

**Stage 5:** In the city of São Paulo, 29.9% of the adult population already had antibodies against SARS-CoV-2 at the time the vaccination program started. This estimate reached 37.9% among those with a family income of up to BRL 2,200.00 and 37.8% among those whose self-declared skin color/ ethnic heritage was black or mixed heritage ("Pardo").

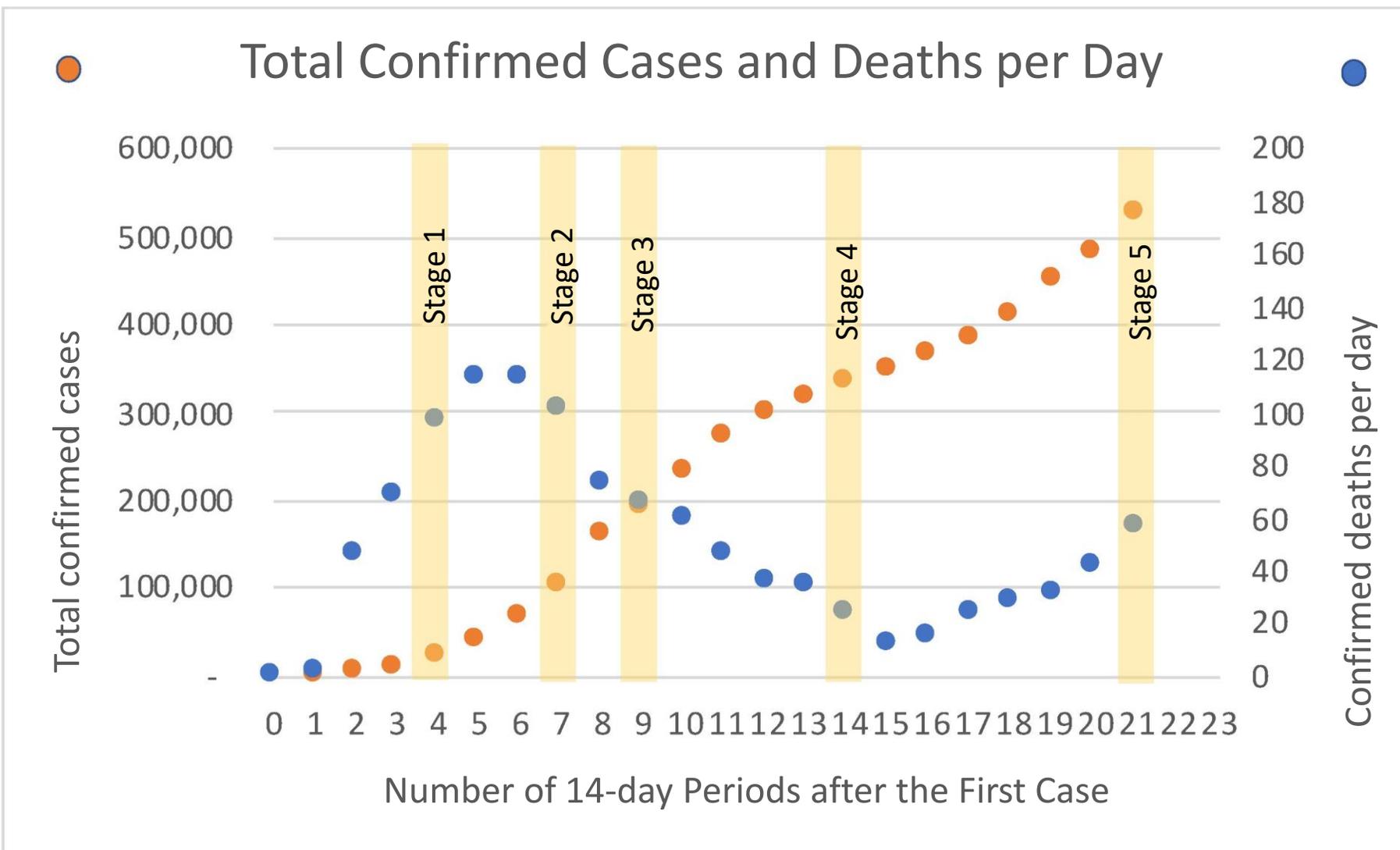
Household survey to monitor the seroprevalence of SARS-CoV-2 infection in adults: a cross-sectional study with probabilistic sampling carried out in the city of São Paulo between January 14<sup>th</sup> and 23<sup>rd</sup>, 2021 (42 weeks after the first case registered in the city)

