Prevalence of SARS-CoV-2 antibodies in the Mozambican population: a cross-sectional Serologic study in three cities, July-August 2020

Paulo Arnaldo, MSc, PhD [1], Nédio Mabunda, MSc, PhD [1], Peter Wesley Young, MPH, PhD [2], Tiffany Tran, MPH [2], Nádia Sitoe, MSc [3], Imelda Chelene, BSc [3], Armando Nhanombe [5], Nália Isamael, MSc [3], António Júnior, MSc [4], Basílio Cubula, MSc [6], Osvaldo Frederico Inlamea, DVM, PhD [5], Eduardo Gudo Jr, MD, PhD [5], Ilesh Vinodrai Jani, MD, PhD [5]

1 Departamento de Regulação e Promoção da Investigação em Saúde,

Instituto Nacional de Saúde, Maputo, Mozambique.

2 Division of Global HIV & Tuberculosis, U.S. Centers for Disease Control and Prevention (CDC), Maputo, Mozambique

3 Departamento de Plataformas Tecnológicas, Instituto Nacional de Saúde, Maputo, Mozambique

4 Departamento de Gestão e Coordenação da Investigação em Saúde, Instituto Nacional de Saúde, Maputo, Mozambique

5 Instituto Nacional de Saúde, Maputo, Mozambique

6 Departamento de Métodos, Instituto Nacional de Estatística, Maputo, Mozambique

Corresponding author contact information

Paulo Arnaldo

INSTITUTO NACIONAL DE SAÚDE (INS)

EN1, Bairro da Vila - Parcela n°3943

Distrito de Marracuene

Província de Maputo-Moçambique

E-mail: paulo.arnaldo@ins.gov.mz

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ABSTRACT

Background

The extent of population exposure to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was uncertain in many African countries during the onset of the pandemic.

Methods

We conducted a cross-sectional study and randomly selected and surveyed general population and occupational groups from July 6 to August 24, 2020, in three cities in Mozambique. Anti-SARS-CoV-2 specific immunoglobulins M and G antibodies were measured using a point-of-care rapid test. The prevalence was weighted for population (by age, sex, and city) and adjusted for test sensitivity and specificity.

Results

A total of 21,183 participants, including 11,143 from the general population and 10,040 from occupational groups, were included across all three cities. General population seropositivity (immunoglobulins M or G) prevalence was 3.0% (95% CI, 1.0–6.6) in Pemba, 2.1% (95% CI, 1.2–3.3) in Maputo City, and 0.9% (95% CI, 0.1–1.9) in Quelimane. The prevalence in occupational groups ranged from 2.8% (95% CI, 1.3–5.2) to 5.9% (95% CI, 4.3–8.0) in Pemba, 0.3% (95% CI, 0.0–2.2) to 4.0% (95% CI, 2.6–5.7) in Maputo City, 0.0% (95% CI, 0.0–0.7) to 6.6% (95% CI, 3.8–10.5) in Quelimane, and showed variations between the groups tested.

Conclusions

Exposure to SARS-CoV-2 was extensive during the first pandemic wave, and transmission may have been more intense among occupational groups. These data have been of utmost importance to inform public health intervention to control and respond to pandemic in Mozambique.

Previous presentations of findings: Results from this study were presented (in Portuguese) at the Mozambican *Jornadas Nacionais de Saúde* in Maputo, Mozambique on Aug 10, 2021 (abstract #108, title, *Prevalência da exposição ao novo coronavírus em três cidades de Moçambique, Julho-Agosto de 2020*).

Keywords: Sero-prevalence, general population, higher-risk occupational groups, SARS-COV-2, Mozambique

INTRODUCTION

On March 11th, 2020 the World Health Organization announced that COVID-19 met the definition of a pandemic [1,2]. As of March 1st, 2022, there were more than 433 million confirmed cases of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections and over 5.9 million deaths globally [3]. In Mozambique, more than 225,000 individuals had been confirmed positive and 2,192 COVID-19-related deaths were reported as of Mach 1st, 2022 [4]. Despite the implementation of various interventions to control its spread, SARS-CoV-2 infection has continued to steadily expand. The full burden of infections is potentially underestimated due to mild or absent symptoms and limited country molecular testing capacity [5].

Understanding community transmission patterns can guide interventions to limit the spread of SARS-CoV-2 [6]. Community seroprevalence studies have identified greater exposure to SARS-CoV-2 than would be expected based on cumulative laboratory-based case reporting [7–10]. Such studies can indicate the rate of transmission over time, inform disease modeling efforts, and identify risk factors for infection [11]. Several countries have been conducting seroprevalence surveys to better understand the level of prior population exposure to the virus, and identify higher-risk populations for prioritization for vaccination [10,12,13]. However, representative studies about the prevalence of SARS-CoV-2 infection in African countries remain limited [14–16] and so far no data are available for Mozambique.

