

## Conflict of Interest

The author has declared  
no conflict of interest.

# Mortality and seroprevalence of SARS-CoV-2 among general population in Omdurman – Sudan

## A cross-sectional study

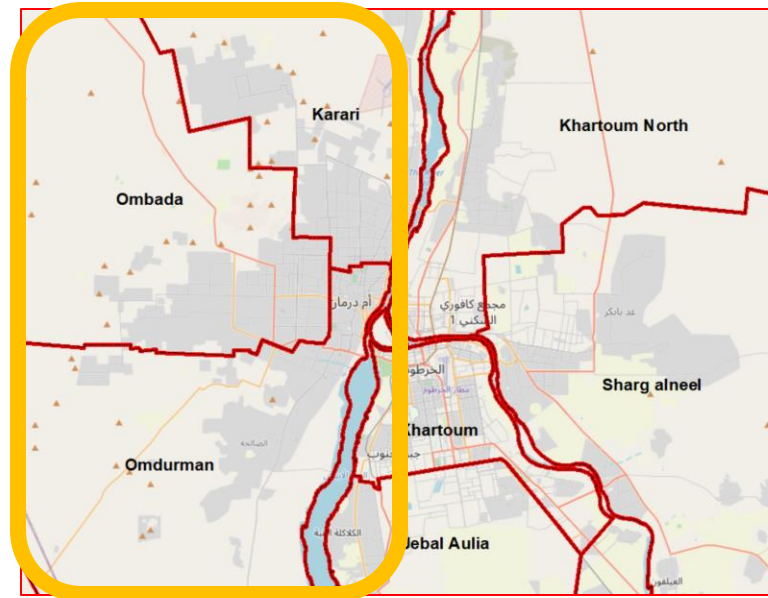
*Switzerland*

**10.05.2022**

By Wendelin Moser (MSF)

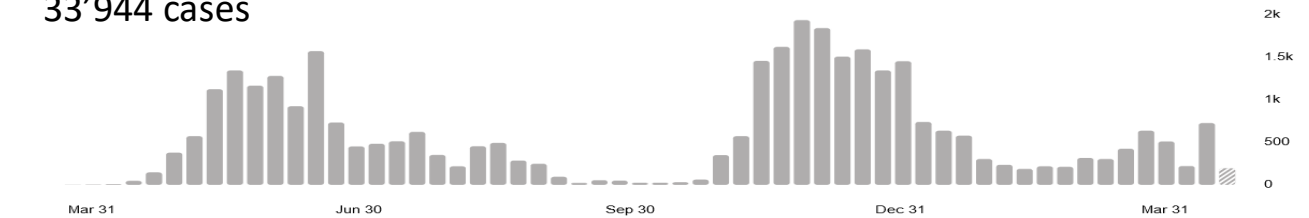
# Study rationale

- MSF ran a COVID-19 emergency project in Omdurman (2020)
- Sudan has officially 33,944 COVID-19 cases and 2,340 deaths (30.04.2021)
- >80% of cases reported from Khartoum
- Modelling study suggests far more deaths >16'000

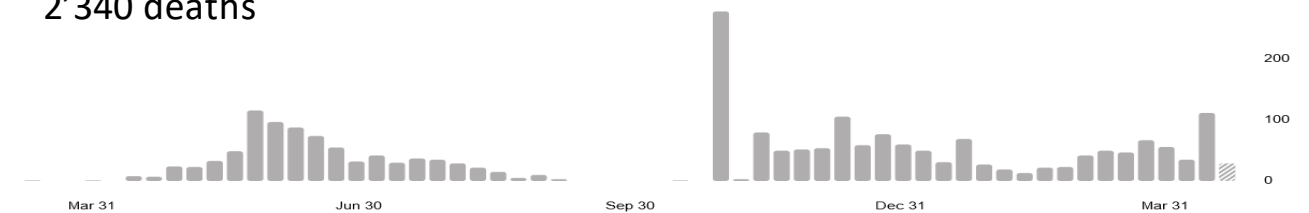


Map: Wendelin Moser (ArcGIS),  
Basemap: OSM

33'944 cases



2'340 deaths



<https://covid19.who.int/region/emro/country/sd>

# Objectives

## Primary objective

To estimate the **crude mortality rate (CMR)** and **seroprevalence** of anti-SARS-CoV-2 antibodies among the population of greater Omdurman

## Secondary objectives

- Compare **seropositivity** among **age groups**
- Estimate the **sensitivity and specificity** of the rapid diagnostic test (**RDT**; STANDARD Q COVID-19 IgM/IgG Combo from SD-Biosensor) compared with ELISA (Euroimmun)

