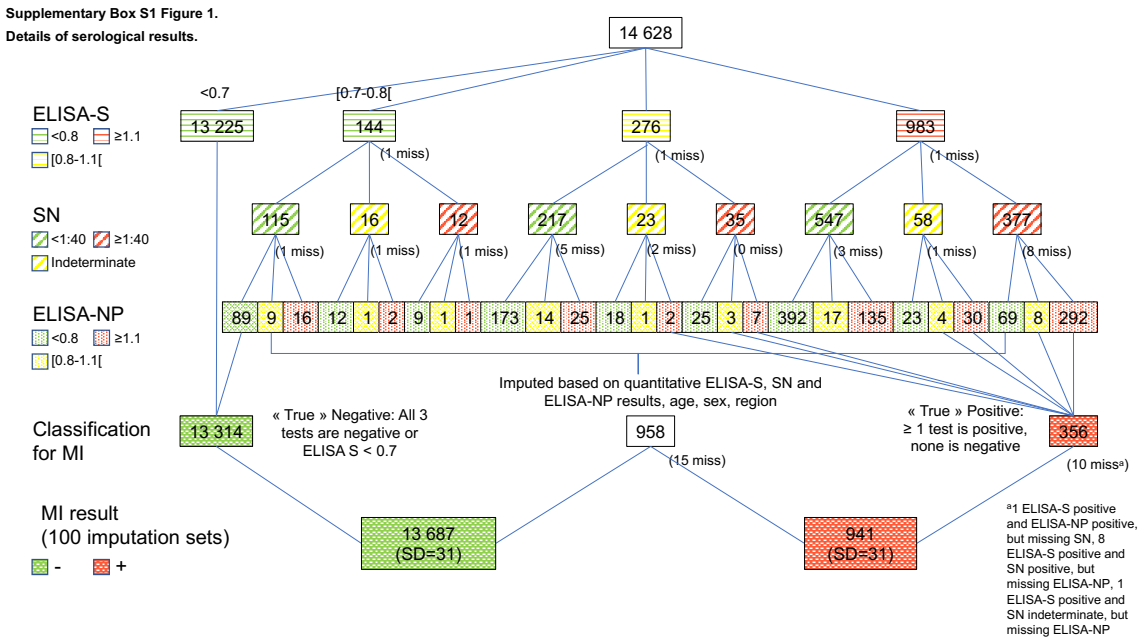
Supplementary Box S1. Inferring the probability of infection from serological results

We used multiple imputation (MI) to infer the probability of infection among participants: those with at least one positive ELISA-S, ELISA-NP and SN and no negative test results were assumed to be "truly infected" (n=356), those with all three negative results or ELISA-S <0.7 were assumed to be "truly non infected" (n=13 314) and the rest of participants (n=958) was re-classified according to the MI model using the numerical values from the three serological tests (log-transformed), region, age and gender (Supplementary Box S1 figure 1). Among the "truly infected" participants, 82% (292/356) had three positive tests, 15% (54/356) had two positive tests and 3% (10/356) had one positive test.



Since the specificity was >95% for each serological test independently (supplementary Box S1 table 1), the likelihood of two or three false positive tests can be considered negligible and that of one false positive test - no negative test was low and concerned very few participants. Therefore, we assumed that the specificity of the MI model for infection status was 100%.

However, an ELISA-S < 0.7 was sufficient to classify a participant as "non-infected" which could be biased by the imperfect sensitivity of this method. We estimated the probability of an ELISA-S ≥ 0.7 in participants with positive RT-PCR result in our sample. We found that 77 participants had a positive SARS-CoV-2 RT-PCR less than 3 months before the DBS collection, including 68 (88% (95%CI: 79%, 95%) with an ELISA-S ≥0.7. This value was in line with the test sensitivities reported in samples collected in RT-PCR positive patients (Supplementary Box S1 Table 1). We therefore applied a correction to adjust for imperfect ELISA-S test sensitivity (88% at the 0.7 threshold) to our MI estimates to derive cumulative incidence of SARS-CoV-2 infection.

Supplementary Box S1 Table 1. Accuracy of serological methods

	Sensitivity	Specificity	Reference
ELISA-S	threshold for test positive=0.8	threshold for test positive=1.1	
	90.4% (84.4%; 94.7%)	97.5% (95.8%; 98.6%)	[1]
	83.0% (75.6%; 90.4%)	99.7% (99.1%; 100%)	[2]
	88.9% (80.1%; 94.3%)	100% (91.1%; 100%)	[3]
ELISA-NP	threshold for test positive=0.8	threshold for test positive=1.1	
	90.8% (82.7%; 96.0%)	97.9% (93.9%; 99.6%)	[4]
	90.0% (81.4%; 95.0%)	100% (91.1%; 100%)	[3]
SN		threshold for test positive=40	
	NA	100% (99.2%; 100%)	[5]

