

SARS-CoV-2 seroprevalence among nursing home residents and staff in Belgium

SCOPE

(Sars-COV-2 seroPrEvalence)

SCIENTIFIC REPORT

RESULTS VISIT 1 – FEBRUARY 2021

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Eline Meyers¹, Ellen Deschepper², Els Duysburgh³, Liselore De Rop⁴, Tine Deburghgraeve⁴, Pauline Van Ngoc⁵, Marina Di Gregorio⁵, Simon Delogne⁵, Anja Coen⁸, Nele De Clercq⁸, Laëtitia Buret⁵, Samuel Coenen⁶, An De Sutter⁸, Béatrice Scholtes⁵, Jan Verbakel^{4,7}, Piet Cools¹, Stefan Heytens⁸

SARS-COV-2 SEROPREVALENCE AMONG NURSING HOME RESIDENTS AND STAFF IN BELGIUM

SCOPE

Ghent University – University of Liège – KU Leuven - Sciensano

Principal Investigators: Stefan Heytens⁸, An De Sutter⁸

Co-principal Investigator: Els Duysburgh³

Statistician: Ellen Deschepper²

Study team: Eline Meyers¹, Liselore De Rop⁴, Tine De Burghgraeve⁴, Pauline Van Ngoc⁵, Marina Di Gregorio⁵, Simon Delogne⁵, Anja Coen⁸, Nele Declercq⁸, Laëtitia Buret⁵, Samuel Coenen⁶, Beatrice Scholtes⁵, Jan Verbakel^{4,7}, Piet Cools¹

Study protocol V6.2: <https://www.sciensano.be/nl/biblio/sars-cov-2-seroprevalence-among-nursing-home-staff-and-residents-belgium-protocol>

Sponsor: Sciensano, Belgian Institute for Health, Brussels, Belgium

Contact person: Stefan Heytens  stefan.heydens@ugent.be  +32 475 39 58 43

¹ Department of Diagnostic Sciences, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium, ² Biostatistics Unit, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium, ³ Department of Epidemiology and Public Health, Sciensano, Brussels, Belgium, ⁴ EPI-Centre, Department of Public Health and Primary Care, KU Leuven, Leuven, Belgium, ⁵ Research Unit of Primary Care and Health, Department of General Medicine, Faculty of Medicine, University of Liège, Liège, Belgium ⁶ Department of Family Medicine & Health Policy, Faculty of Medicine and Health Sciences, University of Antwerp, Antwerp, Belgium, ⁷ Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford, United Kingdom ⁸ Department of Public Health and Primary Care, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium

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ABBREVIATIONS

CI	Confidence interval
COVID-19	Coronavirus disease 2019
GEE	Generalised estimating equation
Ig	Immunoglobulin
IQR	Interquartile range
NH	Nursing home
N/A	Not applicable
RBD	Receptor binding domain
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SCOPE	Sars-CoV-2 seroPrevalence
V1	Visit 1

MAIN FINDINGS

From February 1st until March 24th, 2021, the SCOPE study measured the proportion of residents and staff members in Belgian nursing homes (NH) that had anti-SARS-CoV-2 antibodies (seroprevalence). In total, 1,572 residents and 1,253 staff members from 69 NHs in Belgium were tested for the presence of SARS-CoV-2 antibodies by a point-of-care rapid test, and responded to a COVID-19 related questionnaire. At the first testing moment (five bimonthly follow-up testing moments are scheduled), we observed the following:

- Between February 1st and March 24th, 2021, during the ongoing SARS-CoV-2 vaccination campaign, 69% (95% CI: 63%-74%) of residents and 80% (95% CI: 76%-83%) of staff in Belgian nursing homes had anti-SARS-CoV-2 antibodies.
- At the time of testing 96% of the residents received at least one vaccination dose and 68% were fully vaccinated. For staff this data were respectively 85% and 48%. So, although more residents than staff were vaccinated at the moment of testing, seroprevalence was lower among residents than among staff.
- At least one day after receiving one dose of a COVID-19 vaccination, 52% of residents tested positive for anti-SARS-CoV-2 antibodies and 77% tested positive at least one day after receiving two doses. Among staff these findings were higher, being respectively 75% and 98%.
- The proportion of residents and staff with antibodies after vaccination was higher among those who reported a previous SARS-CoV-2 infection than among those without a self-reported previous infection.

1 INTRODUCTION

Monitoring the dynamics of disease propagation and immunity among the population are of key importance for public health decisions in the current SARS-CoV-2 pandemic.

Seroprevalence studies assess the proportion of the population which has developed SARS-CoV-2 antigen-specific antibodies, and is therefore potentially protected against subsequent infection (1). As serosurveillance studies are crucial to plan an adequate public health response, the Belgian Institute for Public Health, Sciensano, coordinates SARS-CoV-2 seroprevalence studies in the general population and relevant subpopulations in Belgium (school-aged children and school staff, hospital health care workers, primary health care workers and staff and residents in nursing homes).

Within this framework, the SCOPE (Sars-COV-2 seroPrEvalence) study assesses the seroprevalence among nursing home (NH) residents and staff members. Older adults living in residential care facilities have been disproportionately affected by COVID-19, as 53.5% of the more than 23,000 reported COVID-19 fatal cases in Belgium (between March 8th, 2020 and April 18th, 2021) were nursing home residents (2).

At the end of December 2020, Belgium launched its large-scale COVID-19 vaccination campaign, giving priority to nursing home residents and staff. Between December 28th, 2020 and March 24th, 2021, all eligible nursing home residents and staff members willing to be vaccinated received a Pfizer-BioNTech vaccine (3). It is of crucial importance to monitor the impact of this vaccination campaign on public health and its immunogenicity as part of post-marketing surveillance of the COVID-19 vaccines. In this context, assessment of the proportion of the population that develops SARS-CoV-2 specific antibodies and the persistence of this antibody response provides key information.