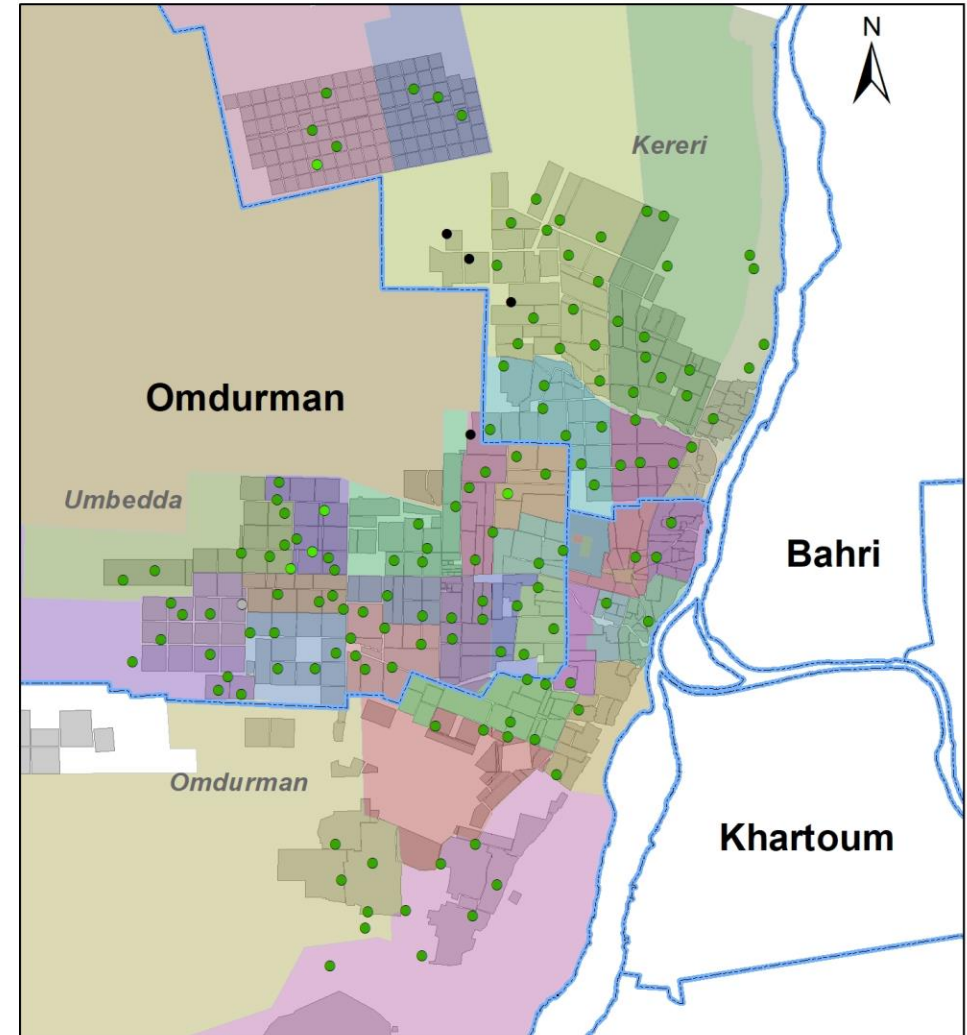
# Method

**Study Design:** Retrospective, cross-sectional mortality survey with nested seroprevalence survey

**Clusters:** 140 random points defined a cluster of 30 households

## Study Period

1<sup>st</sup> March – 10<sup>th</sup> April 2021

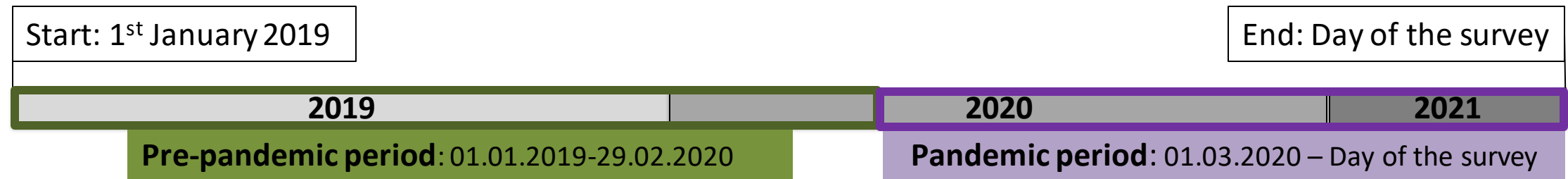
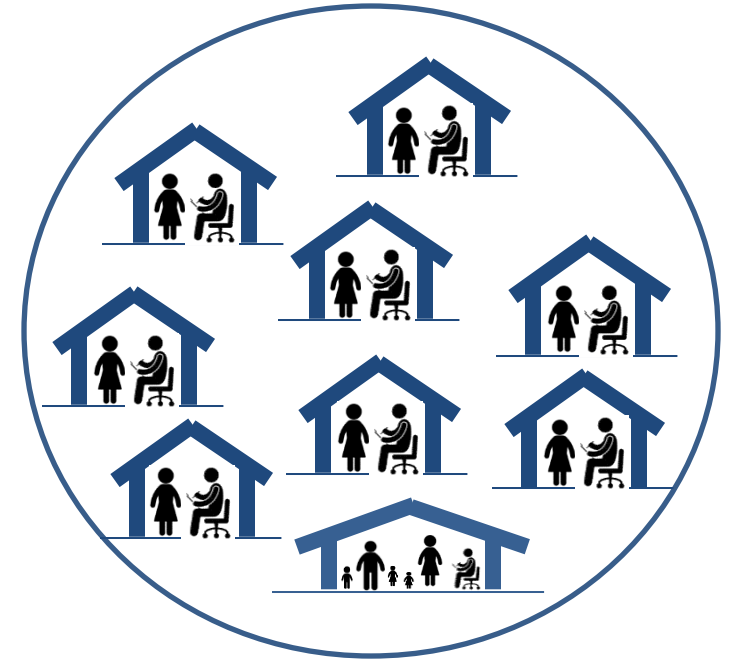


Map: Wendelin Moser (ArcGIS),  
Basemap: OSM

# Method

## Mortality survey

- Questionnaire with head of households
- Sample Size: Mortality for people  $\geq 50$  years
- Number of households: 3,637
- Recall : Pre-and pandemic period