References

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4. Favresse J, Cadrobbi J, Eucher C, Elsen M, Laffineur K, Dogne JM, et al. Clinical performance of three fully automated anti-SARS-CoV-2 immunoassays targeting the nucleocapsid or spike proteins. J Med Virol. 2021; 93(4):2262-2269.
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Supplementary Box S2.
Weighting and calibration procedures

Weighting.
We used inverse probability weighting to correct for selection bias (when only a subgroup of the whole cohort was invited to participate by internet) and inverse probability weighting to correct for participation bias (when only a subgroup of those invited did participate to the survey). Sampling weights were estimated from each source cohort using inverse predicted probabilities obtained from logistic regression models, with selection or participation as response variables and socio-demographic characteristics as covariates. Age group, gender, region, socio-professional category, smoking status were used in all logistic models, while area deprivation index, household size, housing type, rural/urban life, education level, BMI, perceived health, alcohol consumption, chronic diseases, disability, life satisfaction, confidence in the financial situation could be used in some specific cohort models. No correction was applied for the participation into the serological study as 96.3% of those randomly invited returned a DBS.

Calibration.
An initial cohort-specific calibration was performed by generalized raking in relation to the marginal totals of the age-class, gender and socio-professional-category distributions in the cohort-specific target population. We used 2016 regional population census data for calibration (available at https://www.insee.fr/fr/statistiques/4171523).

Target population differed between cohorts and an age- and gender-specific stratum s may belong to some cohort-specific target populations and not to others. A reweighting procedure was therefore applied to account for (i) the relative stratum-specific sample size of subjects from each cohort and (ii) the marginal totals of the age-class, gender and socio-professional-category distributions in the overall target population.

Let us define $w_{s,i,j}$ the cohort-specific post-calibration weight for subject $j \in [\![1, n_{s,j}]\!]$ belonging to strata $s \in S$ in cohort $i \in [\![1, c_s]\!]$, with:

- S the set of all age- and gender-specific strata;
- c_s the number of cohorts with subjects belonging to stratum s;
- $n_{s,i}$ the sample size for stratum s in cohort i.

If we note N_s the population size for stratum s, these weights are appropriate for cohort-specific estimations using the Horvitz–Thompson estimator as the total weight of subjects belonging to this stratum in cohort i satisfies the relation:

$$\sum_{j=1}^{n_{s,i}} w_{s,i,j} = N_s$$

We defined for each subject a rescaled weight $w'_{s,i,j}$, accounting for the relative sample size of stratum s from each cohort:

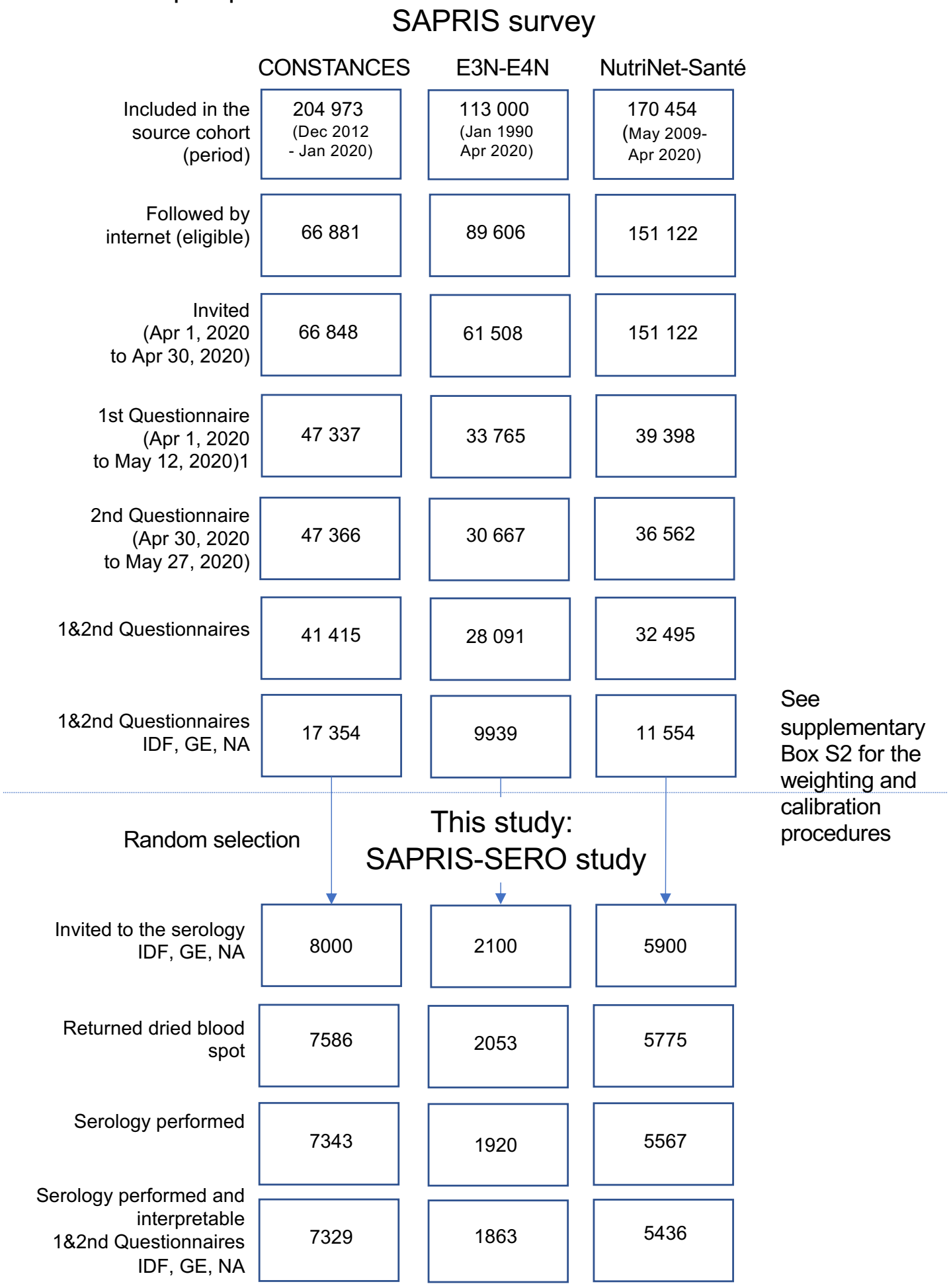
$$w'_{s,i,j} = w_{s,i,j} \frac{n_{s,i}}{\sum_{k=1}^{c_s} n_{s,k}}$$