The SCOPE study assesses the seroprevalence of SARS-CoV-2 in a cohort of residents and staff in Belgian nursing homes. The testing started on February 1st, 2021 using a point-of-care (POC) COVID-19 IgG/IgM rapid test, with subsequent bimonthly follow-up of the sero-incidence over a period of 10 months. Additionally, using a questionnaire being completed at each testing visit, we gain additional insights in the association between seropositivity and COVID-19 vaccination status, COVID-19 clinical manifestations, pre-existence of relevant comorbidities, SARS-CoV-2 infections and mortality outcomes.

This report summarises the result of the first testing visit (visit 1, V1) which took place between 1 February and 24 March, 2021. We report the geographical representativeness of our sample, the cohort characteristics, and the prevalence of antibodies against SARS-CoV-2 among residents and staff in Belgian NH, by region, vaccination status and self-reported history of infection.

For each follow-up testing visit, we will report the updated seroprevalence, the bimonthly incidence of SARS-CoV-2 infections and mortality in the study population, and the persistence of the serological antibody response among seropositive participants.

2 METHODS

2.1 Objectives

This report addresses primary objective 1 at month 0 (visit 1) of the SCOPE study, as given below. The secondary and tertiary objectives of the SCOPE study can be found in the study protocol published online: <https://www.sciensano.be/nl/biblio/sars-cov-2-seroprevalence-among-nursing-home-staff-and-residents-belgium-protocol>

2.1.1 Primary objectives

1. To assess the seroprevalence of SARS-CoV-2 among NH residents and staff in Belgium at month 0 and at every follow-up visit in the cohort at month 2, 4, 6, 8 and 10.
2. To assess the sero-incidence of SARS-CoV-2 among NH residents and staff in Belgium over five two-month time frames and summarised over a ten-month time period.

2.1.2 Ethics

The SCOPE study was approved by the Ethics committee of the Ghent University Hospital (BC-08719). The study is registered at ClinicalTrials.gov (NCT04738695). Informed consent forms were collected for every recruited participant.

2.2 Study population

To assess the seroprevalence and -incidence in Belgian nursing homes, the SCOPE study aimed to recruit 3,036 participants, NH residents (1,656) and staff (1,380), in 69 nursing homes throughout Belgium. We aimed to recruit a sample of NHs that is evenly spread across the Belgian territory, and therefore randomly sampled within the strata defined by region and province, and in proportion to the population. Random samples from the stratified province were taken proportional to the number of beds to guarantee general representativity. An optimal number of forty-four participants (20 staff, 24 residents) were randomly recruited per NH. The sample size was calculated assuming a seroprevalence rate of 0.5 at the baseline moment and half width of a 95% confidence interval of 0.05, a drop-out rate over ten months time of 0.2 and 0.4 for respectively staff and residents and a design effect of 2.68. Detailed information on the sample size calculation can be found in the study protocol published online: <https://www.sciensano.be/nl/biblio/sars-cov-2-seroprevalence-among-nursing-home-staff-and-residents-belgium-protocol>

2.3 Study design

This study was designed as a prospective observational cohort study. A random sample of 69 NHs was recruited during the months December 2020 and January-February 2021. Sample collection started on February 1st, 2021. Baseline sampling (day 0, month 0) started in a staggered way, so all baseline samples among the different nursing homes are collected within the first \pm four weeks after collection of the first sample. However, the sample collection period of testing visit 1 was extended with three additional weeks due to late recruitment of three NHs (two in Liège, one in Hainaut). Follow-up sample collection occurs with a 2-month interval in month 2, month 4, month 6, month 8 and month 10 after the baseline collection of that specific nursing home (see Table 1). Ideally, follow-up samples are collected 60, 120, 180, 240 and 300 days (\pm 2 months between each visit) after the first NH collection for visit 2, 3, 4, 5 and 6 respectively. However, when collection after 60 days is not possible for practical reasons, samples are collected within a margin of \pm 7 days.

Table 1: Overview and timing of the sample collection periods in the SCOPE study

Follow-up visit	Month	Start sample collection	End sample collection
VISIT 1	0	1/02/2021	24/03/2021 ¹
VISIT 2	2	31/03/2021	1/05/2021
VISIT 3	4	30/05/2021	30/06/2021
VISIT 4	6	29/07/2021	29/08/2021
VISIT 5	8	27/09/2021	28/10/2021
VISIT 6	10	26/11/2021	27/12/2021

¹ The end date of the sample collection period of visit 1 was extended from 1/03/21 to 24/03/21 due to late recruitment of three NHs (two in Liège, one in Hainaut). The other 66 nursing homes in the study were sampled during February 2021.

2.4 Data collection

2.4.1 Antibody testing

Seroprevalence is assessed using the point-of-care COVID-19 IgG/IgM Rapid Test Cassette (Orient Gene Biotech Co). This rapid test detects IgM and IgG directed against the receptor binding domain (RBD) of the SARS-CoV-2 spike protein. Sciensano validated this rapid test using capillary blood against ELISA and PCR+Ab-positivity results and reported a sensitivity of 92.9% and specificity of 96.3% (4). Sample collection is performed by a team of trained study researchers. In case a participant is absent during the NH testing visit, a detailed instruction sheet will be left at the NH to perform self-sampling under supervision of medical staff.