To assess the seroprevalence of SARS-CoV-2 in the general population living in locations of higher population density in Mozambique, as well as among key groups believed to be at increased risk of infection due to their work or living conditions, we implemented serological surveillance based on cross-sectional sampling of individuals from randomly selected households in three provincial capitals and from occupational groups in those cities.

We report the estimated prevalence of anti-SARS-CoV-2 immunoglobulins G (IgG) and M (IgM) antibodies in three cities during the first pandemic wave.

METHODS

Study design, population and sampling

We conducted a cross-sectional survey in the general population and selected occupational groups believed to be at increased risk of SARS-CoV-2 infection (high-risk groups) from three cities in Mozambique, in July and August, 2020. The selected cities were Pemba (6–13 July), Maputo City (4–24 August) and Quelimane (10–21 August) in the provinces of Cabo Delgado, Maputo City, and Zambézia, respectively.

In each city, in addition to including participants from households, we recruited participants from occupational groups at their workplace. The general population sample was selected through multistage sampling by the Mozambique National Institute of Statistics. From every neighborhood in each city, a first stage sample of two to four blocks or segments per neighborhood were selected with equal probability. This was followed by listing of all the occupied households in the block or segment by the survey team. Immediately following the listing, in the second stage, a fixed number of 16 households were randomly sampled within each selected block using interval sampling with a random starting point. Any household refusals led to selection of the next household in the list, and so on until 16 households were included. From each head of household, the total household size was obtained and one individual in each of three target age groups (0–17, 18–54, 55+ years) present at time of interview was selected through convenience sampling. If individuals in the target age group were not available for sampling or refused to provide a sample or to be interviewed, a replacement member was selected from the household, or if unavailable or unwilling to participate, from the next household in the list. Convenience sampling was used for the occupational groups. First, sampling points for each occupational group were enumerated

with assistance from local informants. Members of each occupational group were then sampled among those present at the sampling point, at the time of the survey. These groups comprised health professionals (physicians, nurses, health-care workers, pharmacy staff, administrative staff, laboratory technicians, service agents, etc.), transport workers (bicycle taxi, motorcycle taxi and car taxi drivers, urban, semi-collective transporter drivers, and their ticket collectors, district/provincial transporters, and truck drivers), market vendors, supermarket staff and defense and security forces. If participants refused to provide consent for the interview or blood collection, they were excluded. Interviews and testing were done at the place of work from which individuals were selected.

Sample Design

Generally, the goal was to obtain representative estimates at the neighborhood level for each city, however sample size per city was determined based on availability of tests and other resources such as lab supplies and human resources. The resulting sample design called for 1,344, 9,360 and 4,800 individuals to be sampled in Pemba, Maputo City and Quelimane, respectively. For key populations, the initial sample size of 2,800, 2,856 and 2,914 in Pemba, Maputo City and Quelimane, respectively was defined based on available resources such as rapid tests, laboratory supplies and interviewers in each city after accounting for the community sample requirements.

Study coordination and COVID-19 prevention measures

Fieldwork was carried out by trained health workers from each of the study sites under a protocol developed by the Mozambique National Institute of Health (*Instituto Nacional de Saúde - INS*). The INS coordinated the study implementation including training of all staff and fieldworkers. All field data collectors were tested three days before fieldwork using the rt-PCR test and only participated in the study if the result was negative, and were provided with personal protective equipment (gloves, surgical face masks, and hair covers

and face-shield) that were discarded and managed as hospital waste after each interview. Study personnel were advised to conduct all study procedures outdoors where feasible.

Ethical considerations

The Mozambique National Health Bioethics Committee approved the protocol (reference number 258/CNBS/20) and the activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy [17]. The Ministry of Health of Mozambique and local study sites provided administrative approval. Written informed consent was obtained from each participant.

Procedures

After informed consent, participants were interviewed using pretested electronic questionnaires to assess demographic characteristics, recent self-reported COVID-19-related symptoms (i.e., fever, chills, severe tiredness, sore throat, cough, shortness of breath, headache), and COVID-19-related exposures (i.e., contact with suspected or confirmed cases), and medical history including pre-existing medical conditions (i.e., diabetes, chronic lung disease, high blood pressure, heart condition, chronic kidney disease, HIV infection or AIDS, Tuberculosis). After completion of the questionnaire, all participants had a point-of-care rapid test performed to assess anti-SARS-CoV-2-specific IgM and IgG antibodies in whole blood samples. The answers to the questionnaire, geographic coordinates of each household and the result of the point-of-care rapid test were recorded on site in a secure tablet or smartphone application developed for the Open Data Kit (ODK).