These rescaled weights allow unbiased estimations in the overall population with the Horvitz–Thompson estimator, as the total weight of subjects belonging to stratum s in cohort i satisfies the relation:

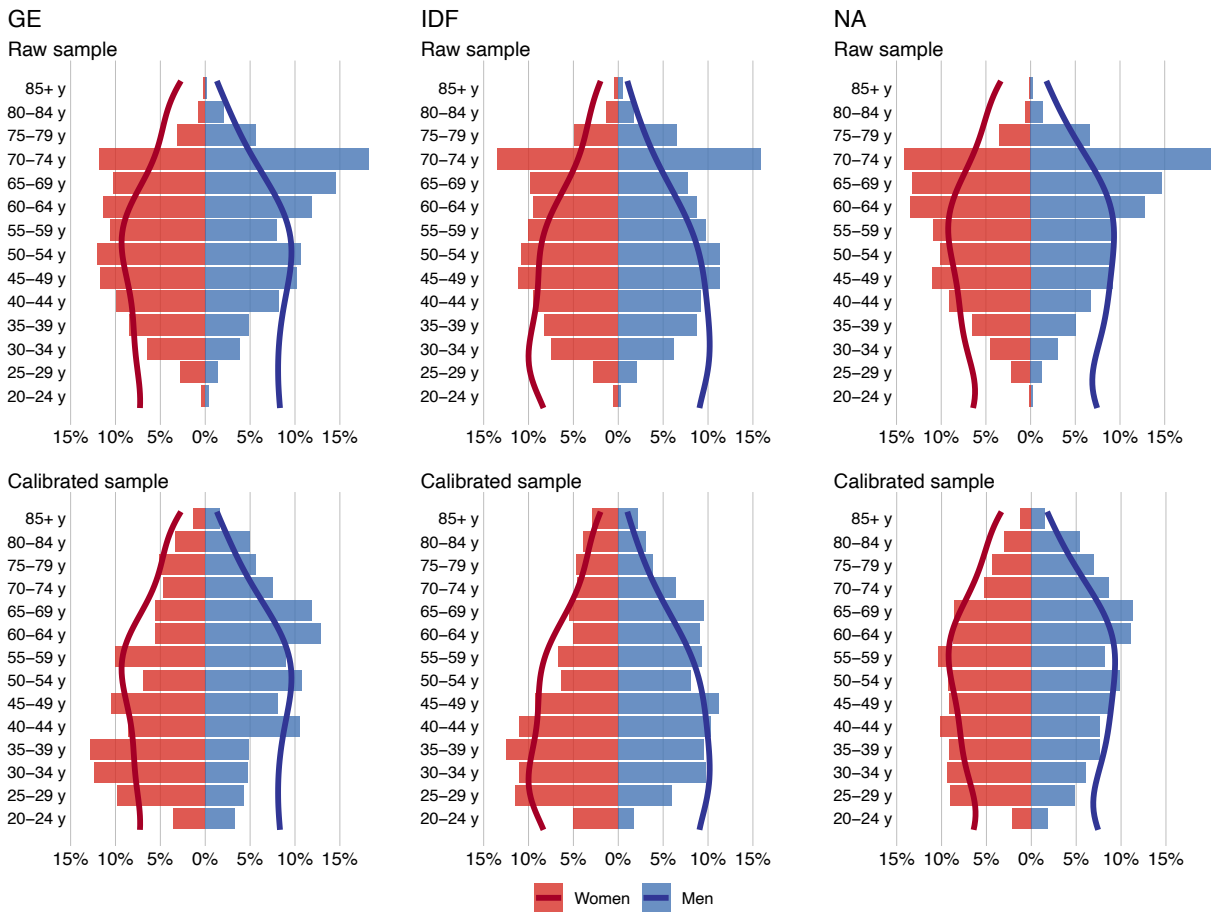
$$\sum_{i=1}^{c_s} \sum_{j=1}^{n_{s,i}} w'_{s,i,j} = \sum_{i=1}^{c_s} \left(\frac{n_{s,i}}{\sum_{k=1}^{c_s} n_{s,k}} \sum_{j=1}^{n_{s,i}} w_{s,i,j} \right) = \frac{\sum_{i=1}^{c_s} n_{s,i}}{\sum_{k=1}^{c_s} n_{s,k}} \sum_{j=1}^{n_{s,i}} w_{s,i,j} = N_s$$