2.4.2 Questionnaire

Each participant is asked to complete an online questionnaire (LimeSurvey version 3.22) at each testing visit. The questionnaires for residents are completed by the head nurse(s). In the baseline questionnaire, participants are asked for COVID-19 relevant comorbidities (5). At baseline and in every follow-up questionnaire, participants are asked whether they received a COVID-19 vaccination (date, type of vaccine, number of doses), underwent a PCR-/ antigen-/saliva-test, or whether COVID-19 was confirmed by a CT-scan, and, if they experienced COVID-19-like symptoms. The COVID-19 symptoms episode is defined as stated in the Sciensano case definition (6). At the NH level, the management is asked about the care levels among their residents, the vaccination coverage in the NH and non-COVID-19 related mortality between the start of the COVID-19 epidemic and the start of the study. The COVID-19 incidence and mortality during the period between beginning of data registration and the start of the study (May 12th, 2020 until January 31st, 2021) of these NH will be extracted from the Sciensano nursing home surveillance database (7). At every follow-up sampling visit, the following items are requested at NH level: vaccination coverage, if COVID-19 testing was performed, the respective proportion of positive tests, possible outbreaks (maximal prevalence) and (non-)COVID-19 related death rate.

2.4.3 Statistical analysis

Seroprevalence of SARS-CoV-2 was estimated as the number of participants with positive IgG and/or IgM test divided by the total number of valid test results. The seroprevalence among NH residents and staff in Belgium at month 0 is reported stratified for staff and residents, as well as a total seroprevalence with the 95% confidence interval (CI), assessed by a generalised equation estimation (GEE) analysis with independence covariance structure, binomial family and logit link, and robust variance estimator. Confidence intervals for seroprevalence are back-transformed from the logit scale. All characteristics are displayed for Belgium and for its three regions.

As the first testing visit was performed during the national vaccination campaign in the NHs, seroprevalence is reported by the vaccination status (number of covid vaccine doses) of participants. Further, seroprevalences will depend on whether the participant had a history of a COVID-19 infection.

Therefore, estimated overall and stratified for staff and residents seroprevalences are also reported by the subgroups of self-reported history of a COVID-19 infection within the vaccination status, averaged over NHs based on a GEE analysis with exchangeable covariance structure.

All statistical analyses based on GEE models were performed on participants who had a valid rapid test result, and completed the survey to derive the vaccination status and the self-reported history of a COVID-19 infection. All analyses are performed in R, version 4.0.2, using the GEE-library (version 4.13-20) and emmeans-library (version 1.5.0).

3 RESULTS

3.1 Description of the study cohort

3.1.1 NH sample

A stratified random sample of **69** NHs across Belgium was recruited. In total, 108 NHs were contacted for participation, of which 33 refused to participate in the study and 6 dropped-out before recruitment of participants. These NHs were substituted by the subsequent NH for the corresponding province in the randomised selection until all 69 NHs were recruited. The total SCOPE study cohort is demographically representative for NHs in Belgium. A geographical representation of the distribution of the NHs in the study and in Belgium can be found in Figure 1. An overview of the recruited number of NH residents and staff by region and province in relation to the total number of NH staff and beds in Belgium can be found in Table 2.

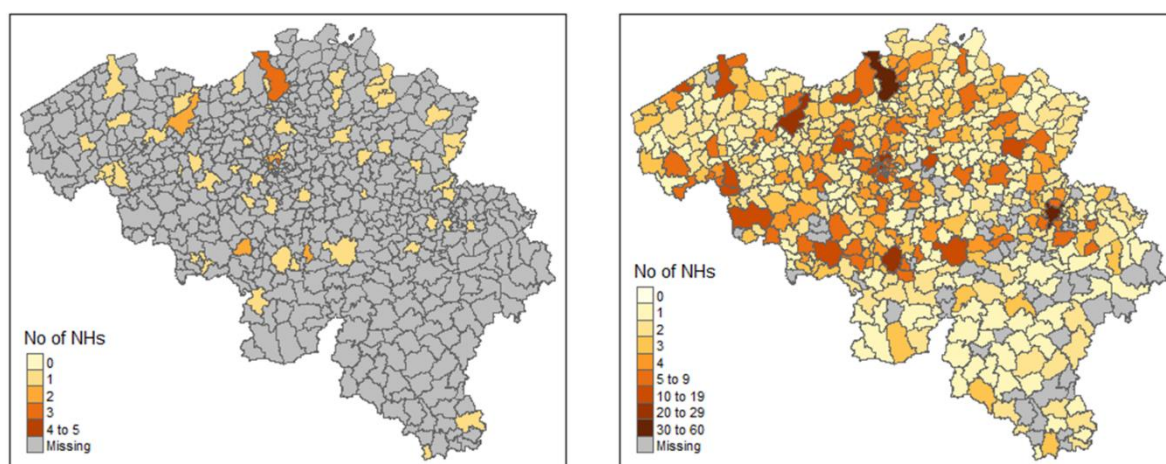


Figure 1: Geographical representation of NHs in the SCOPE study (left) and in Belgium (right).