Financiers:



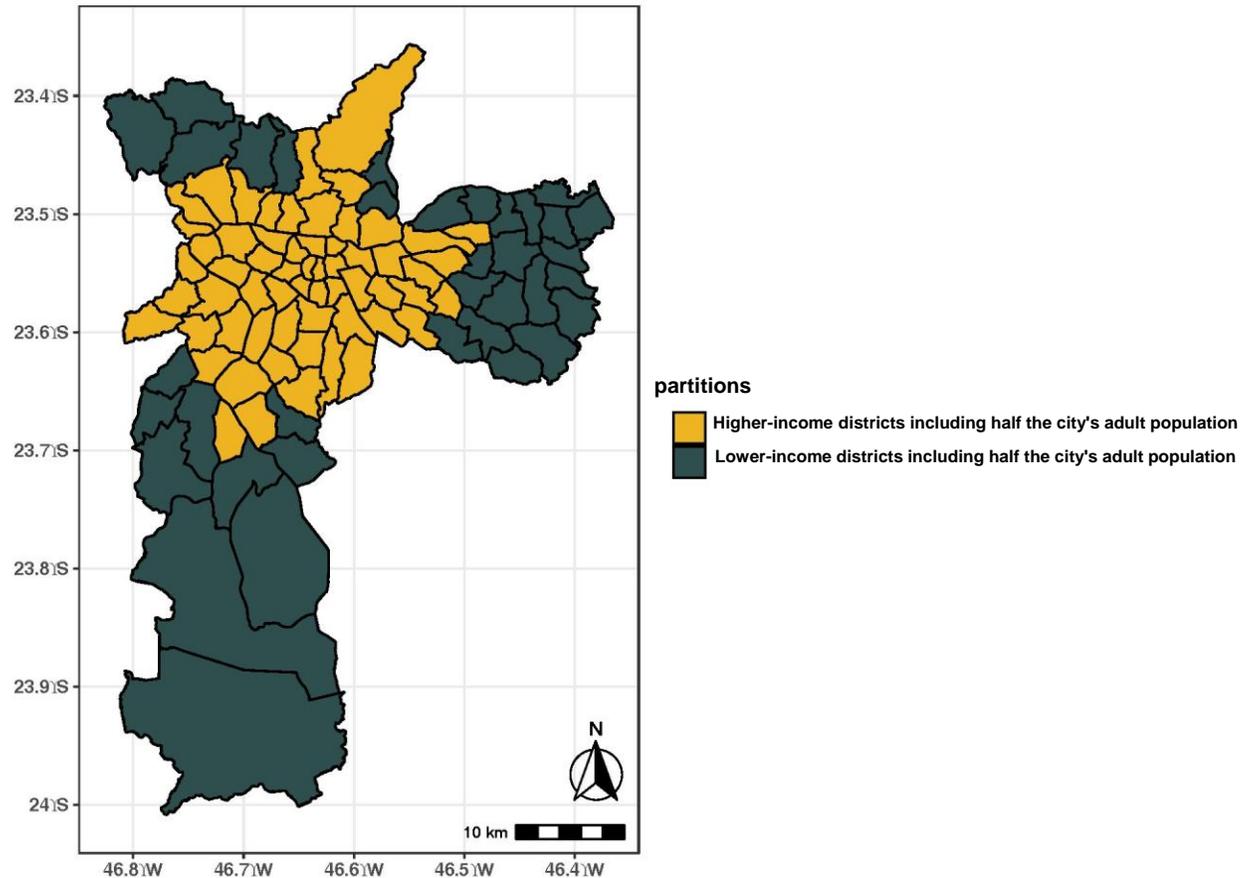
<https://www.monitoramentocovid19.org/> (in Portuguese)

Sample collection ended on January 23<sup>rd</sup>, when the city had a total of 546,523 confirmed cases (red dots) and 16,945 confirmed deaths. The number of deaths per day (blue dots) was approximately 55.



A total of 1,194 blood samples from participants in 149 census sectors were analyzed to measure SARS-CoV-2 seroprevalence in the city of São Paulo. 8 households were drawn in each census sector

Map of the Districts



**Methodology Summary:** The city of São Paulo has a population of 8,407,202 inhabitants aged 18 or older. Two strata were created for the city: higher-income districts, and lower-income districts, each corresponding to approximately one half of the city's adult residents.