This weighting procedure was performed for each region independently.

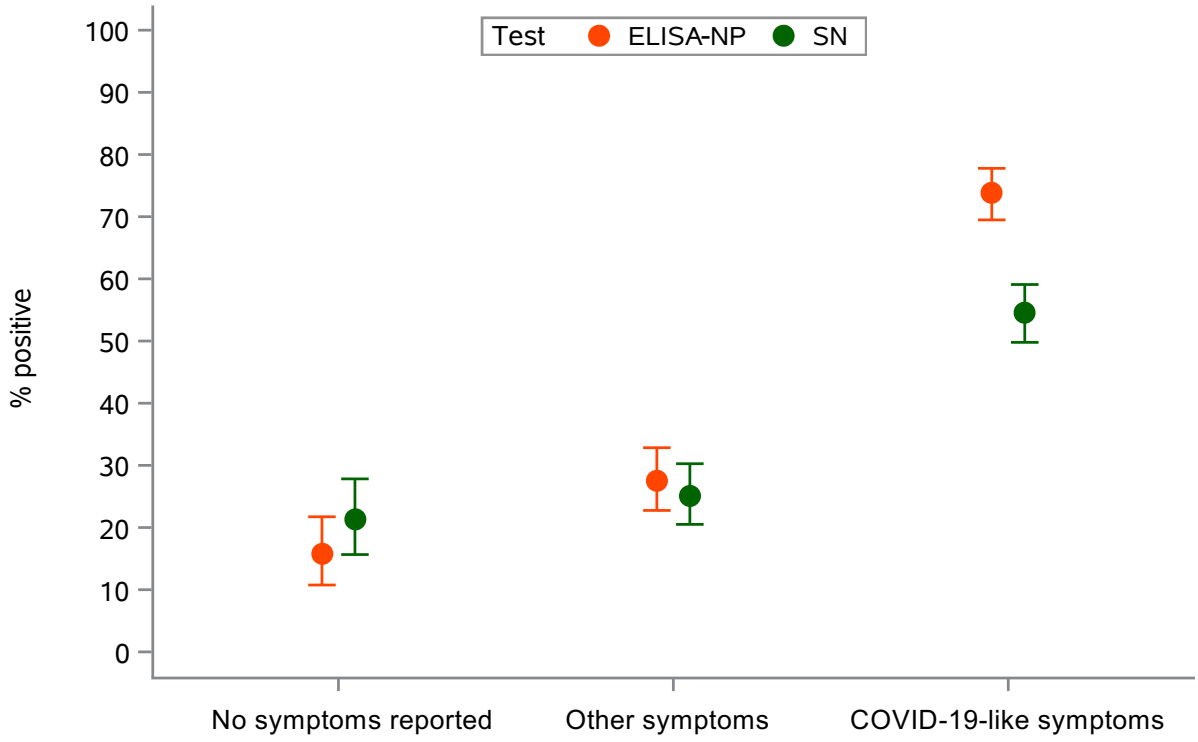
Supplementary Figure S1.
Flow chart of participants



Supplementary Figure S2.
Comparison of raw and calibrated age distributions by gender with the distribution in the general population (rows).
IDF: Ile-de-France, GE: Grand Est, NA: Nouvelle Aquitaine