Table 2: Distribution of the recruited NHs, residents and staff in the study and total number of NHs, NH beds and NH staff in Belgium

	NH/participants in study						Total NH/resident beds/staff in Belgium					
	NH		Residents		Staff		NH		Resident beds		Staff	
	n	%	n	%	n	%	n	%	n	%	n	%
Total	69	100	1,640	100	1,368	100	1,521	100	142,503	100	105,164	100
Region												
Brussels	7	10	165	10	139	10	142	9	15,943	11	9,394	9
Wallonia	23	33	551	34	452	33	578	38	50,511	35	36,112	34
Flanders	39	57	924	56	777	57	801	53	76,049	53	59,658	57
Province												
Brussels	7	10	165	10	139	10	142	9	15,943	11	9,394	9
Walloon Brabant	3	4	71	4	60	4	52	3	4,751	3	3,400	3
Flemish Brabant	7	10	165	10	137	10	135	9	12,697	9	8,352	8
Antwerp	11	16	259	16	220	16	208	14	21,006	15	15,661	15
Limburg	5	7	120	7	100	7	99	7	8,851	6	7,501	7
Liège	7	10	168	10	133	10	179	12	15,644	11	11,298	11
Namur	3	4	72	4	59	4	75	5	6,152	4	4,517	4
Hainaut	8	12	192	12	160	12	230	15	20,510	14	14,273	14
Luxembourg	2	3	48	3	40	3	42	3	3,454	2	2,624	2
West Flanders	7	10	167	10	140	10	164	11	15,348	11	13,380	13
East Flanders	9	13	213	13	180	13	195	13	18,147	13	14,764	14

3.1.2 Participants

3.1.2.1 Participant characteristics

In total, **3,008** participants were recruited among these 69 nursing homes, of which **1,640** residents and **1,368** staff members. On average, **24** residents and **20** staff members were recruited per NH. Of the total cohort, **2,985** (99%) participants were tested during the first visit (V1) and **2,840** (94%) participants had a completed baseline questionnaire. For visit 1, combined seroprevalence and questionnaire data is available for **2,807** (93%) participants (1,572 residents; 1,235 staff members).

Participant characteristics are described in Table 3. These include age, gender and proportion of comorbidities. The median age of NH residents during V1 was **87 years old** (IQR 81;91), while for staff members this was **43 years of age** (IQR 33;52). The majority of both residents and staff in the cohort are female (80%). The majority of residents (69%) suffered from at least one of the following comorbidities (cardiovascular disease, diabetes, hypertension, severe heart-/lung-/renal disease, immunosuppression, active cancer), while for staff this was 18%. The care dependency of participating residents and the type of job for participating staff are presented in annex, Table A1. More than half of the staff members in the cohort are nursing staff (54%), followed by paramedical staff (e.g., physiotherapists, occupational therapists) (13%) and cleaning staff (11%). Of the residents in the cohort, 75% is highly care-dependent (care level B, C, Cd and D) while 25% needs, according to the 'Katz' evaluation scale, little or no care.

Table 3: Participant characteristics: age, gender and comorbidities

	NH population n=3,008		Residents n=1,640		Staff n=1,368	
Missing questionnaires, n⁴, %	168	6	57	3	111	8
Median age¹, IQR⁵	74	45;88	87	81;91	43	33;52
Minimum age; maximum age		18;103		46;103		18;71
Male², n⁴, %	578	20	394	25	184	15
Female², n⁴, %	2,262	80	1,189	75	1,073	85
Comorbidities² (as listed below)³, n⁴, %	1,316	46	1,086	69	230	18
Cardiovascular disease ²	694	24	652	41	42	3
Diabetes ²	318	11	278	18	40	3
Hypertension ²	686	24	546	34	140	11
Severe heart-/lung-/renal disease ²	206	7	180	11	26	2
Immunosuppression ²	62	2	39	2	23	2
Active cancer ²	77	3	70	4	7	1
No comorbidities² (as listed above), n⁴, %	1,524	54	497	31	1,027	82

¹ Median age was based on the number of valid questionnaire data points (NH population= 2,806; residents= 1,572; staff=1,234). Ages <16 years old and <40 years old for staff and residents respectively were considered invalid and therefore reported as missing. ² Gender distribution and the proportion of comorbidities were based on the available number of questionnaires (NH population= 2,840; residents= 1,583; staff=1,257). ³ One or more of the comorbidities below. ⁴ Absolute number. ⁵ Interquartile range.

3.1.2.2 Time varying participant characteristics

Time varying cohort characteristics are presented in Table 4. During V1, Belgium experienced a third epidemic wave and the vaccination campaign in Belgian NHs, which started December 28th, 2020, was fully ongoing (8). As these two variables directly impact the seroprevalence, the vaccination status and self-reported history of infections (a previous PCR-/antigen rapid test/CT-scan confirmed SARS-CoV-2 infection) at the time of sampling during visit 1 is described in Table 4 and presented per region in Figure 2.

All vaccinated participants in the study were administered a Pfizer-BioNTech vaccine, except for three participants (0.02%) (two received AstraZeneca-Oxford and one a Moderna vaccine). The mean time between the first and second vaccination was 21.3 days. During V1 testing, **59%** was fully vaccinated, while **91%** received at least one vaccination dose. A total of **9%** (4% residents; 15% staff members) of the cohort had not received a first vaccination dose at the moment of sampling in V1. Residents were slightly ahead in vaccination coverage; 68% of residents and 48% of the staff were fully vaccinated at V1.

The proportion that was fully vaccinated and the proportion that reported a history of SARS-CoV-2 infection during V1 slightly differed among the regions with respectively **56%, 57%, 64%** and **30%, 34% and 40%** for Brussels, Flanders and Wallonia. However, these differences in vaccination status and/or self-reported history of infection between regions could possibly be explained by the differences in

moment of testing, as three NHs in Wallonia were tested in March 2021 in contrast to all other NHs which were tested in February 2021.

Table 4: Time varying participant characteristics: vaccination status and self-reported history of SARS-CoV-2 infections¹ at V1

	Not vaccinated		At least one dose ¹		Two doses (= fully vaccinated) ¹		Self-reported history of infection ²	
	n	%	n	%	n	%	n	%
All (n=2,840)	251	9	2,589	91	1,684	59	1,009	36
Residents (n=1,583)	62	4	1,521	96	1,077	68	595	38
Staff (n=1,257)	189	15	1,068	85	607	48	414	33

¹ Participants that had received respectively at least one dose, or two doses (= fully vaccinated) at least one day before the antibody testing date. ² Self-reported history of infection is defined as a previously reported positive PCR-/antigen rapid test-/CT-scan COVID-19 test result between February 2020 and the moment of V1 testing.