Detection of anti-SARS-CoV-2 antibodies

Capillary blood was collected from a fingerstick into a capillary tube and immediately applied to a single point-of-care rapid test for SARS-CoV-2 exposure. Two different point-of-care rapid tests were used during the survey – the Qingdao Hightop Biotech IgM/IgG Duo (Qingdao Hightop Biotech Co., Ltd, Shandong, China) in Pemba and Panbio™ COVID-19

IgG/IgM Rapid Test Duo (Abbott Laboratories, Orlando, USA) in Maputo City and Quelimane. Both are lateral-flow immunochromatographic assays for qualitative differentiation between IgG and IgM against the receptor binding domain of SARS-CoV-2 spike (S) protein [18]. We conducted an independent validation using serum samples from 30 patients with rt-PCR-confirmed SARS-CoV-2 infection and 150 serum samples collected in 2014-15, which were considered negative for SARS-CoV-2 as they were collected five years before the pandemic (Supplementary Table S1).

During the survey, the rapid antibody test results were interpreted by the fieldworker, communicated to the participant or their guardian and recorded on the ODK device. Participants with positive IgG and/or IgM results were referred for rt-PCR testing for active SARS-CoV-2 infection through the national COVID-19 response system – results of such testing are not included in the analysis.

Statistical analysis

For the general population sample, design weights were developed separately for each city using the population for each neighborhood by age from the 2017 population census. Three weighting classes based on the recruitment age bands (0–17, 18–54, 55+ years) were used. Due to the use of sampling with replacement at the household and individual level, non-response adjustments were not performed. Final weights were calibrated, post-stratified to the total city population by age and sex and normalized.

The general characteristics of the study population were described for each individual city. We estimated the population prevalence of exposure to SARS-CoV-2 for the general population and at-risk populations by occupation and by city. The crude prevalence of exposure was estimated as the proportion of individuals who had a positive rapid test result for IgM, IgG or both. In the general population, the crude prevalence was then weighted to adjust for population structure and adjusted for the corresponding locally derived test

performance for the specific test used in each city. As a sensitivity analysis, these adjustments were also done using the manufacturers' reported test sensitivity and specificity (see Supplementary Appendix 1). The prevalence in occupational groups was reported as crude and adjusted for test performance by city, by population. Percentages are reported to two significant figures. Analyses were done using Stata 16.1 (StataCorp, College Station, TX, USA) and R 4.0.2 (R Core Team, Vienna, Austria).

RESULTS

Of 15,504 sampled residents in the general population sampling, 11,143 participants (72%) were recruited, of whom 59% were female. Although participants were sampled with replacement, in some cases, particularly in Maputo City, it was not possible to reach the target sample size due to higher rates of absence or refusal of household members. The median participant age was 24 years (interquartile range 12–40), with 20% aged from 15–24 years. Overall, 11% of participants reported COVID-19 related symptoms in the 30 days before the interview, 222 (16%) in Pemba, 744 (16%) in Maputo City and 224 (4.4%) in Quelimane. Among the general population, 77% had either primary or secondary education (whether completed or not), while 16% had not attended school or were not of school age (Table 1). During fieldwork, the number of participants recruited from occupational groups in Maputo was greater than originally planned, resulting in a total of 10,859 recruited participants. Of these, 10,040 (92%) were included in the analysis across all three cities. Eight-hundred and nineteen (7.5%) were excluded from analysis due to withdrawal of consent after enrollment, having age (i.e., too young) inconsistent with the occupational group they were enrolled in, or being from a group of fishermen, port, airports staff, reception centers because they were only present in one of the cities (Figure 1).

Seropositivity in the general population and in occupational groups

Unadjusted prevalence in the general population ranged from 2.5% in Quelimane and Pemba to 3.8% in Maputo City (Table 2). Population-weighted prevalence was 3.9% (95% CI, 2.1–6.9) in Pemba, 3.7% (95% CI, 2.9–4.7) in Maputo City and 2.7% (95% CI, 2.1–3.5) in Quelimane. Seroprevalence estimates fell to 3.0% (95% CI, 1.0–6.6) in Pemba, 2.1% (95% CI, 1.2–3.3) in Maputo City and 0.9% (95% CI, 0.1–1.9) in Quelimane when weighted and adjusted to account for test performance. The highest seroprevalence by age across sites was observed in individuals aged 15–24 years in Quelimane, while in Pemba and Maputo City individuals aged 45–59 years were highly exposed (Figure 2). The weighted and adjusted seroprevalence in individuals who reported COVID-19 related symptoms was higher than that in individuals without such symptoms in Maputo and Quelimane, while the opposite was true in Pemba, though the difference was only significant in Quelimane (Table 2).

Compared with that observed in the general population in each city, adjusted seroprevalence was greater for most occupational groups, ranging from 2.8% to 5.9% in Pemba, 0.8% to 4.0% in Maputo City and 0.0% to 6.6% in Quelimane (Table 3). In Pemba and Maputo, cities with ongoing community transmission at the time of survey, the adjusted prevalence among market vendors, 5.9% (95% CI 4.3–8.0) in Pemba and 4.0% (95% CI 2.6–5.7) in Maputo City, and health professionals, 5.0% (95% CI 3.0–7.7) in Pemba, were higher than that observed in the community. In Quelimane, which had no community transmission declared at the time of the survey, and with the apparent low prevalence in the general population, transport workers were highly exposed to SARS-CoV-2 (6.6% [95% CI 3.8–10.5]) (Table 3).