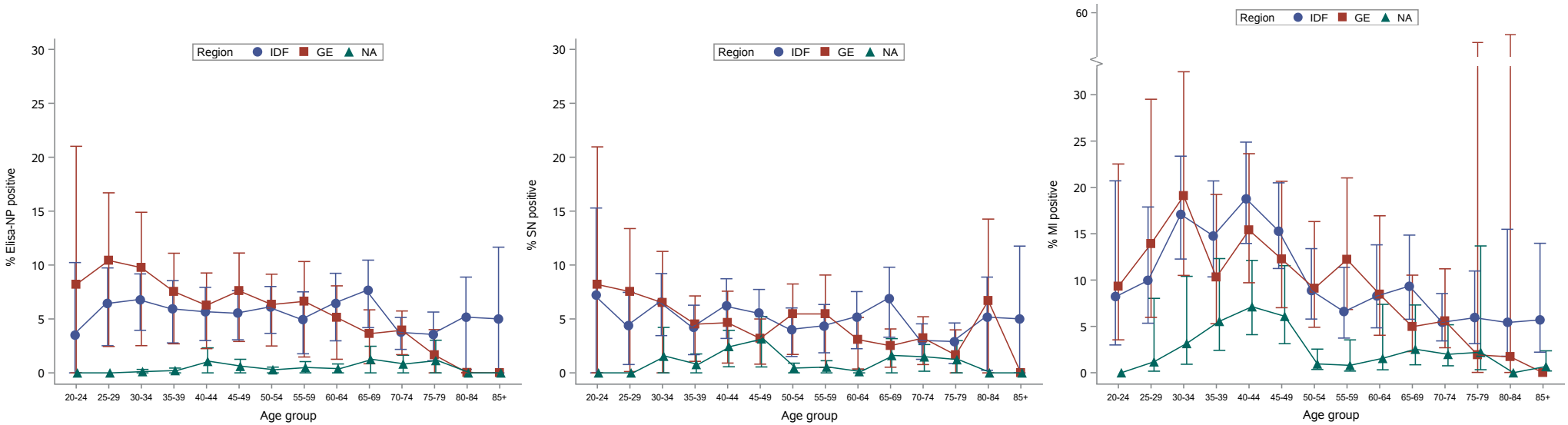
Supplementary Figure S3.
Positive ELISA-NP and SN in ELISA-S positive participants according to reported symptoms



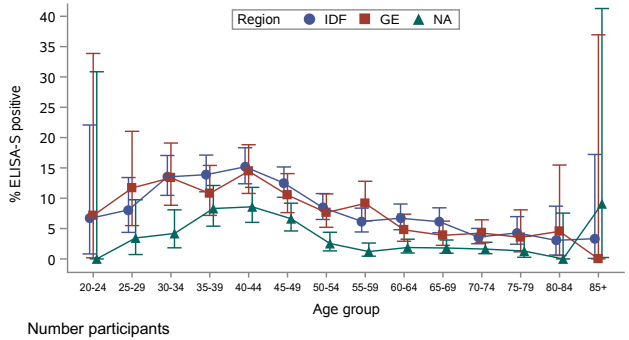
Number of participants with ELISA-S positive test (number with ELISA-NP or SN positive test)

ELISA-NP	185 (29)	319 (88)	454 (335)
SN	188 (40)	322 (81)	459 (250)

Supplementary Figure S4.
Positive serological results by age and region.
(weighted estimates; MI positive showed cumulative incidence estimates corrected for imperfect test accuracies)
IDF: Ile-de-France, GE: Grand Est, NA: Nouvelle Aquitaine



Supplementary Figure S5.
Positive serological results by age and region.
(unweighted estimates, numbers indicate participants and positive tests; MI positive showed cumulative incidence estimates corrected for imperfect test accuracy)
IDF: Ile-de-France, GE: Grand Est, NA: Nouvelle Aquitaine

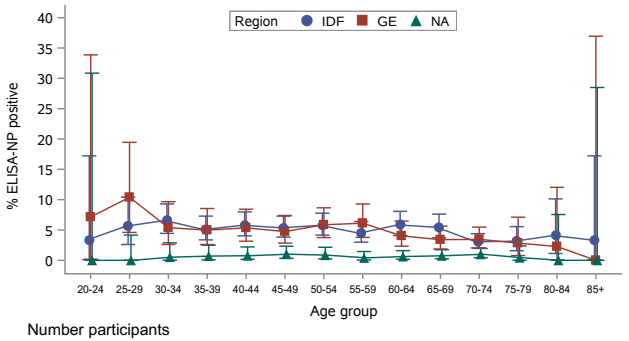


Number participants

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
IDF	30	161	444	533	593	712	698	630	582	571	916	350	98	30
GE	14	77	187	241	318	380	393	328	397	412	493	141	44	8
NA	10	87	191	289	396	498	473	497	641	669	805	232	47	11