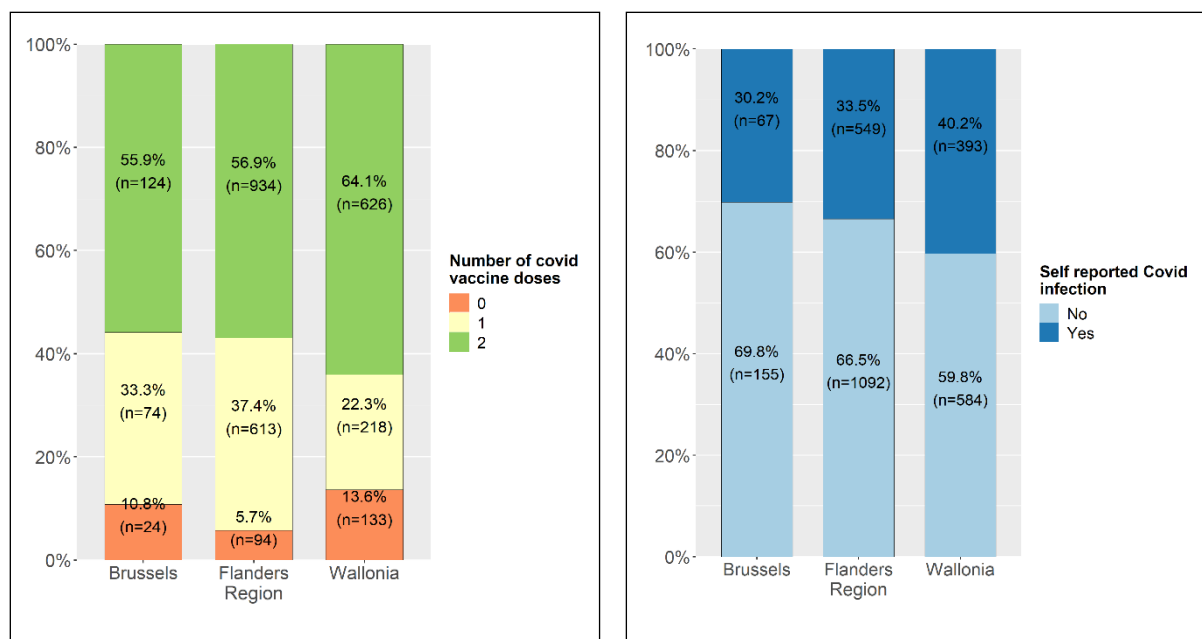


Figure 2: Vaccination status (not vaccinated, one dose or two doses) (left) and self-reported history of SARS-CoV-2 infections (yes/no) (right) by region (Brussels, Flanders, Wallonia)

3.2 SARS-CoV-2 seroprevalence

Between February, 1st and March, 24th, 2021, **69%** (95% CI: 63%;74%) of residents and **80%** (95% CI: 76%;83%) of staff in Belgian nursing homes had anti-SARS-CoV-2 antibodies. An overview of the seroprevalence (IgG/IgM/IgG+IgM) among residents and staff by region is given in Table 5. Forty seven (2%) out of 3,008 participants had no test result due to absence (illness, hospitalisation, holidays or other) or had an invalid test result. Among all the participants tested during V1, 43% tested positive for IgG antibodies, 1% for IgM antibodies and 29% for both IgM and IgG antibodies. Overall, in Belgium the prevalence of anti-SARS-CoV-2 antibodies among residents and staff together was 74% (95% CI: 70%-78%) and was similar in NH in Brussels, Flanders and Wallonia being respectively 77% (95% CI: 61%;88%), 73% (95% CI: 68%;78%) and 74% (95% CI: 67%;80%).

Table 6 gives the anti-SARS-CoV-2 antibodies prevalence by vaccination status and by self-reported infection history at the moment of testing. The same is visualised in Figure 3.

We observed differences in prevalence of anti-SARS-CoV-2 antibodies among residents and staff. Among fully vaccinated participants (residents and staff together), **83%** (95% CI: 78%;87%) had anti-SARS-CoV-2 antibodies, this was **98%** (95% CI: 96%;99%) among staff and **77%** (95% CI: 70%;83%) among residents. Among participants who received only one dose of the vaccine at V1, **66%** (95% CI: 60%;72%) had antibodies, being **75%** (95% CI: 67%;81%) among staff and **52%** (95% CI: 44%;59%) among residents. Looking at the group of participants without a reported previous SARS-CoV-2 infection, the difference between the number of staff and residents developing antibodies after one vaccination dose is even larger, being **65%** (95% CI: 55%;73%) of staff and **28%** (95% CI: 20%;37%) of residents having antibodies. For those without a reported previous SARS-CoV-2 infection but who received two doses of the vaccine, this increased to **97%** (95% CI: 94%;99%) and **66%** (95% CI: 57%;73%) respectively.

Among the non-vaccinated participants, **39%** (95% CI: 31%;47%) had anti-SARS-CoV-2 antibodies. Among those non-vaccinated that reported no previous infection, **16%** (95% CI: 10%;24%) had antibodies. Oppositely, in about 30% of the non-vaccinated participants that reported a prior confirmed SARS-CoV-2 infection, no antibodies were detected.

