities corresponds to 12.3%, a similar figure for the Cordoba Department, which reports a total of 13% of indigenous population [16].

Regarding the symptoms reported in older adults with positive test results, it can be observed that cough, fever and cephalea were more frequent, coinciding these findings with other studies both in the general population [17-19] and specifically in older adults however, it is recognized that within older adult patients with active infection there is a subgroup with an unusual presentation of the disease, in whom it is more frequent to observe falls, reduced mobility, and delirium [21]. In our study these symptoms were not investigated.

Diabetes and asthma were among the most frequently reported clinical antecedents, but none of them were significantly associated with PCR test positivity, similar to that reported by Buitrago-Gomez *et al.* in institutionalized adults [22], but contrary to other reports in the literature that indicate that the presence of comorbidities increases the probability of infection [23-26].

The vaccination status for the older adult population for this study was close to 82% with at least one dose, a figure consistent with data from the National Vaccination Plan against the SARS-CoV-2 virus, which indicates that for people aged 60 to 69 years old, coverage was 82.94%, for people aged 70 to 79 years old, 88.9%, and for people over 80 years old, coverage was 158% [27].

The factors that were independently associated with PCR test positivity were sex, area of residence, and history of travel to an area with a high prevalence of infection. Regarding sex, our finding corresponds with literature reports that support the fact that males have higher rates of infection, hospitalization and mortality; these differences are possibly explained by innate or adaptive immune responses, genetic factors, sex hormones, and sex-specific behaviors [28-30].

Being insured in the subsidized health care system was associated, in a study carried out in the department of Santander, with a higher risk of mortality [31], and in a study with national data [32], however, to our knowledge there are no published data on the difference in the prevalence of infection in the different systems. In our study we did not find differences in the probability of infection according to the type of health insurance.

Residing in a population center was associated with a higher probability of positivity to infection, a situation that may be related to a higher population density than in dispersed rural areas; these results are consistent with studies that confirm through logarithmic and homographic models that the higher the population density, the higher the risk of infection and death [33, 34].

The results of the present study should be analyzed in the light of the following limitations; first, the self-reporting of symptoms makes it possible that these data are subject to information bias, insofar as their reporting could generate stigmatization of the participant and, therefore, it is preferred to conceal them. It is possible that participants with a greater severity of infection would have withdrawn their participation in the study, therefore, the analysis could have been limited to the mildest cases. The information on vaccination was contrasted in all cases in which it was possible with that contained in the vaccination card.

It is possible that in the case of the elderly there is a decrease in the specific recall of certain antecedents, so the information on antecedents should be interpreted taking this possibility into account.

5. CONCLUSION

The prevalence of SARS-CoV-2 infection in the elderly population is 2.4%. Being male, residing in a population center, and having traveled to areas of high infection are associated with a higher prevalence of infection. The proportion of vaccination with at least one dose is 81%. The most common symptom reported was cough.

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AUTHORS' CONTRIBUTIONS

GAMF: conceptualization of the idea, procurement of resources, development of the questionnaire, supervision of the fieldwork, data analysis and interpretation, writing of the manuscript.

SJSG: development of the questionnaire, supervision of fieldwork, data analysis and interpretation, writing of the manuscript.

ITRA: supervision of field work, analysis and interpretation of data, writing of the manuscript

AMFA: development of the questionnaire, supervision of fieldwork, data analysis and interpretation, writing of the manuscript.

JMMF: development of the questionnaire, supervision of fieldwork, data analysis and interpretation, writing of the manuscript.

JLMN: development of the questionnaire, supervision of fieldwork, data analysis and interpretation, writing of the manuscript.

MRP: development of the questionnaire, supervision of fieldwork, data analysis and interpretation, writing of the manuscript.

RJPU: development of the questionnaire, supervision of fieldwork, data analysis and interpretation, writing of the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Research and Ethics Committees of the Remington University Corporation evaluated and approved the study and all its procedures. All participants signed the informed consent form at the beginning of the study.

The current study is original and has not been published elsewhere in any form or language (partially or in its entirety). The results of the current study were presented honestly and without fabrication, falsification or inappropriate manipulation of data. No data, text, or theories of others are presented as if they were the authors' ('plagiarism').

CONSENT FOR PUBLICATION

Not applicable

AVAILABILITY OF DATA AND MATERIALS

The data sets used and/or analyzed during the current study are available upon request from the corresponding author.

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COMPETING INTERESTS

The authors declare that they have no competing interests. The funders had no role in the design of the study; in the collection, analysis, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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