The sample was obtained by probabilistic sampling with a two-stage drawing: census sector and household. 160 census sectors were drawn in the first stage, then 8 households were drawn in each sector in the second stage. All residents in the selected households over the age of 18 were invited to participate.

After answering a questionnaire, a blood sample was taken from each participant by venipuncture. The amount of anti-SARS-CoV-2 antibodies (IgG and IgM) was measured using chemiluminescence and a second test using electrochemiluminescence (total Ig).

Further details on the project can be found on its website: <https://www.monitoramentocovid19.org/> (in Portuguese)

The seroprevalence in the municipality of São Paulo was estimated at 29.9%, being lower in the higher-income districts (22.8%) and higher in the lower-income districts (36.4%). The difference between the strata is statistically significant.

Strata	N = 1194		Prevalence		P-value
	%		%	95% CI	
Total	100		29.9	26.2 - 33.5	
Higher-income districts	48.6		22.8	18.1 - 27.6	0.0003
Lower-income districts	51.4		36.4	31.1 - 41.8	

\*chi-square test with Rao-Scott correction

## Schooling level, skin color/ ethnic heritage and age are related to the seroprevalence

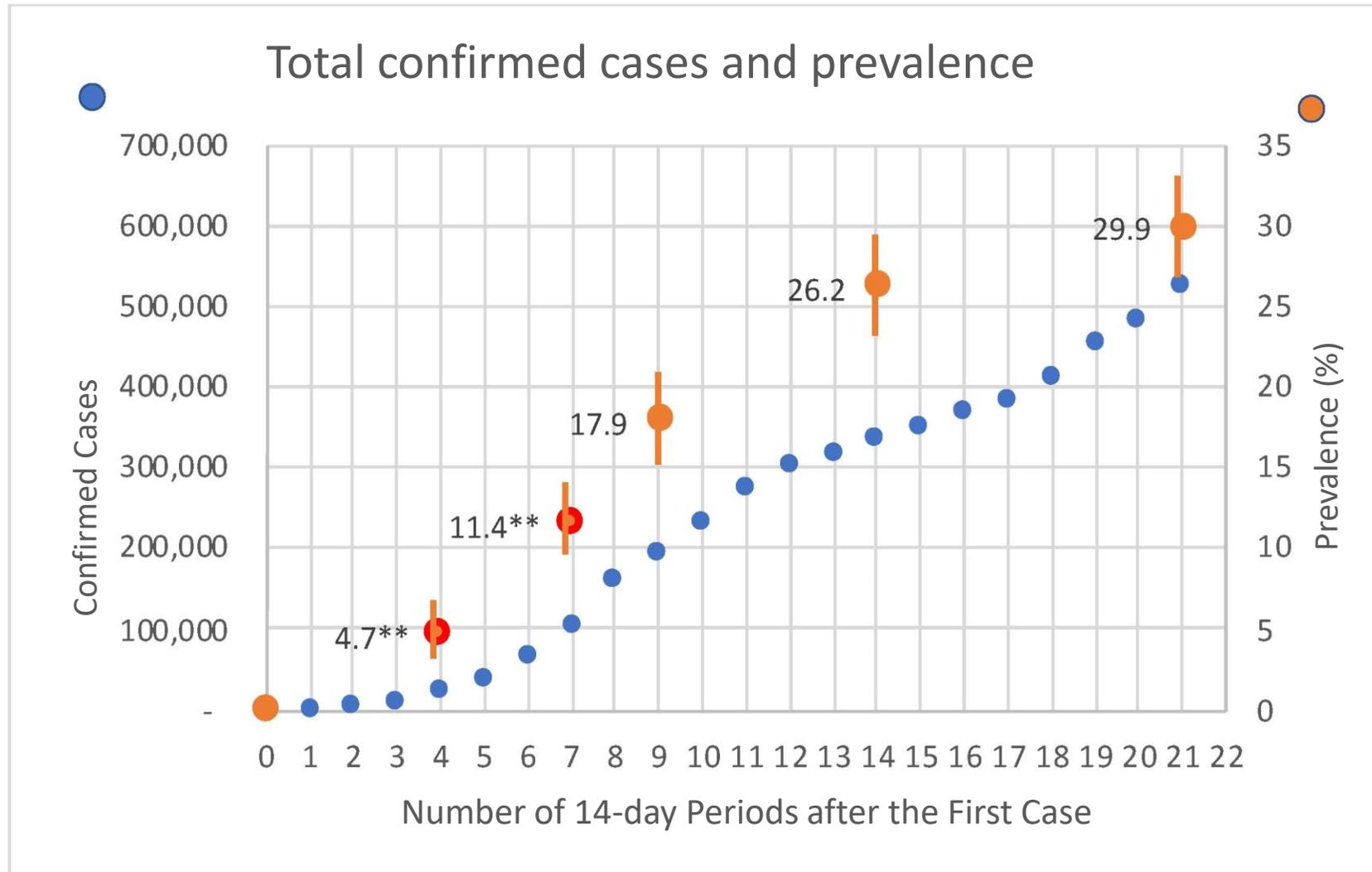
Individuals who have 9 or less years of study (complete Elementary School or less) have a seroprevalence 1.7 times higher than individuals who completed higher education (33.8% versus 19.6%).