Table 5: IgG/IgM Rapid test results and SARS-CoV-2 seroprevalence among residents and staff in Belgian nursing homes, by region, between February 1st, 2021 and March 24th, 2021¹

	NH population		Residents		Staff	
	n ³ (total) ⁴	% (95% CI)	n ³ (total) ⁴	% (95% CI)	n ³ (total) ⁴	% (95% CI)
IgG/IgM rapid test results						
No test	23	1	11	1	12	1
Invalid test	24	1	5	0	19	1
Negative	770	26	503	31	267	20
Positive						
IgM	21	1	12	1	9	1
IgG	1,285	43	580	35	705	52
IgM+IgG	885	29	529	32	356	26
Self-sampled	185	6	30	2	155	11
Positive IgG/IgM rapid test²	2,191 (2,961)	74 (70;78)	1,121 (1,624)	69 (63;74)	1,070 (1,337)	80 (76;83)
Positive rapid test by region²						
Brussels	234 (302)	77 (61;88)	134 (165)	81 (60;93)	100 (137)	73 (59;83)
Flanders	1,234 (1,688)	73 (68;78)	604 (922)	66 (58;72)	630 (766)	82 (77;86)
Wallonia	723 (971)	74 (67;80)	383 (537)	71 (61;80)	340 (434)	78 (73;83)

¹ The majority of nursing homes (NHs) were sampled during February 2021. Only three NH in the study were sampled during March 2021 due to late recruitment. ² 95% confidence intervals (CI) are estimated using a generalised estimating equation (GEE) for seropositivity, with independence covariance structure. ³ Absolute number. ⁴ The number between brackets represents the denominator (total number of valid tests) for the specific subgroups.

Table 6: Positive IgG/IgM rapid test results and SARS-CoV-2 seroprevalence among residents and staff in Belgian nursing homes and 95% confidence interval (CI) by vaccination status and self-reported history of infection based on generalised estimating equation (GEE) analyses with exchangeable covariance structure

	NH population		Residents		Staff	
	n=2,807		n=1,572		n=1,235	
	n ¹ (total) ²	% (95% CI)	n ¹ (total) ²	% (95% CI)	n ¹ (total) ²	% (95% CI)
Vaccinated two doses⁴	1,399 (1,672)	83 (78;87)	812 (1,070)	77 (70;83)	587 (602)	98 (96;99)
Self-reported history of infection ³	540 (550)	98 (95;99)	374 (384)	97 (93;99)	166 (166)	100 (99;100)
No self-reported history of infection	859 (1,122)	77 (71;82)	438 (686)	66 (57;73)	421 (436)	97 (94;99)
Vaccinated one dose⁵	578 (891)	66 (60;72)	239 (441)	52 (44;59)	339 (450)	75 (67;81)
Self-reported history of infection ³	308 (337)	91 (87;94)	157 (174)	88 (81;93)	151 (163)	92 (87;95)
No self-reported history of infection	270 (554)	50 (42;58)	82 (267)	28 (20;37)	188 (287)	65 (55;73)
Not vaccinated	100 (244)	39 (31;47)	32 (61)	48 (33;63)	68 (183)	37 (29;46)
Self-reported history of infection ³	79 (110)	70 (59;79)	28 (33)	81 (65;91)	51 (77)	64 (51;75)
No self-reported history of infection	21 (134)	16 (10;24)	4 (28)	13 (6;28)	17 (106)	15 (10;24)

¹ Absolute number ² The number between brackets represents the denominator for the specific subgroups. ³ Self-reported history of infection is defined as a previously reported positive PCR-/antigen rapid test-/CT-scan COVID-19 test result between February 2020 and the moment of V1 testing. ⁴ Participants that received the first and second dose of the vaccine dose at least one day before the antibody testing date. ⁵ Participants that received only the first dose of the vaccine at least one day before the antibody testing date.