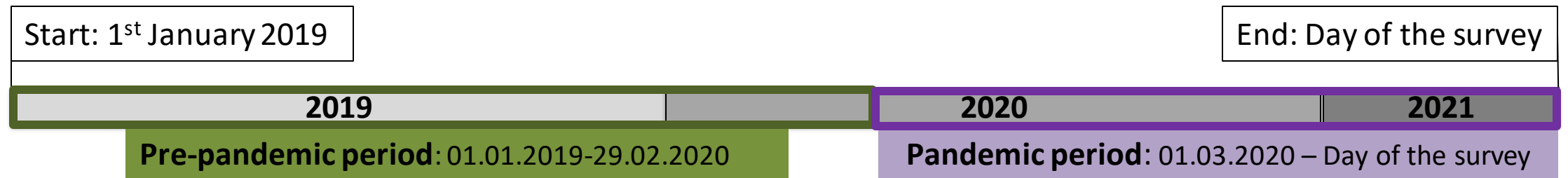
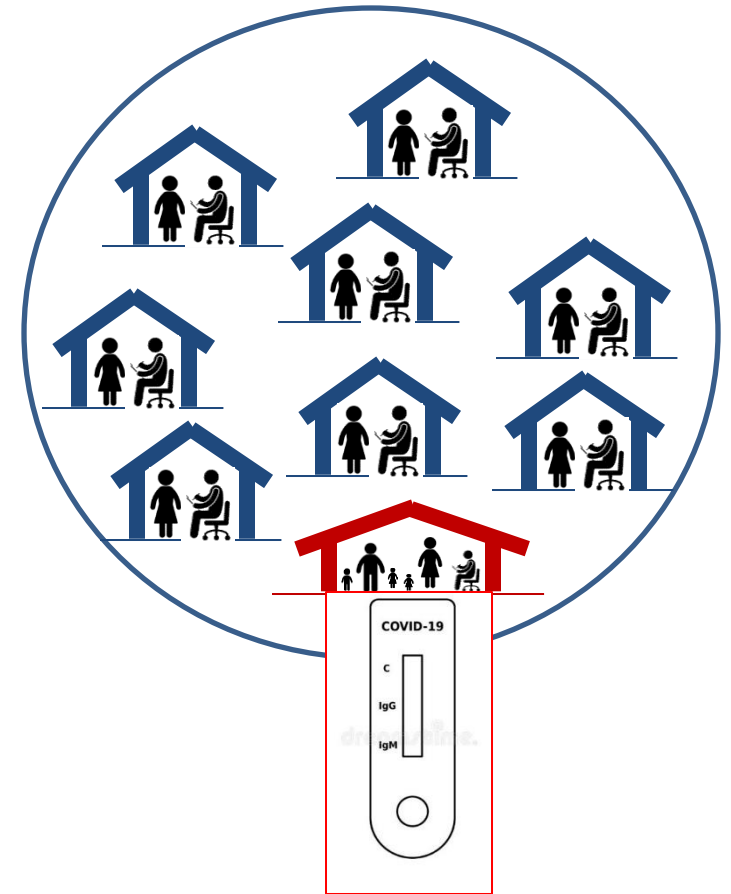
# Method

## Mortality survey

- Questionnaire with head of households
- Sample Size: Mortality for people  $\geq 50$  years
- Number of households: 3,637
- Recall : Pre-and pandemic period

## Seroprevalence survey

- RDT & Questionnaire
- Sample Size: 34% Seropositivity, Number of people: 363 by age group (total = 3,156)
- Recall: Pandemic period



# Method

## Mortality survey

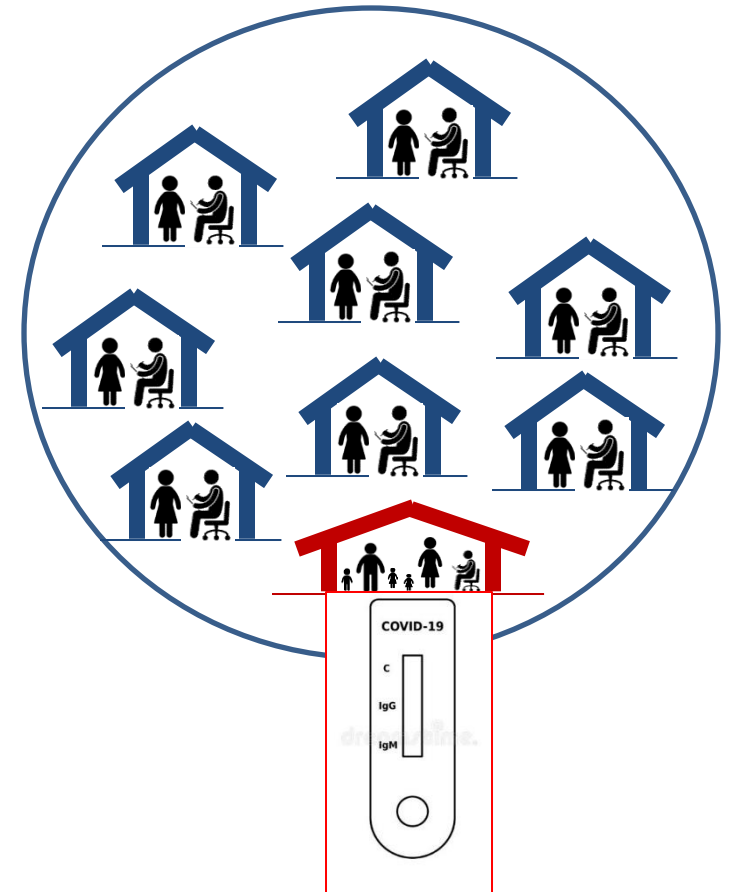
- Questionnaire with head of households
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## Seroprevalence survey