Number ELISA-S positive

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
IDF	2	13	60	74	90	89	59	39	39	35	33	15	3	1
GE	1	9	25	26	46	40	30	30	19	16	21	5	2	0
NA	0	3	8	24	34	33	12	6	12	12	13	3	0	1

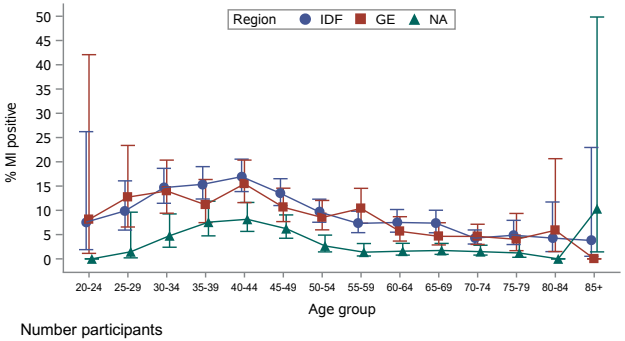


Number participants

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
IDF	30	160	442	533	589	709	694	627	582	571	916	350	98	30
GE	14	77	186	241	318	380	393	327	397	412	492	141	44	8
NA	10	87	191	288	395	498	473	497	641	669	805	232	47	11

Number ELISA-NP positive

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
IDF	1	9	29	27	34	38	40	28	34	31	28	11	4	1
GE	1	8	10	12	17	18	23	20	16	14	17	4	1	0
NA	0	0	1	2	3	5	4	2	4	5	8	1	0	0

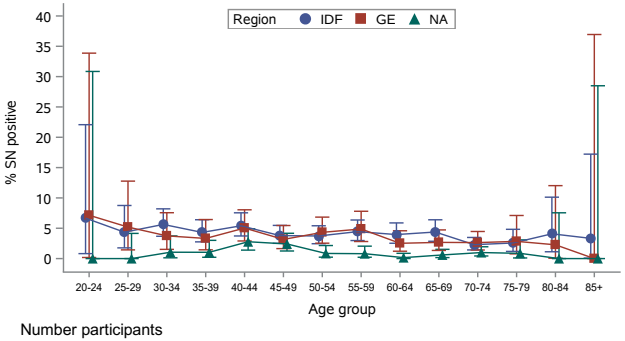


Number participants

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
IDF	30	161	444	533	593	712	698	630	582	571	916	350	98	30
GE	14	77	187	241	318	380	393	328	397	412	493	141	44	8
NA	10	87	191	289	396	498	473	497	641	669	805	232	47	11

Number MI positive

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
IDF	2.3	15.9	65.2	81.9	100	96.2	67.4	46.0	43.7	42.0	39.2	17.0	4.2	1.1
GE	1.1	9.8	26.1	26.9	49.2	40.4	33.5	34.1	22.5	19.1	22.8	5.7	2.6	0.0
NA	0.0	1.3	9.1	21.9	32.3	31.0	12.6	6.8	10.1	11.5	11.9	2.8	0.0	1.1



Number participants

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
IDF	30	161	444	533	592	712	698	630	581	571	916	350	98	30
GE	14	77	187	241	318	380	393	328	397	412	493	141	44	8
NA	10	87	191	289	396	498	473	497	641	668	805	232	47	11

Number SN positive

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
IDF	2	7	25	23	32	27	26	28	23	25	21	9	4	1
GE	1	4	7	8	16	12	17	16	10	11	13	4	1	0
NA	0	0	2	3	11	12	4	4	1	4	8	2	0	0

Supplementary Table S1. Participant characteristics.