F

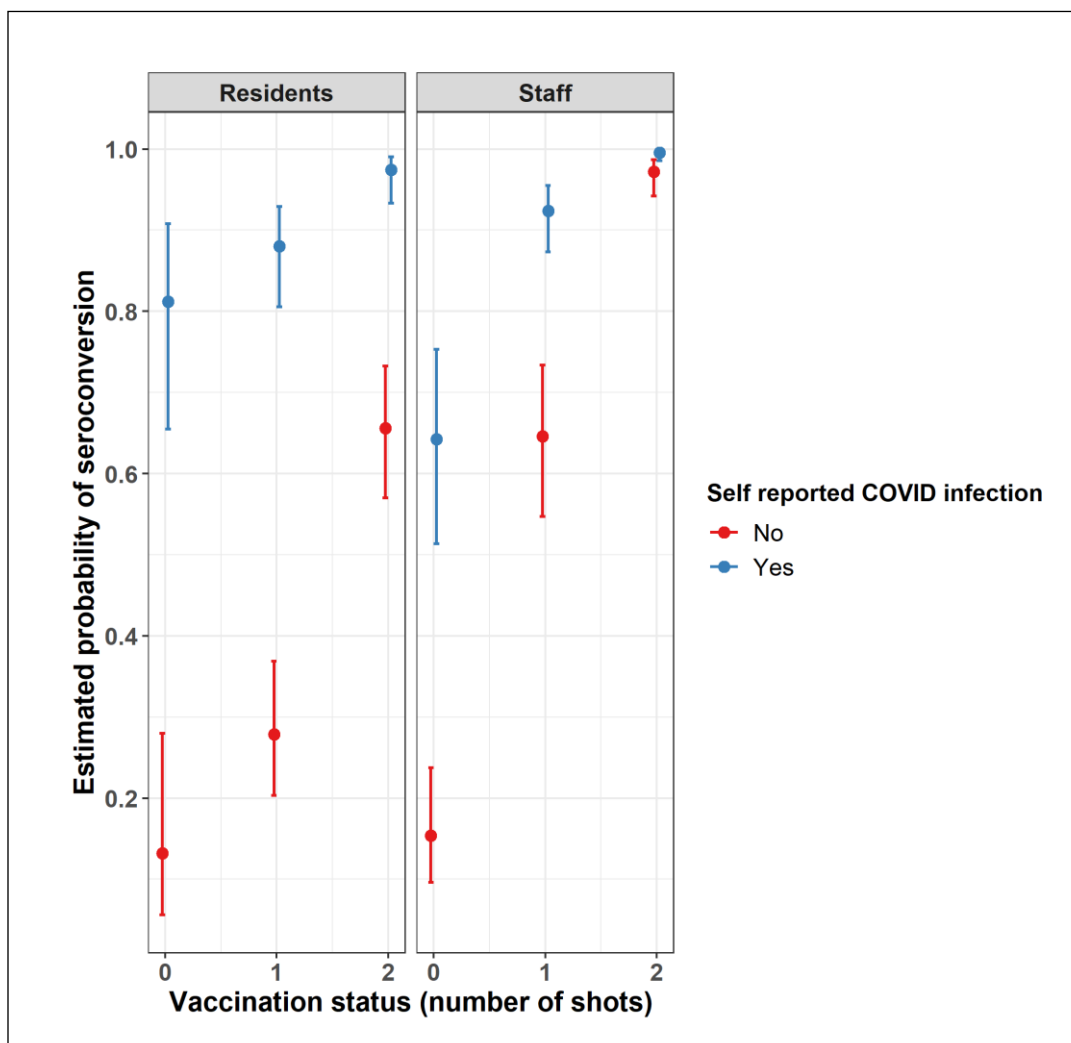


Figure 3: Visualisation of the seroprevalence based on a generalised estimating equation (GEE) model averaged over nursing homes (with exchangeable structure) by vaccination status (not vaccinated, one dose, two doses) in residents and staff with and without self-reported history of SARS-CoV-2 infections, Belgium, February-March 2021

4 CONCLUSION

Between February 1st and March 24th 2021, the SCOPE study measured the prevalence of SARS-CoV-2 antibodies in NHs in Belgium. The vaccination campaign in Belgian NHs was fully ongoing at that time, meaning that a heterogeneous study population of participants that received one (32%), two (59%) or no vaccine doses (9%) was sampled. Within this random sample of NHs in Belgium, 69% (95% CI: 63%;74%) of residents and 80% (95% CI: 76%;83%) of staff had anti-SARS-CoV-2 antibodies. At the time of testing, 96% of the residents received at least one vaccination dose and 68% were fully vaccinated. For staff, this data were respectively 85% and 48%.

The seroprevalence according to vaccination status demonstrated differences between NH residents and staff, suggesting that vaccine-induced antibody responses in elderly living in NH might be impaired or delayed, compared to a generally healthy working age population. Among staff, anti-SARS-CoV-2 antibodies were detected in 75% after receiving a single vaccine dose, while 52% of residents tested positive for antibodies after administration of one vaccine dose. Nevertheless, among fully vaccinated individuals, a seroprevalence of >70% was reached for both residents and staff members.

Among participants who reported a previous SARS-CoV-2 infection, the proportion of residents and staff with antibodies after vaccination was higher than among those without a self-reported history of infection. In this group, seroprevalence was above 88% after a first vaccination dose and increased to nearly 100% among those fully vaccinated.

However, sampling of participants occurred at varying time points after receiving a first or second dose of the vaccine. During V1 testing, some of the testing may have occurred too soon after administration of the vaccine for detection of antibody responses. The results of the second testing visit in April 2021, should give further insights on the proportion with anti-SARS-CoV-2 antibody responses after vaccination in residents and staff with/without a previous SARS-CoV-2 infection. Additionally, further research is needed, like quantitative antibody testing, to fully assess and understand the antibody response after vaccination among elderly and the effect of previous SARS-CoV-2 infections. Nevertheless, our observations are supported by a recent study assessing antibody concentrations in NH residents and staff upon COVID-19 vaccination, which showed reduced antibody levels in residents without a history of SARS-CoV-2 infection (9).

Among the non-vaccinated NH residents and staff, 39% participants (n=244) had anti-SARS-CoV-2 antibodies. However, this sample of non-vaccinated participants might be biased, as almost half of them reported a history of infection, which might be a reason for not getting vaccinated.

During February-March 2021, the seroprevalence among NH staff was similar to this of other health care workers that were prioritised in the vaccination strategy, like hospital and primary health care workers (see Table 7) (10).

Table 7: Prevalence of anti-SARS-CoV-2 antibodies among different population groups in Belgium during February – March 2021¹ (10)

Population	Sampling period	Vaccinated with at least one dose (%) ²	Vaccinated two doses (%)	Seroprevalence % (95% CI)
NH staff	February 1st – March 24th 2021	85	48	80 (76;83)
Hospital healthcare workers ³	February 24 th – 28 th 2021	80	36	64 (50;76)
Primary healthcare workers ³	February 22 th -28 th 2021	83	66	76 (74;77)

¹ Study design, sample size and time of sampling differ among the different studies. ² Percentage of participants that was vaccinated with at least one dose at the time of sampling (includes both those who received one dose as those who received two doses). ³ Source (10): <https://epistat.wiv-isp.be/covid/covid-19.html>.