- RDT & Questionnaire
- Sample Size: 34% Seropositivity, Number of people: 363 by age group (total = 3,156)
- Recall: Pandemic period

## Diagnostic comparison

- Collection of Dried Blood Spots (DBS)



Start: 1<sup>st</sup> January 2019

End: Day of the survey

2019

2020

2021

Pre-pandemic period: 01.01.2019-29.02.2020

Pandemic period: 01.03.2020 – Day of the survey

# Results: Seroprevalence survey

## Data

- 140 cluster
- 2,374 people included
- 19% intra household refusal, 19% people absent after two re-visits

Crude seroprevalence: **95%CI 34.3% [32.4-36.2]**



# Results: Seroprevalence survey

## Data

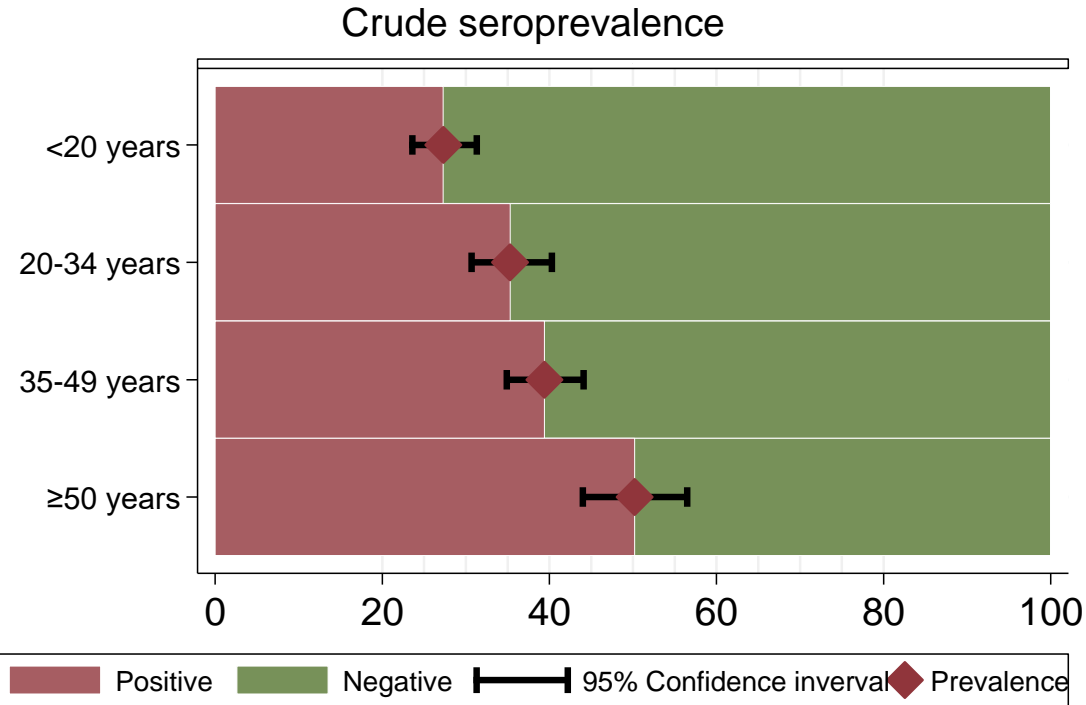
- 140 cluster
- 2 374 people included
- 19% intra household refusal, 19% people absent after two re-visits

Crude seroprevalence: **34.3% [32.4-36.2]**

Adjusted seroprevalence\*: **54.6% [51.4-57.8]**

\*adjusted through a meta-analysis using a random effects model based on existing validation data for the specific test published in the literature and the ELISA results

