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LIFESTYLE AND CHRONIC DISEASES

PREVALENCE OF ANTI-SARS-COV-2 ANTIBODIES IN THE GENERAL POPULATION IN BELGIUM

First results of the SalivaHIS study

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WHO WE ARE

SCIENSANO can count on more than 700 staff members who commit themselves, day after day, to achieving our motto: Healthy all life long. As our name suggests, science and health are central to our mission. Sciensano's strength and uniqueness lie within the holistic and multidisciplinary approach to health. More particularly we focus on the close and indissoluble interconnection between human and animal health and their environment (the "One health" concept). By combining different research perspectives within this framework, Sciensano contributes in a unique way to everybody's health.

For this, Sciensano builds on the more than 100 years of scientific expertise of the former Veterinary and Agrochemical Research Centre (CODA-CERVA) and the ex-Scientific Institute of Public Health (WIV-ISP).

Sciensano

Epidemiology and public health ▬ Lifestyle and chronic diseases

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SUMMARY

Key findings

- In the beginning of July 2021 78.1% of the community dwelling population aged 18 years and above had developed anti-SARS-CoV-2 antibodies. This percentage was 98.9% among fully vaccinated people (since at least 2 weeks before being tested) and 28.9% among not vaccinated people.
- A higher prevalence of anti-SARS-CoV-2 antibodies is found in woman than in men. This is in line with literature findings indicating that women showed a higher immune response to COVID-19 vaccination.
- People with a higher education are more likely to have anti-SARS-CoV-2 antibodies than people with a low education, but this difference is due to a higher vaccination rate among the highest educated.
- Vaccinated people with at least one chronic disease are less likely to have anti-SARS-CoV-2 antibodies than vaccinated people without chronic disease. This difference is not explained by socioeconomic differences in the prevalence of chronic diseases. Further research is needed to explore if this difference could be related to a lower immune response of people with certain chronic diseases.
- Vaccinated people who were also vaccinated against influenza in 2020-2021 are more likely to have anti-SARS-CoV-2 antibodies than those who did not receive a flu vaccine. A hypothesis is that a flu vaccination in the past vaccination season boosts the immune response to vaccination against SARS-CoV-2.
- People vaccinated with a nucleic acid vaccine (Pfizer, Moderna) are more likely to have anti-SARS-CoV-2 antibodies than people vaccinated with a vector-borne vaccine (AstraZeneca, Johnson&Johnson).
- In the not vaccinated population, people with a blood type O are less likely to have anti-SARS-CoV-2 antibodies than people with a blood type A, B or AB. Differences in immune response against the SARS-CoV-2 virus in function of the blood type have been described before, but need further investigation.

This study assessed the prevalence of anti-SARS-CoV-2 antibodies in the general community dwelling population in Belgium aged 18 years and above through the collection of saliva and was conducted between 29th March and 28th August 2021.

Although it should be noted that people with a low socio-economic status and in bad health are underrepresented in the study, especially in the Brussels Capital Region, the results provide reasonable estimates of the prevalence of anti-SARS-CoV-2 antibodies in the target population during the study period.

Over the whole study period, the prevalence was 53.5% in the study population, 95.0% in the population that was fully vaccinated since at least 2 weeks, 69.4% in the partially vaccinated population or those fully vaccinated since less than 2 weeks and 18% in the not vaccinated population.

Overall the prevalence increased from 25.2% in week 13-14 (29th March-11th April) to 78.1% in week 26-27 (28th June-11th July).

Among **people who were fully vaccinated since at least 2 weeks before being tested** the prevalence was 74.2% in week 13-14. In week 26-27 this percentage had increased to 98.9%. The lower percentage in the beginning of April could be related to the fact that at that time the majority of vaccinated people were older people, whose immune response may be less than in younger people.

Among **not vaccinated people**, the prevalence remained stable (around 17%) between 11th March and 27th June, but increased to 28.9% in the beginning of July.

Multivariate analyses were performed to assess correlates of the prevalence of anti-SARS-CoV-2 antibodies in the population.

In the **whole study population** a higher prevalence was observed in women (OR 1.70; 95% CI 1.19-2.41), people with a bachelor diploma (compared to those with at highest education degree a secondary diploma) (OR 1.73; 95% CI 1.12-2.66) and people who were vaccinated for influenza in the season 2020-2021 (OR 1.66; 95% 1.04-2.65).