	Total adults	Ile-de-France (IDF)	Grand Est (GE)	Nouvelle-Aquitaine (NA)
	14 628	6348	3434	4846
Questionnaire 1				
First	Apr 1, 2020	Apr 1, 2020	Apr 1, 2020	Apr 1, 2020
Last	May 12, 2020	May 12, 2020	May 12, 2020	May 12, 2020
Questionnaire 2				
First	Apr 30, 2020	Apr 30, 2020	Apr 30, 2020	Apr 30, 2020
Last	May 27, 2020	May 20, 2020	May 27, 2020	May 19, 2020
Dried blood spot collection				
First	May 4, 2020	May 4, 2020	May 4, 2020	May 4, 2020
Last	June 23, 2020	June 14, 2020	June 23, 2020	June 21, 2020
Missing	70	28	18	24
Source cohort				
Constances	7329 (50)	2689 (42)	1629 (47)	3014 (62)
E3N-E4N	1863 (13)	728 (11)	584 (17)	551 (11)
NutriNet-Sante	5436 (37)	2934 (46)	1221 (36)	1281 (26)
Age group (years)				
<40	2265 (15)	1168 (18)	520 (15)	577 (12)
[40-50[	2897 (20)	1305 (21)	698 (20)	894 (18)
[50-60[	3019 (21)	1328 (21)	721 (21)	970 (20)
[60-70[	3272 (22)	1153 (22)	809 (24)	1310 (27)
>=70	3175 (22)	1394 (22)	686 (20)	1095 (23)
Gender				
Male	5810 (40)	2469 (39)	1357 (40)	1984 (41)
Female	8818 (60)	3879 (61)	2077 (60)	2862 (59)
Living Area				
Rural	2176 (15)	222 (4)	937 (27)	1017 (21)
<20,000 inhab.	1863 (13)	716 (11)	516 (15)	931 (13)
20-000-100,000 inhab.	2797 (19)	1644 (26)	460 (13)	693 (14)
>100,000 inhab.	7769 (53)	3763 (59)	1518 (44)	2488 (52)
Missing	23	3	3	17
Household size and composition				
Nb adults (inc. participants)				
1	2851 (19)	1562 (25)	571 (17)	718 (15)
2	6533 (45)	2594 (41)	1559 (45)	2380 (49)
3+	5244 (36)	2192 (35)	1304 (38)	1748 (36)
Nb children (<18yrs)				
0	10 848 (74)	4740 (75)	2511 (73)	3597 (74)
1+	3780 (26)	1608 (25)	923 (27)	1249 (26)
Nb rooms				
1-2	1696 (12)	1334 (21)	165 (5)	197 (4)
3-4	5715 (39)	2998 (48)	1108 (33)	1609 (34)
5-6	5366 (37)	1546 (25)	1562 (46)	2258 (47)
7+	1700 (12)	416 (7)	566 (17)	718 (15)
Missing	151	54	33	64
Total household monthly income				
<1000€	201 (1)	86 (1)	41 (1)	74 (2)
1000-1499	447 (3)	154 (3)	104 (3)	189 (4)
1500-1999	1000 (7)	363 (6)	251 (8)	386 (8)
2000-2999	2500 (18)	929 (16)	628 (20)	943 (20)
3000-3999	3426 (25)	1111 (19)	883 (28)	1432 (31)
>4000	6045 (44)	3184 (55)	1255 (40)	1606 (35)
Missing	1009	521	272	216
Educational level				
<High-school degree	1629 (12)	382 (7)	472 (16)	775 (17)
High-school degree or undergraduate	6032 (45)	2026 (35)	1592 (52)	2414 (54)
Graduate degree or doctorate	5646 (42)	3405 (59)	971 (32)	1270 (28)
Missing	1321	535	399	387
Professional activity before lockdown				
Student	81 (1)	42 (1)	19 (1)	20 (0)
Working	8309 (57)	3912 (62)	1961 (57)	2436 (50)
Looking for a job	402 (3)	186 (3)	86 (3)	130 (3)
Retired	5381 (37)	2024 (32)	1256 (37)	2101 (43)
Not working due to health conditions	125 (1)	46 (1)	27 (1)	52 (1)

No professional activity (housewife or husband)	306 (2)	129 (2)	78 (2)	102 (2)
Missing	24	12	7	5
Essential job position				
Healthcare worker	568 (4)	196 (3)	165 (5)	207 (4)
Other essential job	1425 (10)	476 (8)	415 (12)	534 (11)
Professional activity during lockdown				
Not working	6295 (44)	2424 (39)	1466 (44)	2405 (51)
Stopped working	1457 (10)	607 (10)	379 (11)	471 (10)
Working from home, remote working	4444 (31)	2507 (40)	891 (26)	1046 (22)
Partially working from home	759 (5)	270 (4)	220 (7)	269 (6)
Working outside home	1134 (8)	341 (5)	348 (10)	445 (9)
Other	242 (2)	70 (1)	66 (2)	106 (2)
Missing	297	129	64	104
Smoking status before lockdown				
Active smoker	1750 (12)	795 (13)	372 (11)	583 (12)
Ex-smoker	5973 (42)	2590 (41)	1360 (40)	2023 (43)
Non smoker	6670 (46)	2858 (46)	1658 (49)	2154 (45)
Missing	235	105	44	86
Alcohol use before lockdown (in g/dy)				
<5	5803 (42)	2548 (42)	1413 (43)	1842 (40)
[5,10[	2641 (19)	1111 (18)	649 (20)	881 (19)
[10,20[	2963 (21)	1253 (21)	722 (22)	988 (22)
[20,30[	1359 (10)	580 (10)	270 (8)	509 (11)
≥30	1128 (8)	527 (9)	244 (7)	357 (8)
Missing	734	329	136	269
Body Mass Index (kg/m^2)				
<18.5	499 (3)	262 (4)	96 (3)	141 (3)
[18.5; 25[	8521 (59)	3953 (63)	1845 (54)	2723 (57)
[25; 30[(overweight)	3995 (28)	1527 (24)	1028 (30)	1440 (30)
>=30 (obese)	1409 (10)	506 (8)	420 (12)	483 (10)
Missing	204	100	45	59
Chronic diseases				
Yes	4756 (33)	1977 (31)	1153 (34)	1626 (34)
No	9767 (67)	4321 (68)	2258 (66)	3188 (66)
Don’t know	80 (1)	40 (1)	20 (1)	20 (0)
Missing	25			
Chronic diseases				
Asthma, COPD, other respir. diseases	1534 (11)	723 (11)	377 (11)	434 (9)
Diabetes	481 (3)	192 (3)	141 (4)	148 (3)
Hypertension	1553 (11)	626 (10)	419 (12)	508 (11)
Other cardiovascular diseases	451 (3)	174 (3)	109 (3)	168 (3)
Cancer	830 (6)	405 (6)	193 (6)	232 (5)
Anxiety, depression	404 (3)	164 (3)	102 (3)	138 (3)
Other	1826 (13)	827 (13)	459 (13)	540 (11)
Missing	25	10	3	12