DISCUSSION

This study was the first of its kind in Mozambique and was conducted in the context of urgent needs for epidemiological data to inform intervention strategies during the first wave of the COVID-19 pandemic in the country. The seroprevalence of SARS-CoV-2-

specific antibodies was estimated in a representative sample of the general population in three cities in the north, center and south of Mozambique and among higher-risk occupational groups. COVID-19 testing had reached 1.79 tests per 1,000 population nationally by July 31, 2020. The first prevention measures were introduced between March 23 and April 2 before the studies presented here were conducted. They consisted of: mandatory quarantine for certain international travelers, closing of borders and suspension of issuing of visas, closing schools and gathering spaces (e.g., bars, churches), prohibiting social events involving more than 50 people, such as celebrations, sporting and cultural events and religious ceremonies, and mandatory masking in some high-risk settings, among other measures [19]. During the early phase of the response, measures were introduced uniformly throughout the country, though implementation may have varied by region. A survey in Maputo City observed high levels of mask use at markets and bus stops (90.2% combined), 85.3% of which were homemade, and not all that wore them did so correctly [20]. Another online survey also found high self-reported compliance with COVID-19 prevention measures [21].

The population-weighted and adjusted seroprevalence in Pemba and Maputo City was 3.0% and 2.1%, respectively, while in Quelimane it was 0.9%. Based on the population of Maputo City, this seroprevalence equated to 23,625 cumulative infections, yet only 307 cases had been reported by July 31, 2020, representing only 1.3% of the expected cases (city-level case reports were not available for other cities). The higher level of SARS-CoV-2 infection in the general population in Pemba and Maputo City was consistent with the timing of the official declarations of community transmission during the study period for these cities. The provinces of Cabo Delgado, of which Pemba is the capital city, and Maputo City were the first and second provinces to report increased numbers of cases early in the pandemic, respectively. In Pemba, the first SARS-CoV-2 outbreak was observed in mining camps, which may have contributed to increased community transmission in that city.

The overall seroprevalence estimates in Pemba and Maputo City were similar to those observed in Zambia [22] and Ethiopia [23, 24], which were conducted from July–September, 2020, but lower than observed in some cities of South Africa [25], conducted in similar periods. Most other reported studies in sub-Saharan Africa in 2020, were conducted during April and May, and reported a wide range of seroprevalences from 1.6% to 23.7% [14,15,16, 26, 27]. However, most of these studies were done in specific groups that might not be representative of the general population. At a global level, among the few seroprevalence studies reported later in 2020, estimates ranged from 3.1% in Brazil [28], to 7.1% in India [29], 29.2% in Cameroon [30] and 34.7% in Kenya [31], many of which are higher than observed here. Variations in seroprevalence likely reflect differences in study designs and sampling methods, community transmission based on population behavior, epidemic conditions and public health response applied in each setting.

The higher seroprevalence of exposure observed in adolescents and young adults compared to older adults, which is consistent with previous studies [32], is possibly because adolescents and young adults are a more active group with more contacts or because older adults might be more likely to adhere to prevention measures due to greater perceived vulnerability [32,33]. Moreover, even with preventive measures implemented by the Mozambican Government restricting movement, the number of people in the workplace and on public transport remained elevated given many had few alternatives but to continue working in person [19.

Consistent with previous reports [34,35], most people with SARS-CoV-2 infection in this study did not experience any COVID-19 related symptoms in the thirty days before the study. Although recall bias may have influenced symptom reporting by study participants, the high proportion of asymptomatic SARS-CoV-2 infections observed in this study highlights

the importance of prevention measures such as wearing masks, handwashing, physical distancing to reduce the spread of SARS-CoV-2 in the community.

Frequent or close physical interaction should result in increased risk of transmission in certain occupations, such as transport workers, social workers and healthcare workers [36,37]. In this study, the adjusted seroprevalence of SARS-CoV-2 infection ranged from 0.0% to 6.6% among occupational groups across the study cities and in many cases was found to be higher than that observed in the general population, which may be partially explained by the risk of SARS-CoV-2 infection in the work environment combined with low compliance to COVID-19 health regulations (e.g., physical distancing, use of protective masks), and by inadequate personal protective equipment [38]. The observed seroprevalence among healthcare workers might arise from their professional activity, working in high-risk sectors, long duty hours, and practicing suboptimal prevention measures, perhaps due to limited availability of personal protective equipment early in the pandemic. Their insertion in the community could increase the risk of community transmission. This reflects the need of strong adherence of health professionals to infection prevention and control measures.