In **the population who was fully vaccinated since at least 2 weeks before being tested** a lower prevalence was observed in people reporting at least one chronic disease (OR 0.30; 95% 0.12-0.76); a higher prevalence was found in people who received a nucleic acid vaccine (compared to a viral-vectored vaccine) (OR 5.10; 95% 1.89-13.79) and who were vaccinated for influenza in the season 2020-2021 (OR 2.62; 95% CI 1.06-6.49). The prevalence decreased with age but this decrease was not significant (OR 0.97; 95% 0.93- 1.00).

In the **not vaccinated population** a higher prevalence was observed among people with a non-O blood type (OR 1.95; 95% 1.04-3.68) and people with a history of a positive COVID-19 result (OR 14.36; 95% CI 5.84-35.27).

The study furthermore presents results on the mental and social health of the Belgian population, the impact of COVID-19 on life and lifestyle and aspects related to the COVID-19 vaccination during the study period.

The main findings of this part are listed below.

- During the study period, among the study population aged 18 years and above…:

    11% reports being (very) unsatisfied with their life;

    11% presents symptoms of an anxiety disorder;

    9% suffers from a depressive disorder;

    12% reports having mental health problems that disrupt their daily life and social activities.
- Compared to before the COVID-19 crisis, 11.1% of the study population reports a decline in their social support.
- In the study population aged 18 years and above, 21.4% declared that they encountered a financial loss as a consequence of the crisis and 17.0% had to delay health care during the COVID-19 crisis. These figures are an underestimation because people with a low education are underrepresented in the study.
- Around one in five people who consume tobacco, illegal drugs, sedatives or antidepressants reported having increased their consumption during the crisis.
- A large part of the users have decreased their physical activity (38.6%) and leisure time activity (54.8%) compared to before the crisis.
- In the study population 12.3% had a family member or friend who had been admitted to hospital because of COVID-19 and 7% had a family member or friend who died from COVID-19. In Wallonia (10.1%) this was twice as much as in Flanders (4.6%).
- From those who were tested positive for a COVID-19 infection 5.3% had been admitted to hospital, and 1.5% had stayed in the intensive care unit. This is an underestimation because people who died in the hospital are not counted here.
- The most common symptoms among people who had been tested positive were fatigue or exhaustion (54.7%), loss of taste (51.4%), loss of smell (51.3%), headache (50.8%), cough (43.3%) and muscle pain (42.8%).
- One out of three people (33.1%) with a positive test result still experienced symptoms which they attributed to their COVID-19 infection. Among those, fatigue or exhaustion (60.2%) and memory or concentration problems (28.4%) were most prevalent.
- People aged 18-29 years and men were more likely not having strictly complied with COVID-19 preventive measures then older people and women.
- In this study the percentage of fully vaccinated people was 34.5%; 23.1% was partially vaccinated and 42.5% not vaccinated.

- The vaccination rate is lower among people with as highest education degree a secondary diploma than among those with a bachelor or master diploma. This is particularly the case in Brussels and is not observed in Flanders.
- There is a strong and positive association between the vaccination status and being a health care worker, but in Wallonia the magnitude of this association is much lower than in Flanders and Brussels.
- Factors associated with unwillingness or hesitance to be vaccinated are being female, a lower age, a lower education and not working.
- The top three reasons why people do not want to be vaccinated against COVID-19 are fear for side effects of the vaccine (66.6%), suspiciousness about the fact the vaccines were developed so quickly (42.2%) and scepticism about the effectiveness of new vaccines (36.6%).

1. Introduction

Since the beginning of 2020, Belgium - as the rest of the world - has been under the spell of the SARS-CoV-2 virus, which has caused high morbidity and mortality in the adult populations. As of the 7th October 2021, 1,256,191 confirmed COVID-19 cases had been reported in Belgium (1).

Reported cases, however, are likely to represent only a fraction of SARS-CoV-2 infections. An unknown proportion of the population with mild or asymptomatic infections remains undetected, or is otherwise not diagnosed or ascertained through passive public health reporting (2). Antibodies to SARS-CoV-2 in the blood indicate that the person was infected at some point during the pandemic or has received the anti-COVID-19 vaccine. Thus, serologic assays can be used to provide population-based estimates of infection or vaccination, and give an estimation of the fraction of the population which is protected against SARS-CoV-2.