Supplementary Table S2. Multivariable analysis of factors associated with a positive ELISA-NP.

		Odds-Ratio[a]	95%CI	P-value
Regions				
	Ile-de-France	6.54	4.58, 9.32	<0.0001
	Grand Est	6.20	4.28, 8.99	<0.0001
	Nouvelle-Aquitaine	Reference		
Age group (years)				
	<40	1.06	0.80, 1.42	0.6818
	[40-50[	0.98	0.74, 1.29	0.8584
	[50-60[	Reference		
	[60-70[	0.90	0.68, 1.19	0.4578
	>=70	0.65	0.47, 0.91	0.0106
Gender				
	Male	Reference		
	Female	0.93	0.76, 1.13	0.4457
Household size and composition- Nb children (<18yrs)				
	0	Reference		
	1+	1.14	0.90, 1.44	0.2800
Smoking status before lockdown				
	Active smoker	0.81	0.60, 1.11	0.1903
	Ex-smoker	1.01	0.83, 1.23	0.9185
	Non smoker	Reference		

[a]with stratification on the source cohort. 235 participants were excluded from the multivariable model due to missing smoking status

Supplementary table S3. multivariable analysis of factors associated with a positive SN.

	Odds-Ratio[a]	95%CI	P-value
Regions			
Ile-de-France	3.48	2.54, 4.76	<0.0001
Grand Est	3.16	2.25, 4.23	<0.0001
Nouvelle-Aquitaine	Reference		
Age group (years)			
<40	1.10	0.81, 1.51	0.5391
[40-50[	1.14	0.84, 1.54	0.4005
[50-60[	Reference		
[60-70[	0.74	0.54, 1.03	0.0753
>=70	0.65	0.45, 0.93	0.0176
Gender			
Male	Reference		
Female	1.11	0.89, 1.40	0.3406
Household size and composition- Nb children (<18yrs)			
0	Reference		
1+	1.21	0.94, 1.56	0.1393
Smoking status before lockdown			
Active smoker	0.69	0.48, 1.00	0.0491
Ex-smoker	1.08	0.88, 1.34	0.4607
Non smoker	Reference		

[a]with stratification on the source cohort. 235 participants were excluded from the multivariable model due to missing smoking status

Supplementary Table S4. multivariable analysis of factors associated with a positive MI.

	Odds-Ratio[a]	95%CI	P-value
Regions			
Ile-de-France	2.88	2.34, 3.55	<0.0001
Grand Est	2.56	2.04, 3.21	<0.0001
Nouvelle-Aquitaine	Reference		
Age group (years)			
<40	1.70	1.36, 2.11	<0.0001
[40-50[	1.78	1.45, 2.20	<0.0001
[50-60[	Reference		
[60-70[	0.75	0.58, 0.95	0.0188
>=70	0.54	0.40, 0.72	<0.0001
Gender			
Male	Reference		
Female	1.14	0.98, 1.33	0.1014
Household size and composition- Nb children (<18yrs)			
0	Reference		
1+	1.25	1.06, 1.48	0.0086
Smoking status before lockdown			
Active smoker	0.72	0.57, 0.91	0.0062
Ex-smoker	0.96	0.82, 1.11	0.5567
Non smoker	Reference		

[a]with stratification on the source cohort. 235 participants were excluded from the multivariable model due to missing smoking status