We also found higher seroprevalence of SARS-CoV-2 among market vendors and transport workers, indicating an increased risk of transmission in markets and transportation chains in Mozambique. This might have resulted from the crowded working conditions in most formal and informal markets which are frequently interspersed with dense urban neighborhoods. The connection of markets with the communities for food gathering, coupled with the lack of adequate infrastructure for the implementation of preventive measures such as physical distancing and handwashing, means that markets constitute a transmission focus of SARS-CoV-2 infection. Higher seroprevalence estimates in transportation chains observed in our study indicates the dynamics of transport in African cities where the conditions for physical distancing are non-existent and makes containment and response measures

considerably more difficult. Therefore, specific strategies in occupational group populations such as market and transportation workers are necessary to maximize the prevention efforts applied at the community level.

The potential limitations of our analyses include the restriction of the sample population to provincial capital cities that constitute an urban population as well as the convenience sampling of household members present in the household at time of survey. This allowed us to rapidly survey a geographically representative sample population in areas with potential higher risk of SARS-CoV-2 transmission. However, rural areas, where approximately 64% of the Mozambican population lives, were not surveyed, and urban household residents who are often away from home may have been under-represented. Concerns have been raised regarding the performance of rapid diagnostic tests, including the seroconversion period. However, their use in seroprevalence studies is less controversial, provided that sensitivity and specificity are sufficiently high and analyses are appropriately adjusted [39,40]. We used lateral-flow tests with acceptable performance and adjusted estimated seroprevalence using sensitivity and specificity estimated from the Mozambican population, though we did not adjust our confidence intervals to account for the uncertainty in test performance. Finally, the use of different tests in the three study cities limits our ability to make prevalence comparisons between the locations.

The prevalence of SARS-CoV-2 exposure in the three capital cities in general and occupational group populations six months after the notification of the first case were higher than would be expected from case reporting alone. The higher prevalence estimates of exposure in selected populations compared with the general population are a sign that specific and targeted efforts to reduce the burden of COVID-19 in high-risk occupational groups is warranted. Population-based and serial seroprevalence surveys will provide insight

regarding the true extent of disease transmission over time to support refinement of strategies to fight against COVID-19 in Mozambique.

NOTES

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Data sharing

Deidentified participant data used for this analysis can be requested from the *Instituto Nacional de Saúde*, Mozambique after December 31, 2021. Researchers interested in secondary analysis must submit a research proposal for consideration by the study investigators as well as by the Directorate for health surveys and observation of the Mozambique National Institute of Health. Upon approval, the requestor must sign a data use agreement. All data requests should be directed to the corresponding author.

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Contributions. PA conceived the study, study analysis plan, and wrote the manuscript. NM co-conceived the study, secured seroprevalence testing, and supervised sample processing and data preparation, co-wrote the manuscript. PWY assisted with data cleaning and analysis planning, and manuscript writing. TT assisted with data cleaning and analysis planning, and

manuscript writing. IC undertook sample processing. NS co-conceived the study, selected seroprevalence testing. AN conceived data collection tools, undertook data cleaning and analysis. NI selected seroprevalence testing, supervised sample processing. AJ assisted with data cleaning and analysis planning, contributed to manuscript writing. BC contributed to sample estimation and selection of study sites. OFI contributed to conception of the study. EG conceived the study, supervised data collection, and contributed to data interpretation. IJ supervised the study conception, analysis plan, identified relevant external data, contributed to data interpretation, and supervised manuscript writing.

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FIGURE LEGENDS:

Figure 1: Flow chart of study participants in general population and occupational risk group samples.

Figure 2: Population-weighted, and test performance–adjusted seropositivity to SARS-CoV-2 by participant age group.

Table 1. Characteristics of community sample by provincial city, July–August 2020

	Pemba	Maputo City	Quelimane	Total
	N (%)	**N (%)**	**N (%)**	**N (%)**
Sex				
Female	786 (58)	2,842 (60)	2,896 (57)	6,524 (59)
Age				
0-9	226 (17)	766 (16)	885 (17)	1,877 (17)
10-14	180 (13)	450 (10)	487 (10)	1,117 (10)
15-24	262 (19)	862 (18)	1,155 (23)	2,279 (20)
25-34	195 (14)	665 (14)	782 (15)	1,642 (15)
35-44	126 (9)	559 (12)	433 (9)	1,118 (10)
45-59	109 (8)	681 (14)	421 (8)	1,211 (11)
60+	60 (4)	657 (14)	222 (4)	939 (8)
Unknown	200 (15)	79 (2)	681 (13)	960 (9)
Median (IQR)	21 (12-35)	28 (14-48)	21 (11-34)	24 (12-40)
Education level				
Not of school age (0-5 years)	105 (8)	417 (9)	490 (10)	1,012 (9)
Primary	650 (48)	2,192 (46)	2,194 (43)	5,036 (45)
Secondary	384 (28)	1,506 (32)	1,637 (32)	3,527 (32)
Post-secondary	75 (6)	359 (8)	348 (7)	782 (7)
Did not attend any school	144 (11)	241 (5)	389 (8)	774 (7)
Unknown	0 (0)	4 (0)	8 (0)	12 (0)
Symptoms				
Symptoms reported	222 (16)	744 (16)	224 (4)	1,190 (11)
Total	**1,358**	**4,719**	**5,066**	**11,143**

Note: N and percentages are unweighted.