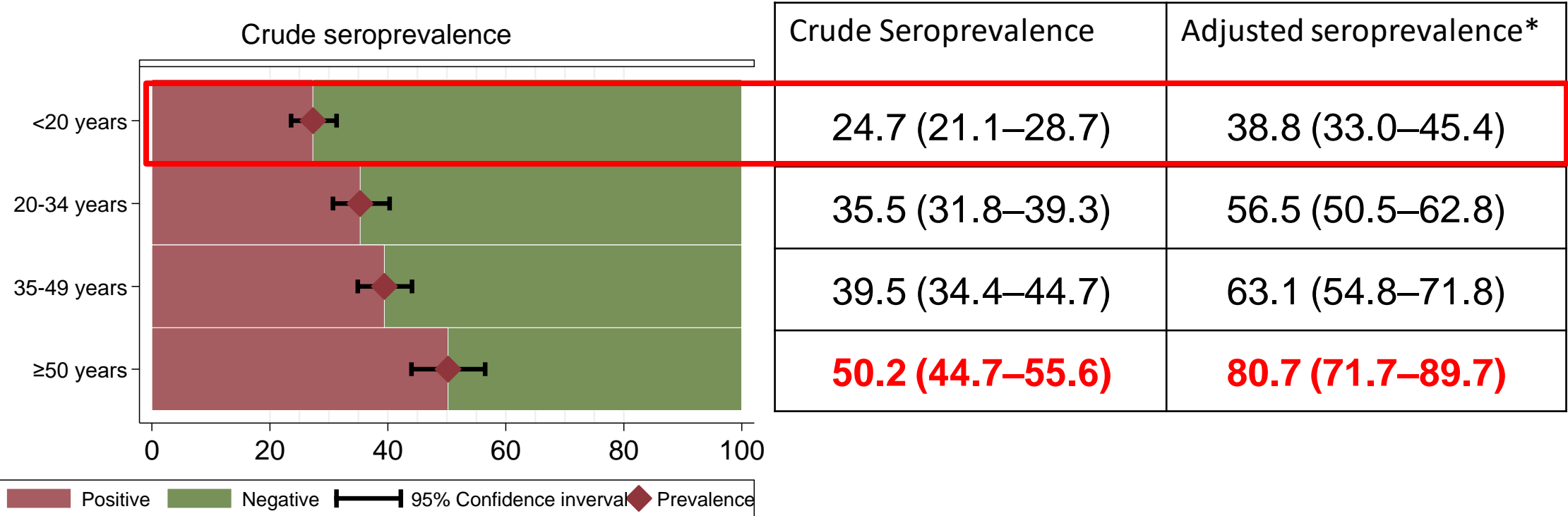
# Results: Seroprevalence survey



Crude Seroprevalence	Adjusted seroprevalence*
24.7 (21.1–28.7)	38.8 (33.0–45.4)
35.5 (31.8–39.3)	56.5 (50.5–62.8)
39.5 (34.4–44.7)	63.1 (54.8–71.8)
<b>50.2 (44.7–55.6)</b>	<b>80.7 (71.7–89.7)</b>

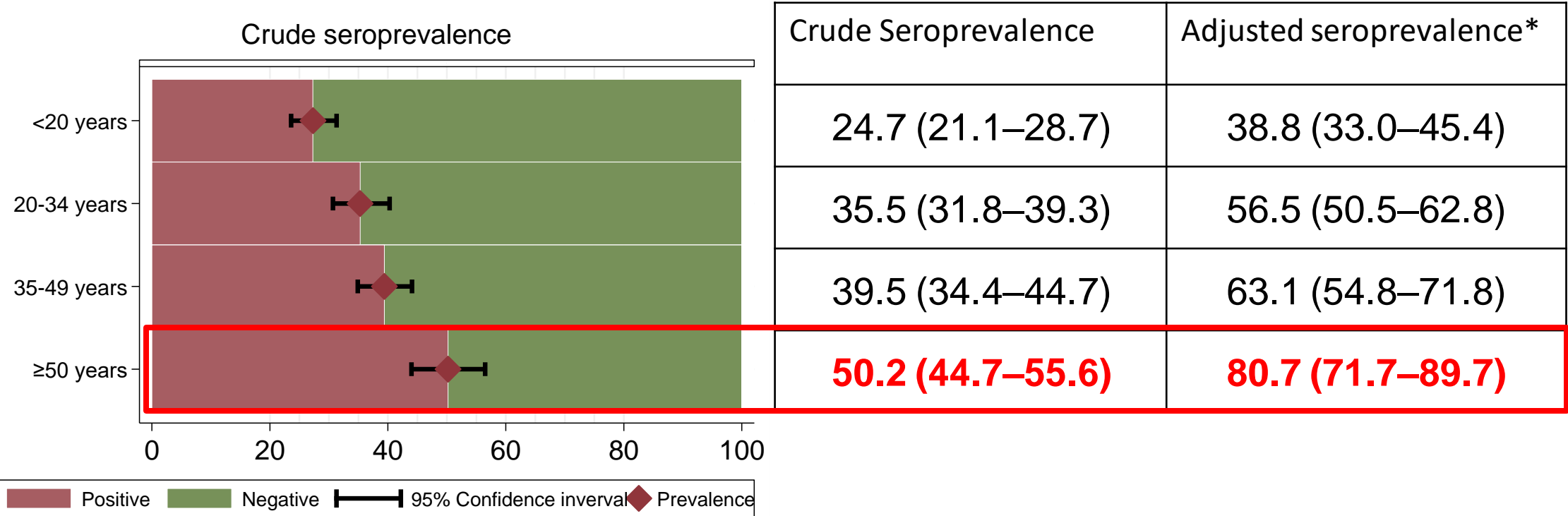
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# Results: Seroprevalence survey