Although serum-based methods are the reference to assess if a person has antibodies to SARS-CoV-2, serum-based studies may be more difficult to implement in the general population because of logistical and practical constraints to obtain a serum sample in a geographically scattered sample of the total population. Therefore, in a general population research the detection of salivary antibodies was thought to be an acceptable non-invasive alternative to serological testing for monitoring SARS-CoV-2 infection and seropositivity.

It has been shown in both the US and Belgium that the use of saliva-based antibody testing is a scalable alternative to blood-based antibody testing (3,4).

Sciensano has coordinated several other national seroprevalence studies of anti-SARS-CoV-2 antibodies in relevant populations since the beginning of the corona crisis (1). Table 1 gives an overview of the population groups that are addressed in those studies, the reference period for the monitoring and the sample type in which anti-SARS-CoV-2 antibodies were measured.

Table 1 | Populations of other Sciensano coordinated SARS-CoV-2 seroprevalence studies

Population	Time period for which results available	Sample type taken
Blood donors in Belgium [1]	18/3/2020 – 25/5/2021	blood
Healthcare workers in hospitals [2]	25/4/2021 – 25/4/2021	blood
Primary healthcare workers [3]	6/1/2021 – 26/9/2021	blood
Children and school staff [4]	28/1/2021 – 10/6/2021 (8/10/21 primary school children)	saliva
Residents and staff in Belgian nursing homes [5]	1/2/2021 - 31/8/2021	blood

The SalivaHIS study focuses on the general population aged 18 years and above living in private dwellings in Belgium and collects information on the prevalence of anti-SARS-CoV-2 antibodies through the collection of saliva.

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1 https://covid-19.sciensano.be/sites/default/files/Covid19/COVID-19_S%C3%A9ropr%C3%A9valence%20du%20SARS-CoV-2%20chez%20les%20donneurs%20de%20sang_FR.pdf

2 https://bmjopen.bmj.com/content/11/6/e050824

3 https://www.sciensano.be/en/biblio/prevalence-and-incidence-antibodies-against-SARS-CoV-2-among-primary-healthcare-providers-belgium-0

4 https://www.sciensano.be/en/biblio/prevalence-and-incidence-antibodies-against-SARS-CoV-2-children-and-school-staff-measured-between-2

5 https://www.sciensano.be/en/biblio/SARS-CoV-2-seroprevalence-among-vaccinated-nursing-home-residents-and-staff-belgium-august-2021

The primary aim of the study is to provide information on the prevalence of anti-SARS-CoV-2 antibodies in the general Belgian adult population and to investigate to what extent the presence of these antibodies varies in function of socio-demographic attributes, health status, COVID-19 related health behavior, and lifestyle, and this, both in vaccinated and not vaccinated people. The study seeks to have results that are as representative as possible of the Belgian population. The study also aims to follow the evolution of the presence of SARS-CoV-2 antibodies over time within the same persons during a follow up period of 6 to 8 months.

This report presents the results of the baseline measures, i.e. the pilot study and wave 1 data collection. These baseline saliva samples were collected between 29th March and 24th August 2021.

All participants who agreed to be re-contacted during the pilot study and the wave 1 study received an invitation to send a new saliva sample in October 2021 (wave 2) and a final saliva collection is planned in January 2022 (wave 3). A report on the findings from wave 2 and wave 3 is planned by the end of June 2022.

1.1. OUTLINE OF THIS REPORT

In this report, we describe in chapter 2 the methodological choices that were made and the procedure implementation.

In chapter 3, we describe the study population in terms of socio-economic characteristics, living situation, health related status and biological factors relevant for a potential COVID-19 infection. For some indicators the study population is compared with the study population of the Belgian Health Interview Survey 2018, which also aims to provide health and health related information at the level of the total Belgian population (5).

The main findings of the report are presented in the next two chapters. Chapter 4 provides estimates of the presence of anti-SARS-CoV-2 antibodies in the general population and the evolution of these during the study period. Chapter 5 deals with factors that are associated with the presence of anti-SARS-CoV-2 antibodies. This is done for the population as a whole, as well as separately for vaccinated and not vaccinated people.