A similar phenomenon occurs is found regarding skin color/ ethnic heritage, with a seroprevalence 1.6 times higher among people who self-declared as black or mixed heritage ("pardo") when compared to whites (37.8,% versus 23.2%).

The prevalence in the 18 to 34 age group is 1.7 times higher than that observed among those aged 60 or over (33% versus 19.9%).

Variable	N = 1194 %	Prevalence %	95% CI	P-value	
<b>Total</b>	100	29.9	26.2	33.5	
<b>Sex</b>					
Male	46.6	28.9	23.9	33.9	0.4509
Female	53.4	30.7	27.1	34.4	
<b>Age</b>					
18 to 34	34.0	33.0	27.6	38.5	0.0005
35 to 44	20.7	36.3	29.4	43.1	
45 to 59	25.0	28.3	22.7	33.9	
60+	20.2	19.9	14.9	24.9	
<b>Schooling level</b>					
Completed Elementary school or less (9 or less years of study)	34.7	33.8	27.7	39.8	0.0002
High School (10 to 12 years of study)	41.8	32.4	28.2	36.6	
Higher education (13 or more years of study)	23.4	19.6	14.7	24.5	
<b>Skin color/ Ethnic heritage</b>					
Black or Mixed heritage ("Pardo")	46.4	37.8	32.5	43.1	<0.0001
White	51.1	23.2	19.4	27.1	
Yellow (i.e. East Asian) or Indigenous	2.4	17.4	2.5	32.3	
<b>Number of Residents in the Household</b>					
1 to 3	39.3	23.8	19.4	28.2	0.0127
4 +	60.7	33.8	28.0	39.6	

The seroprevalence (orange) measured in our study increases along with the number of confirmed cases (blue). The vertical bars indicate the 95% confidence intervals.



\*\* Stage 1 (pilot) and Stage 2 data were obtained with only one test (Maglumi).

# Conclusions

Changes in the seroprevalence of SARS-CoV-2 infection in the city of São Paulo could be identified in the 105 days between Phase 4 (October 1st - October 10th) and Phase 5 (January 14th - January 23rd).

The seroprevalence has increased from 26.2% to 29.9%, an increase of 3.7 percentage points. The prevalence has increased from 21.6% to 22.8% in the higher-income stratum and from 30.4% to 36.4% in the lower-income stratum. Differences in seroprevalence between people of different skin colors/ ethnic heritages, as well as different schooling levels, remain statistically significant.

Differences between family income and skin color/ ethnic heritage categories, although still significant, have decreased in the city of São Paulo. A significant increase in seroprevalence between Stages 4 and 5 was observed in the 18 to 34 age group (from 24.7% to 33.0%). These data indicate that the differences between groups are narrowing and that an increasing number of younger people are becoming infected.

Considering the seroprevalence of 29.9% and the total population aged 18 or over in the city of São Paulo (8.4 million people), the total number of adults already infected in the city is approximately 2.5 million. In the period between Phase 4 and Phase 5, approximately 300 thousand adults were infected with SARS-CoV-2 in the city.

The seroreversion rate estimated using the two tests is very low, as shown by data from the Fleury Laboratory. Therefore, the seroprevalence estimated in this study represents adult residents of the City of São Paulo who have been infected with SARS-CoV-2 and, at some point since the start of the pandemic, produced antibodies detectable by at least one of the two tests used.

## SARS-CoV-2 Mapping Group

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