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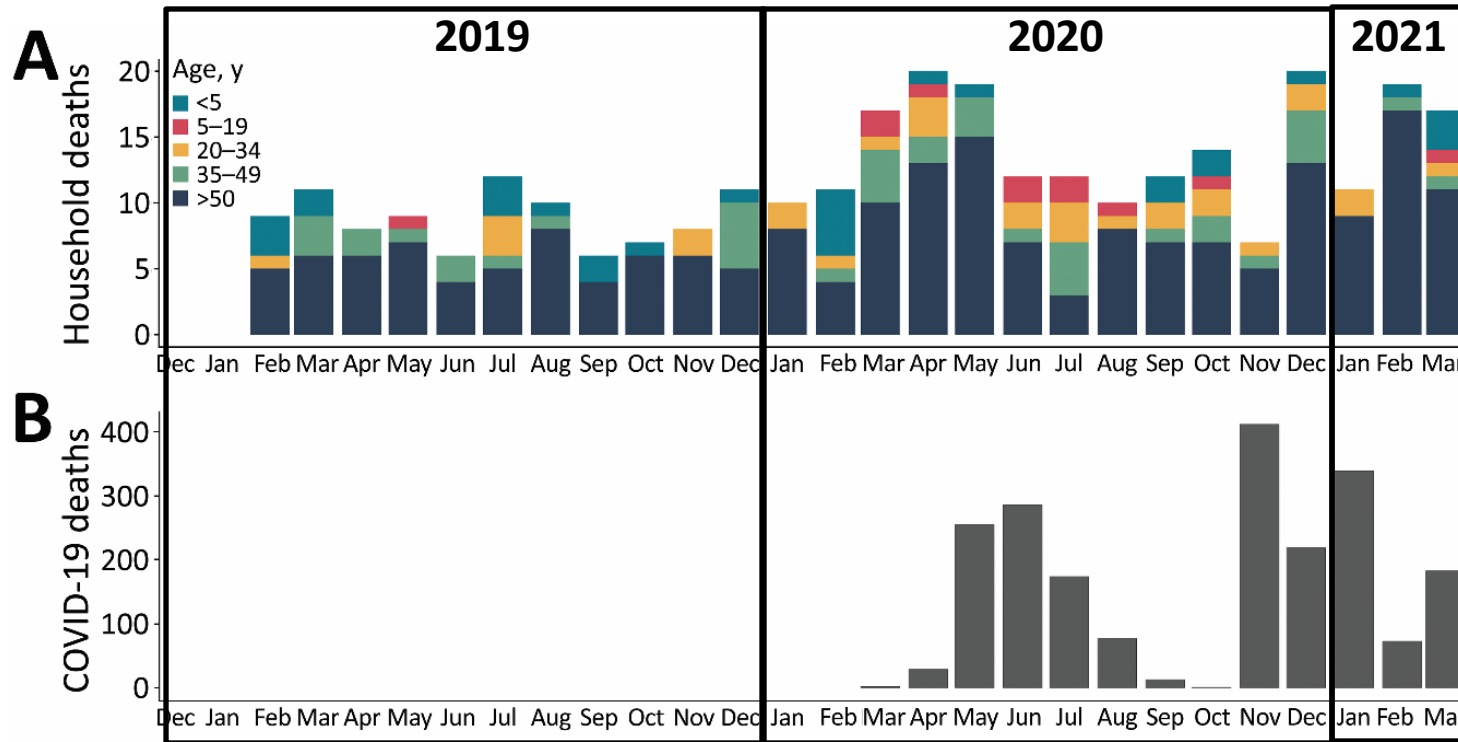
# Results: Mortality survey

## Data

3,716 households included

5% household refusals, 4% absent after two re-visits

27 315 people (319 deaths)