The SalivaHIS questionnaire also includes information on a wide range of topics which are on itself relevant COVID-19 related indicators and/or population-based outcome indicators during the study period. Results regarding these data are presented in the last two chapters and some indicators are compared with similar information obtained in the two COVID-19 health interview surveys that were conducted in 2021 (6,7).

2. Methodology

This chapter describes the main methodological aspects of the study and the outcomes of the procedure implementation. More detailed information on the study methodology can be found in the study protocol (8).

2.1. STUDY POPULATION

The target population includes all people residing in private dwellings in Belgium of 18 years and above, without any restrictions and regardless of their use of health services. The sample frame is the National Register, which includes all citizens with an official address in Belgium, including non-Belgians.

2.2. SAMPLING AND SELECTION OF PARTICIPANTS

A stratified randomized sampling method was applied to select the people to be included in the study. Twenty four strata were defined as a result of a cross classification of the three Belgian regions, four age groups and both genders. As a secondary aim of the study was to assess how the prevalence of anti-SARS-CoV2 antibodies varied within households, the sampling unit was the household. Within each selected household, all members aged 18 years and above were invited to participate in the survey.

First, a pilot study was conducted. The main objectives of the pilot study were:

- to assess the participation rate, overall and per region, per age group and per gender; this information was used to estimate the number of households that should be invited in each group in the next phase (wave 1) in order to reach at least 3,000 baseline participants.
- to test all fieldwork procedures and data collection means (including that of saliva samples) and to assess the completeness of the data obtained.

For the pilot study 1,339 people belonging to 634 households were invited. The household composition from the national health interview survey 2018 (HIS 2018) was used to calculate per stratum the number of households that needed to be invited in order to reach a predefined number of individuals for each gender, age group and region of residence.

In the wave 1 study, a total of 12,862 individuals in 7,598 different households were invited to participate. The stratified sampling method allowed obtaining sufficient participants from the 3 regions, the 4 age groups and both sexes. The mailing of the invitations was spread over a period of 4 weeks. This was done for logistical reasons, to ensure that enough capacity was available to analyze the saliva samples rapidly after collection, but also to make sure that the spread of the collection of saliva samples was large enough to be able to look at time trends during this first study period.

Between the pilot phase and the wave 1 study, the survey procedures did not change, but information on the participation rate in the pilot phase was used to calculate the number of people to be invited for wave 1. To increase the power of our analyses and asses time trends over a longer period (about 5 months), results from the pilot and wave 1 were merged in the actual study and the analyses presented in this report refer to this global study period.

2.3. FIELDWORK

People who were selected for the study received an invitation letter, two consent forms, an Oracol® tube (Malvern Medical Developments Ltd) for the collection of saliva, a document with information on how to collect the saliva and how to obtain their test result, a paper questionnaire and a return envelope. Invitations were sent through Statbel, the Belgian national office of statistics. Participation in the study included returning a saliva sample, a consent form and a completed questionnaire. It was also possible to complete the questionnaire online. The main topics covered in the questionnaire are listed in Table 2.

Table 2 | Topics covered in the SalivaHIS baseline questionnaire

Sociodemographic information	Mental health
Presence of chronic diseases	Social contacts
Work situation	Lifestyle
Financial situation	Possible contact with SARS-CoV-2 virus and consequences
Access to health care services	Adherence to corona measures
Anthropometric measurements (weight and height)	Vaccination status
Perceived health	Attitude towards vaccination

All participants' materials that were received (questionnaire, consent form, saliva tube) contained a project code that served to match the different parts of the survey and the different waves. Researchers in Sciensano did not have any identification data of the participants.

Different Sciensano departments were involved in the reception, transfer and analysis of the participants' materials. This was organized as follows:

1. The Unit of Viral diseases ensured the reception and registration of the saliva samples and other material received from the participants in a dedicated databank and proceeded with the serological tests. After testing the samples were transferred to the Biobank.
2. The Laboratory of Medical Microbiology (in charge of the Sciensano Biobank) did the registration of the information from the participants' consent forms and saliva samples.
3. Once the serology results were available, they were entered in the registration databank under the control of the Unit of Viral diseases.
4. The paper questionnaires and consent forms of the participants were then transferred to the Unit Lifestyle and chronic diseases. The updated registration databank was posted on a server shared between the SalivaHIS researchers of the Units involved.
5. The reception, registration and sorting of the questionnaires and consent forms was carried out in the Unit Lifestyle and chronic diseases.
6. The information from the different databanks was verified, cleaned and harmonized at the level of the Unit Lifestyle and chronic diseases.