Table 2. Crude, population-weighted, and test performance–adjusted seropositivity to SARS-CoV-2 by participant characteristics and city, July–August 2020 (N=11,143).

	Pemba				Maputo City				Quelimane			
	N	U %	W % (95% CI)	A % (95% CI)	N	U %	W % (95% CI)	A % (95% CI)	N	U %	W % (95% CI)	A % (95% CI)
SARS-CoV-2 total prevalence	1,358	2.5	3.9 (2.1-6.9)	3.0 (1.0-6.6)	4,719	3.8	3.7 (2.9-4.7)	2.1 (1.2-3.3)	5,066	2.5	2.7 (2.1-3.5)	0.9 (0.1-1.9)
Sex												
Male	572	3.0	4.5 (2.8-7.1)	3.7 (1.7-6.8)	1,877	3.5	3.1 (2.2-4.3)	1.4 (0.3-2.9)	2,170	2.5	2.7 (1.9-3.7)	0.8 (0.0-2.1)
Female	786	2.2	3.3 (1.3-7.8)	2.3 (0.0-7.6)	2,842	4.0	4.3 (3.2-5.7)	2.8 (1.5-4.6)	2,896	2.6	2.8 (2.1-3.7)	1.0 (0.1-2.1)
Age												
0-9	226	0.9	2.4 (1.0-5.5)	1.3 (0.0-4.9)	766	2.1	2.1 (1.2-3.6)	0.1 (0.0-2.0)	885	2.6	2.7 (1.7-4.3)	0.9 (0.0-2.8)
10-14	180	2.8	5.3 (1.5-17.4)	4.7 (0.2-18.9)	450	5.3	5.4 (3.5-8.2)	4.2 (1.9-7.6)	487	2.7	2.7 (1.6-4.5)	0.8 (0.0-3.0)
15-24	262	2.7	3.5 (1.6-7.3)	2.5 (0.4-7.1)	862	3.5	2.5 (1.6-3.8)	0.6 (0.0-2.2)	1,155	3.3	4.0 (2.8-5.7)	2.4 (1.0-4.5)
25-34	195	3.1	2.6 (1.0-6.1)	1.5 (0.0-5.7)	665	5.3	5.7 (3.6-8.8)	4.5 (2.0-8.3)	782	2.2	1.7 (1.0-3.0)	0.0 (0.0-1.2)
35-44	126	3.2	3.3 (0.8-12.5)	2.4 (0.0-13.1)	559	2.7	1.6 (0.7-4.0)	0.0 (0.0-2.4)	433	1.2	1.4 (0.6-3.4)	0.0 (0.0-1.7)
45-59	109	4.6	6.7	6.3 (3.2-	681	3.8	5.9	4.8	421	3.1	2.4 (1.3-	0.5

			(4.0-10.9)	11.2)			(3.6-9.6)	(2.0-9.4)			4.5)	(0.0-3.0)
60+	60	3.3	4.0 (0.7-20.8)	3.2 (0.0-22.8)	657	4.4	5.0 (3.2-7.8)	3.7 (1.5-7.1)	222	2.3	2.8 (1.1-7.0)	1.0 (0.0-6.2)
Unknown	200	1.5	-	-	79	7.6	-	-	681	2.1	-	-
Education level												
Not of school age (0-5 yrs.)	105	0.0	0.0 (-)	0.0 (-)	417	2.4	2.0 (1.0-4.0)	0.0 (0.0-2.5)	490	2.2	3.1 (1.7-5.7)	1.4 (0.0-4.5)
Primary	650	2.0	3.6 (1.4-8.9)	2.7 (0.1-8.9)	2,192	4.3	4.5 (3.2-6.4)	3.1 (1.5-5.4)	2,194	3.1	3.1 (2.2-4.4)	1.4 (0.3-3.0)
Secondary	384	3.4	3.8 (1.8-7.8)	2.9 (0.6-7.7)	1,506	3.8	3.5 (2.6-4.6)	1.8 (0.8-3.2)	1,637	2.1	2.2 (1.5-3.2)	0.3 (0.0-1.5)
Post-secondary	75	5.3	6.6 (1.4-26.0)	6.2 (0.1-29.0)	359	3.1	2.0 (0.9-4.0)	0.0 (0.0-2.5)	348	1.7	2.1 (0.8-5.4)	0.1 (0.0-4.2)
Did not attend any school	144	2.8	7.7 (2.5-21.6)	7.5 (1.4-23.7)	241	2.9	3.9 (1.2-11.5)	2.3 (0.0-11.7)	389	2.1	1.8 (0.7-4.7)	0.0 (0.0-3.3)
Unknown	0	-	-	-	4	-	-	-	8	-	-	-
Symptoms												
Symptoms reported	222	3.6	3.0 (0.9-9.2)	2.0 (0.0-9.3)	744	7.4	5.7 (3.8-8.3)	4.5 (2.2-7.7)	224	6.7	8.2 (4.8-13.7)	7.7 (3.5-14.4)
No symptoms reported	1,136	2.3	4.0 (1.9-8.3)	3.2 (0.7-8.2)	3,975	3.2	3.4 (2.6-4.4)	1.7 (0.7-3.0)	4,842	2.3	2.5 (1.9-3.3)	0.6 (0.0-1.6)

Notes: U = unweighted and unadjusted; W = weighted and unadjusted; A = weighted and adjusted; CI = confidence interval; N are unweighted.