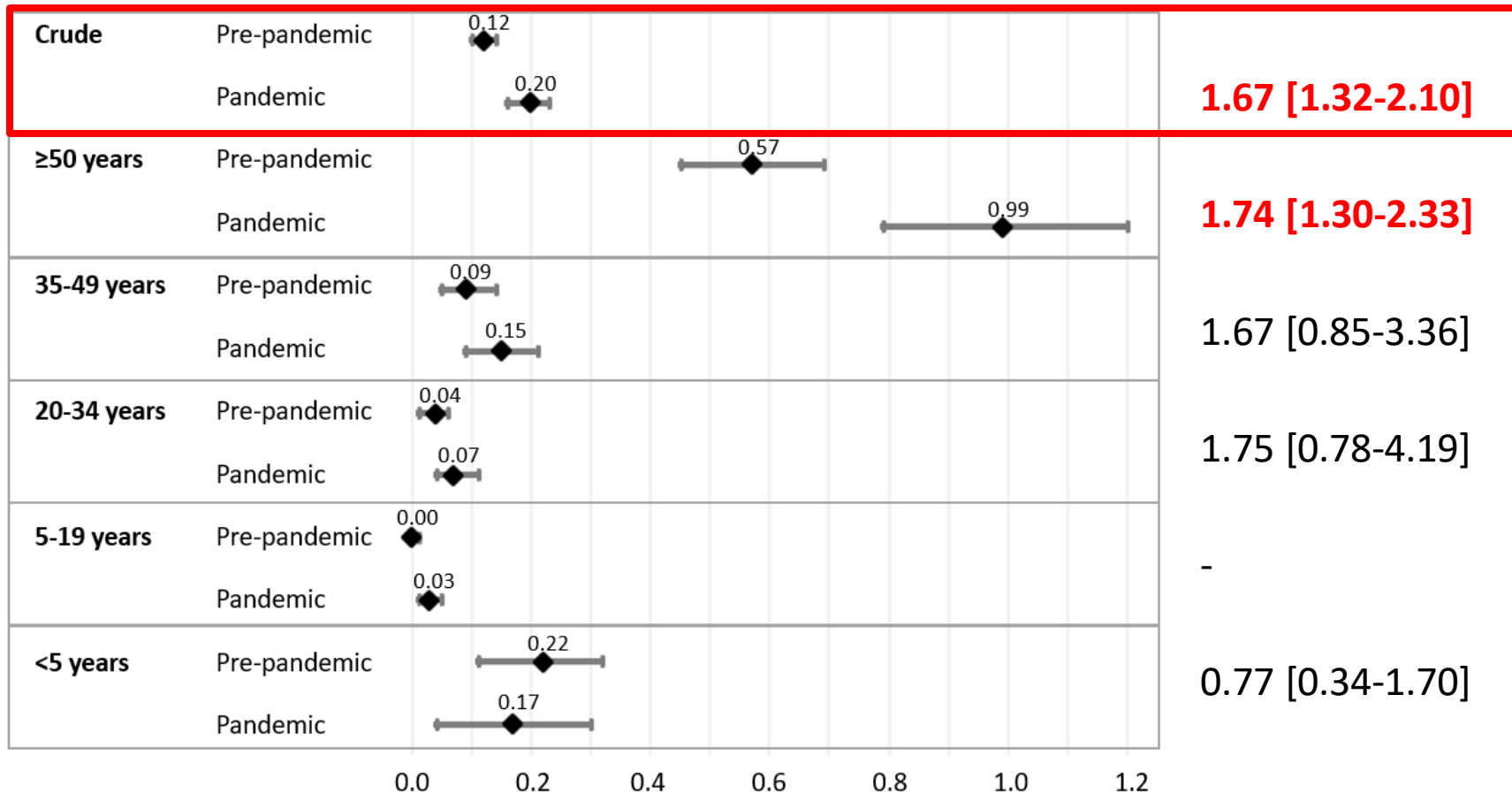
Survey data

Official, country  
wide COVID-19  
deaths

# Results: Mortality survey

Death rate (No. deaths/10 000/day)

Rate ratio

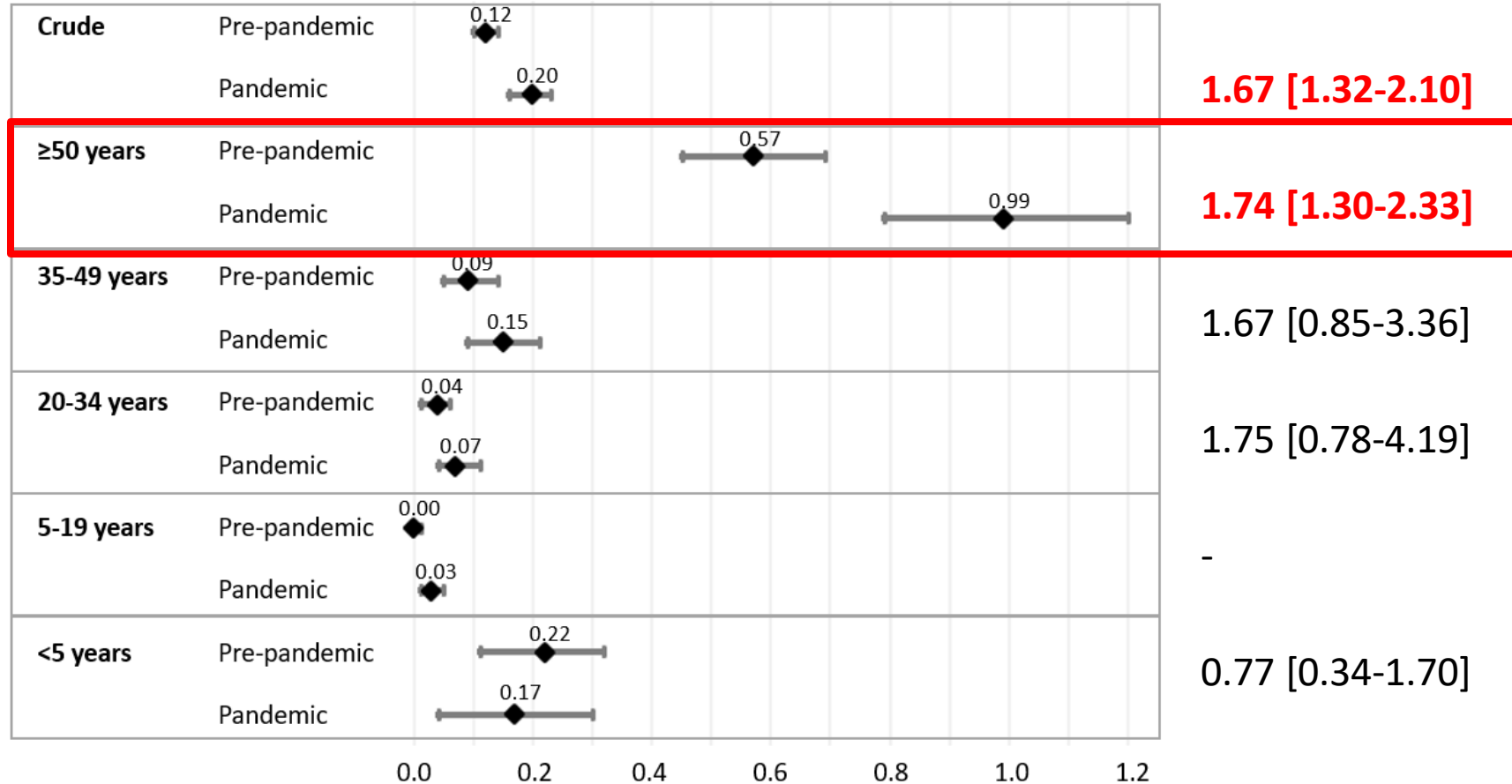


Pre-pandemic period: 01.01.2019-28.02.2020, Pandemic period: 01.03.2020-day of the survey in 2021

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Rate ratio



Pre-pandemic period: 01.01.2019-28.02.2020, Pandemic period: 01.03.2020-day of the survey in 2021

# Conclusion

- The crude seroprevalence assessed using RDT was 34.3% and 50.2% after adjustments
- This was highest in the 50+ age group
- Estimated infections in Omdurman:

Age group	Overall population	≥50 years
Estimated COVID-19 cases	1 660 170 (1 458 225–1 863 936)	317 440 (262 709-328 386)

\*Estimated population Omdurman: 3,040,604



# Conclusion

- We observed an increase in the overall CMR between pre-pandemic and pandemic, particularly within those aged  $\geq 50$  years
- Limitations: long recall period

Period	Overall population	$\geq 50$ years
Excess	7 113 (95% CI 5 015–9 505)	5 125 (95% CI 4 165–6 226)

Estimated population Omdurman: 3 040 604,  $\geq 50$  years population: 12%



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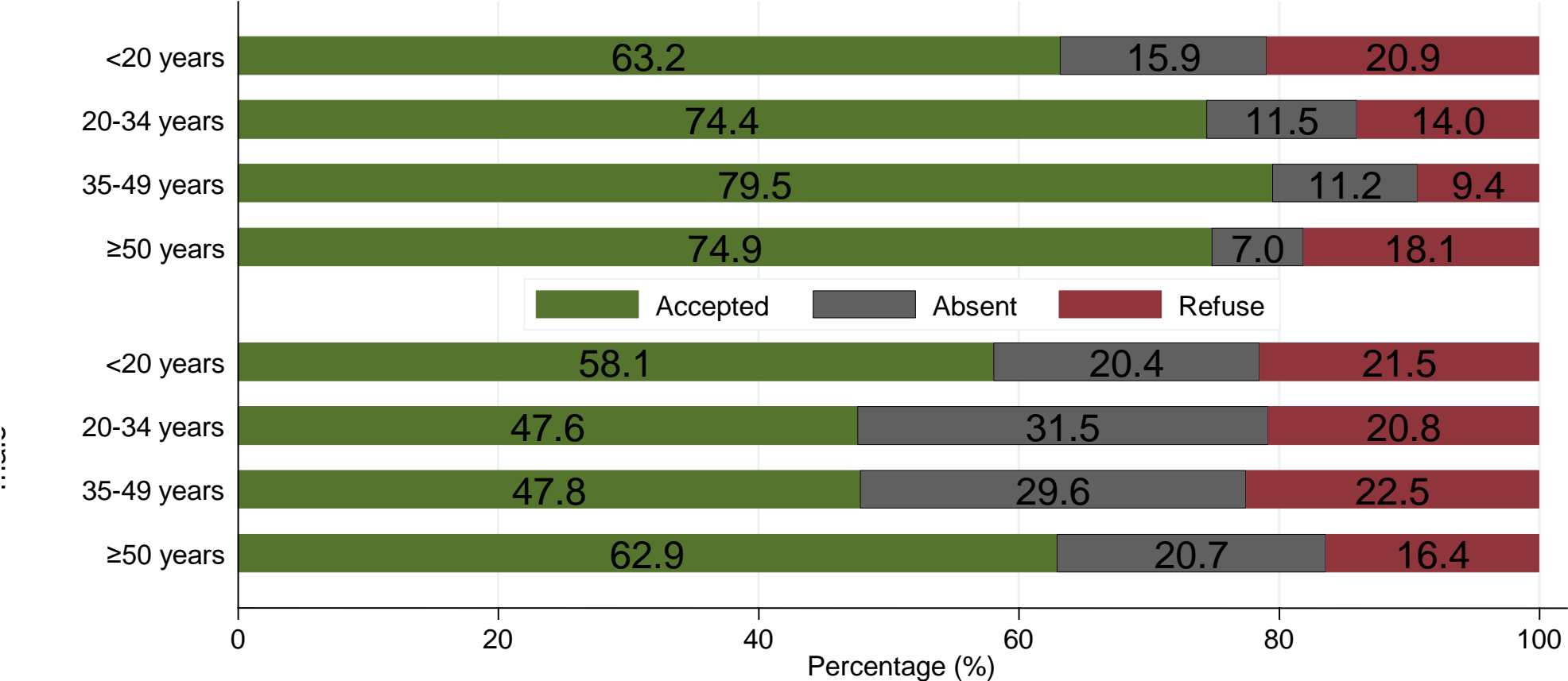
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# Serology

Participation for the RDT collection





Age group	IgG	IgG and IgM	IgM	Total
<20 years	91% (293)	6.8% (22)	2.2% (7)	100% (322)
20-34 years	78.4% (167)	12.2% (26)	9.4% (20)	100% (213)
35-49 years	82% (114)	13.7% (19)	4.3% (6)	100% (139)
≥50 years	83.6% (117)	13.6% (19)	2.9% (4)	100% (140)
Total	84.9% (691)	10.6% (86)	4.5% (37)	100% (814)

825 samples were tested with the ELISA, of which 244 (29.6%) and 322 (39.0%) were positive for SARS-CoV-2 IgG by the RDT and ELISA respectively). Among 198 cases with discordant results considering ELISA as standard, 60 (30.0%) were false positives and 138 (70.0%) false negatives according to the RDT. (serology).

Seroprevalence and mortality survey in Omdurman 2021

Result	ELISA negative, n (%)	ELISA positive, n (%)	Total, n (%)
RDT negative	443 (76.2)	138 (23.8)	581 (100.0)
RDT positive	60 (24.6)	184 (75.4)	244 (100.0)
Total	503 (61.0)	322 (39.0)	825 (100.0)
* ELISA, enzyme-linked immunosorbent assay. RDT, rapid diagnostic test.			

Seroprevalence and mortality survey in Omdurman 2021