2.4. PROCEDURE IMPLEMENTATION

2.4.1. Pilot study

Invitations for the pilot study were sent on 25th March 2021. Figure 1 provides information on the distribution of the invited individuals by demographic characteristics. The stratified approach allowed a distribution of the number of people invited for the study more or less equal by gender, age group and region.

Figure 2 shows the reception of the saliva samples in Sciensano in function of the time. In total 398 samples were received. By 15 April, about 90% of the final number of saliva samples had been returned, although saliva samples continued to come in at a slower pace until 21 May. People who did not return a valid consent form (n=11) were excluded from the study, resulting in 389 valid participants to the pilot study. For only 3 participants (0.8%) no questionnaire was available.

Figure 1 | Distribution of the people invited for the pilot study by age group, region and gender, SalivaHIS, Belgium 2021

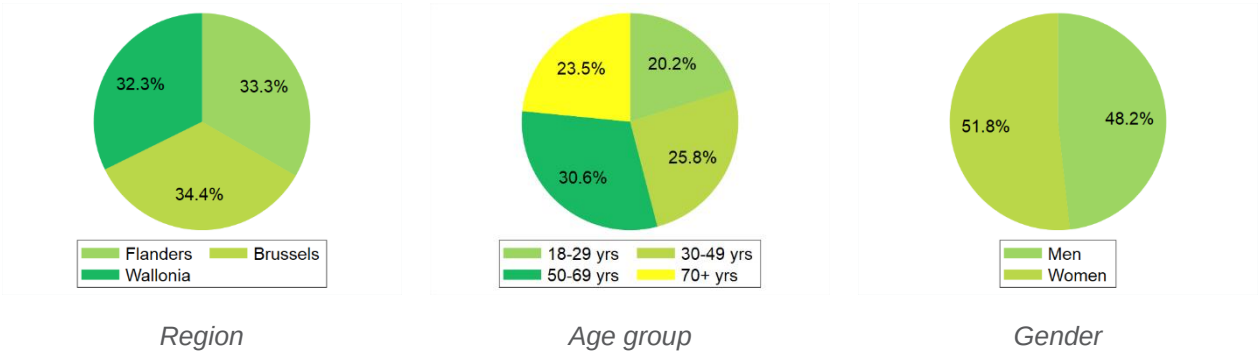
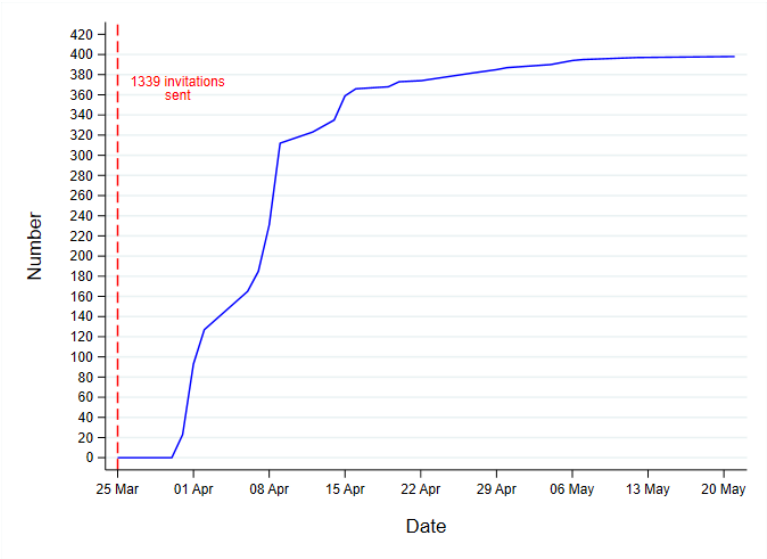


Figure 2 | Cumulative number of saliva samples received per day for the SalivaHIS pilot study, SalivaHIS, Belgium 2021



At household level, 206 (32.5%) out of 634 invited households participated. The household participation rate showed important differences by region: in Flanders it was 48.3%, in Brussels 21.8% and in Wallonia 28.4%.