Table 3. Seropositivity to SARS-CoV-2 in general population and occupational groups by city, July–August 2020 (N=21,183).

	Seropositivity		
Study City	**N**	**U (%)**	**A % (95% CI)**
Pemba			
Total	3,920	4.4	-
Community	1,358	2.5	3.0 (1.0-6.6)
Health professionals	506	5.5	5.0 (3.0-7.7)
Market vendors	927	6.4	5.9 (4.3-8.0)
Security forces	513	3.7	2.8 (1.3-5.2)
Transport	247	4.9	4.2 (1.7-8.3)
Commercial establishment	369	5.4	4.8 (2.6-8.2)
Maputo City			
Total	9,584	3.8	-
Community	4,719	3.8	2.1 (1.2-3.3)
Health professionals	1,443	2.6	0.8 (0.0-2.0)
Market vendors	1,246	5.2	4.0 (2.6-5.7)
Security forces	960	4.5	3.0 (1.6-4.9)
Transport	622	2.3	0.3 (0.0-2.2)
Commercial establishment	594	4.5	3.1 (1.4-5.6)
Quelimane			
Total	7,679	2.7	-
Community	5,066	2.5	0.9 (0.1-1.9)
Health professionals	543	3.7	2.1 (0.5-4.5)
Market vendors	1,121	1.6	0.0 (0.0-0.7)
Security forces	390	3.1	1.3 (0.0-4.1)
Transport	366	7.4	6.6 (3.8-10.5)

Commercial establishment	193	1.0	0.0 (0.0-2.6)

Notes: U = unweighted and unadjusted; A = weighted and adjusted; CI = confidence interval; N are unweighted.