In conclusion, the high seroprevalence found among NH staff and residents reflects the impact of vaccination campaign in Belgian nursing homes. In November 2020, a study in Flemish NHs found a seroprevalence of 19% and 15% in NH residents and staff, respectively (11). We found that at present, during the ongoing COVID-19 vaccination campaign in NH, 74% of participants (staff and residents together) had anti-SARS-CoV-2 antibodies, which is above the defined 70% threshold for herd immunity¹ (12). These findings are supported by the incidence of COVID-19 cases and hospitalisations in Belgian NHs, which are currently (May 26th-June 1st, 2021) below 2/1,000 residents and 0.5/1,000 residents, respectively. This in contrast to the peak COVID-19 incidences and hospitalisations reported during the second epidemic wave, before start of the vaccination campaign, which were over 25/1,000 and 2,6/1,000 residents, respectively (October-November 2020) (13).

¹ The actual threshold for SARS-CoV-2 herd immunity is not known yet and can range from 70 to 95%.

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6 REFERENCES

1. Lipsitch M, Sverdlow DL, Finelli L. 2020. Defining the Epidemiology of Covid-19 - Studies Needed. *N Engl J Med* 382:1194-1196.
2. Surveillance in woonzorgcentra - Rapport 16. https://covid-19.sciensano.be/sites/default/files/Covid19/COVID-19_Surveillance_WZC.pdf. Accessed May 3th, 2021.
3. Catteau L. HF, Dequeker S., Vandael E. , Stouten V., Litzroth A., C. WT. 2021. Surveillance van de COVID-19 vaccinatie in Belgische woonzorgcentra. https://covid-19.sciensano.be/sites/default/files/Covid19/COVID-19_THEMATIC%20REPORT_SURVEILLANCE%20VAN%20DE%20VACCINATIE%20IN%20BELGISCHE%20WOONZORGCENTRA.pdf. Accessed May 18th, 2021.
4. Triest D, Geebelen L, De Pauw R , De Craeye S, Vodolazkaia A, Verbrugghe M, Magerman K, Robben LL, Pannus P, Neven K, Ramaekers D, Van Gucht S, Dierick K, Van Loon N, Goossens M, Desombere I. 2021. Performance of five rapid serological tests in mild-diseased subjects using finger prick blood for exposure assessment to SARS-CoV-2. Manuscript submitted for publication.
5. Specifieke aanbevelingen voor personen met verhoogd risico voor een ernstig verloop van COVID-19 – expert consensus opgesteld onder leiding van prof. Dr. Erika Vlieghe. https://covid-19.sciensano.be/sites/default/files/Covid19/COVID-19_measures-for-high-risk-groups_NL.pdf. Accessed May 21st, 2021.
6. Case definition of a possible COVID-19 case update september. https://covid-19.sciensano.be/sites/default/files/Covid19/20200928_Advice_RAG_Case%20definition%20update.pdf. Accessed May 18th, 2021.
7. S. Dequeker KL, E. Islamaj, I. Int panis, M. Callies I., Catteau b., Catry EV. 2021. COVID-19 surveillance in residential institutions - Protocol V4.2. https://www.sciensano.be/sites/default/files/20210111_protocol_covid-19_surveillance_in_residential_institutions_v4.2_final.pdf. Accessed May 18th, 2021.
8. COVID-19 surveillance: frequently asked questions. https://covid-19.sciensano.be/sites/default/files/Covid19/COVID-19_FAQ_ENG_final.pdf. Accessed May 18th, 2021.
9. Sciensano. 2021. Bewoners van woonzorgcentra die geen COVID-19-infectie doormaakten, zijn mogelijk gebaat bij een 3de vaccindosis. [Bewoners van woonzorgcentra die geen COVID-19-infectie doormaakten, zijn mogelijk gebaat bij een 3de vaccindosis | sciensano.be](https://www.sciensano.be/nl/bewoners-van-woonzorgcentra-die-geen-covid-19-infectie-doormaakten-zijn-mogelijk-gebaat-bij-een-3de-vaccindosis). Accessed on June 11th, 2021.
10. Sciensano. COVID-19 Epistat Dashboard. <https://epistat.wiv-isp.be/covid/covid-19.html>. Accessed June 7th, 2021.
11. Janssens H, Heytens S, Meyers E, Deschepper E, De Sutter A, Devleeschouwer B, Formukong A, Keise S, Nys E, Padalko E, Geens T, Cools P. 2021. SARS-CoV-2 seroprevalence in staff and residents from nursing homes in Flanders, Belgium. Manuscript submitted for publication.
12. Coronavirus COVID-19 vaccination. <https://www.info-coronavirus.be/en/vaccination/>. Accessed May 18th, 2021.
13. Surveillance in woonzorgcentra - rapport week 22. https://covid-19.sciensano.be/sites/default/files/Covid19/COVID-19_Surveillance_WZC.pdf. Accessed June 7th, 2021.

ANNEX

Table A1: Care dependency (according to the Katz evaluation scale) of recruited residents and type of job of recruited staff members

Care dependency/type of job	Residents (n=1,583)		Staff members (n=1,257)	
	n	%	n	%
Care dependency				
O ¹	159	10	n/a	n/a
A ²	243	15	n/a	n/a
B ³	567	36	n/a	n/a
C ⁴	215	14	n/a	n/a
Cd ⁵	370	23	n/a	n/a
D ⁶	29	2	n/a	n/a
Type of job				
Care	n/a	n/a	673	54
Administration	n/a	n/a	102	8
Paramedic	n/a	n/a	168	13
Catering	n/a	n/a	105	8
Cleaning	n/a	n/a	140	11
Hairdresser/pedicure	n/a	n/a	2	0
Other	n/a	n/a	67	5

¹Independent, no care needed; ²light care needed; ³care dependent; ⁴severe care dependency; ⁵severe care dependency with dementia; ⁶dementia.