In households where one individual participated, most other eligible household members (if any) also took part in the study (intra class correlation coefficient 99.0%). The overall individual participation rate was of 29.1%. Table 3 provides information on the individual participation rate by demographic characteristics. There are important regional differences, with the highest participation rate in Flanders and a very low participation rate

in Brussels. Men and women participated more or less equally. The participation rate was highest in the age group 50-69 years, but overall there were no important differences by age group.

Table 3 | Participation rate (in %) by gender, age group and region, SalivaHIS pilot study, Belgium 2021

		%
Gender	Men	28.5
	Women	29.6
Age group	18-29 years	27.4
	30-49 years	24.9
	50-69 years	36.6
	70+ years	25.2
Region	Flanders	42.8
	Brussels	17.8
	Wallonia	26.9

From the 389 saliva samples that were gathered with a valid consent form, 70 (17.6%) could not be analysed, mainly because the saliva volume was insufficient to ensure high quality analysis. This was probably due to the fact that the saliva was taken by the participants themselves, without professional supervision. Table 4 provides the percentage of people with no valid saliva sample in function of age group, gender and region. Women and people aged 50 years and over were more frequently concerned.

Table 4 | Percentage of samples with too little saliva by gender, age group and region, SalivaHIS pilot study, Belgium 2021

		%
Gender	Men	12.5
	Women	21.0
Age group	18-29 years	14.9
	30-49 years	11.6
	50-69 years	19.3
	70 + years	20.3
Region	Flanders	18.9
	Brussels	17.1
	Wallonia	13.8
Total		**17.0**

2.4.2. Wave 1 study

Invitations for the wave 1 study were sent on three moments: 18th May, 1st June and 15th June 2021. Figure 3 provides information on the distribution of the invited individuals by demographic characteristics. The main difference with the pilot study is the proportionally lower number of people invited in Flanders and higher number of people invited in Brussels. Relatively more invitations were sent in Brussels and relatively less in Flanders to account for the differential regional response rates found in the pilot study.

Figure 4 shows the reception of saliva samples at Sciensano in function of the time. In total 2,475 samples were received. Most samples were received between 25th May and 6th July, but saliva samples continued to come in at a slower pace until the study was closed on 27th August. People without valid consent form (n = 97) were excluded from the study, resulting in a total number of 2379 valid participants to the wave 1 study. For only 9 participants (0.4%) no questionnaire was available.

Figure 3 | Distribution of the people invited for the wave1 study by region, age group and gender, SalivaHIS wave 1 study , Belgium 2021