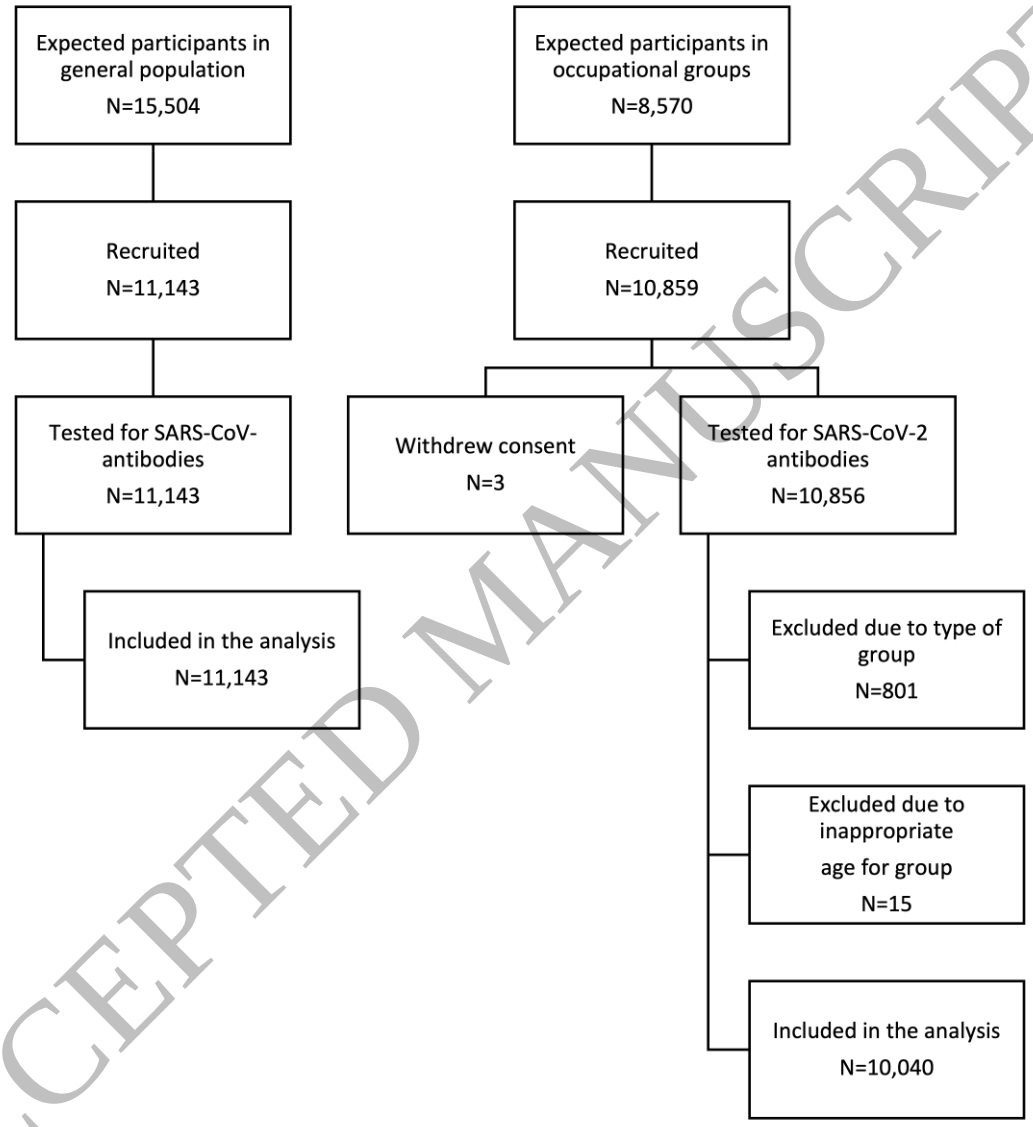

Figure 1
140x152 mm (.15 x DPI)

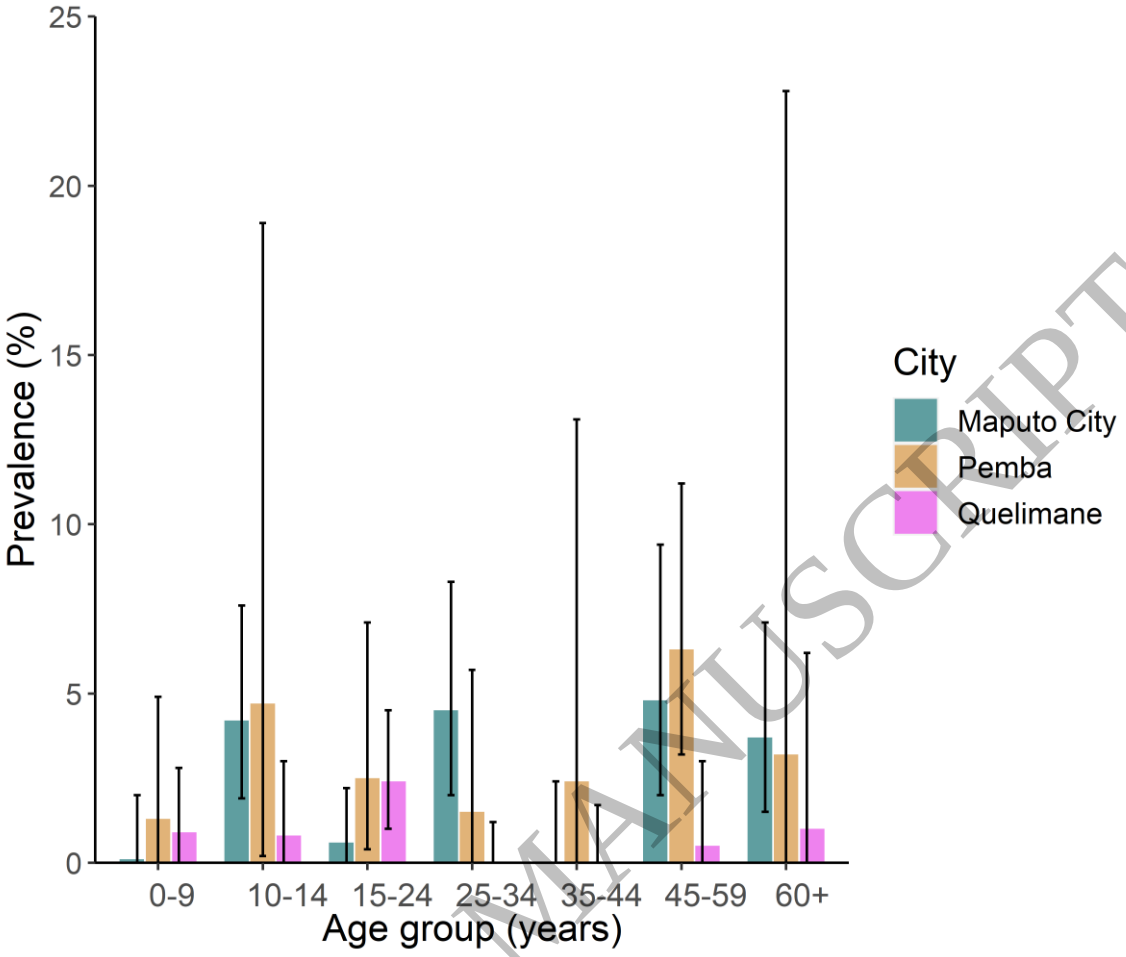

Figure 2
152x127 mm (.15 x DPI)