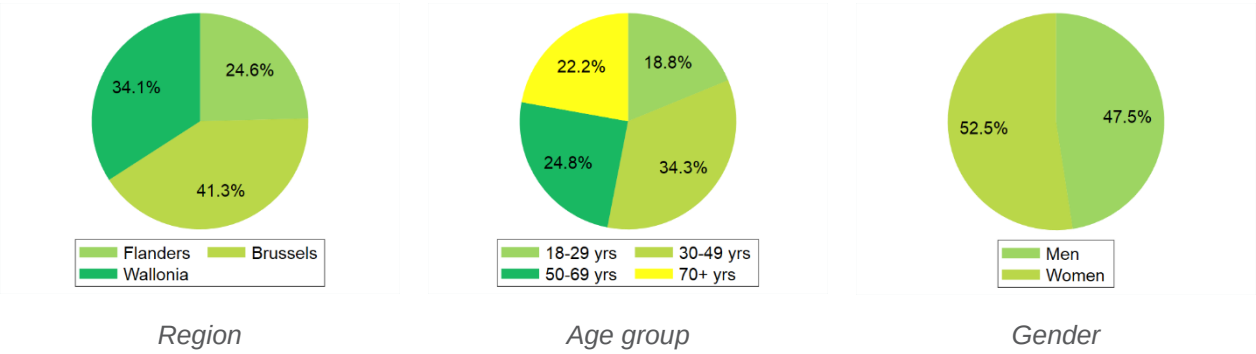
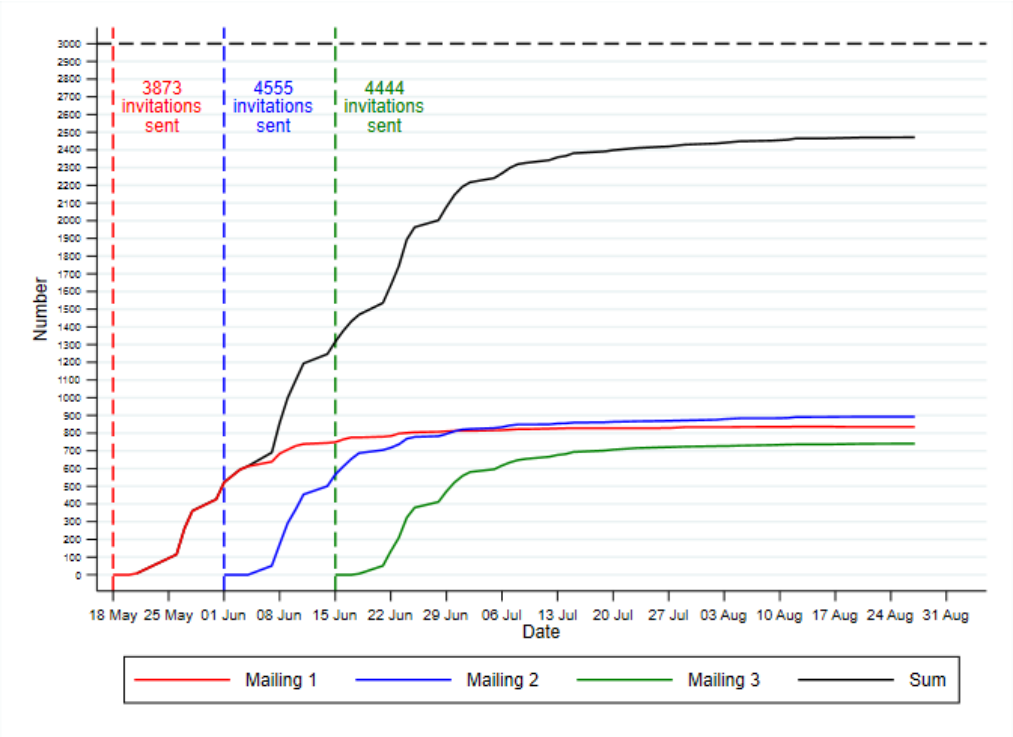


Figure 4 | Cumulative number of saliva samples received per day for the wave 1 study, SalivaHIS wave 1 study, Belgium 2021



At household level, 1,562 (20.6%) out of 7,598 invited households participated. The household participation rate showed important differences by region: in Flanders it was 32.6%, in Brussels 16.6% and in Wallonia 17.1%.

In the households with a participating individual, most other eligible household members (if any) also participated (intra class correlation coefficient 99.3%). The overall individual participation rate for wave 1 was of 18.5%. Table 5 provides information on the individual participation rate by demographic characteristics. In all population groups, the participation rate was much lower than in the pilot study, but this was especially the case in Wallonia where it dropped from 26.9% to 15.3%.

Table 5 | Participation rate (in %) by gender, age group and region, SalivaHIS wave 1 study, Belgium 2021

		%
Gender	Men	17.4
	Women	19.5
Age group	18-29 years	14.4
	30-49 years	17.6
	50-69 years	21.2
	70+ years	20.3
Region	Flanders	30.6
	Brussels	13.9
	Wallonia	15.3

In the wave 1 study, as for the pilot, a substantial number of samples could not be analyzed, mainly because the volume of saliva was insufficient. It concerned 408 saliva samples, or 17.2% of the total number. Table 6 provides the percentage of samples with insufficient saliva in function of age group, gender and region. Women and people aged 70 years and over were more frequently concerned.

Table 6 | Percentage of samples with too little saliva by gender, age group and region, SalivaHIS wave 1 study, Belgium 2021

		%
Gender	Men	13.9
	Women	19.8
Age group	18-29 years	16.1
	30-49 years	13.9
	50-69 years	17.0
	70 + years	22.3
Region	Flanders	19.2
	Brussels	15.1
	Wallonia	16.5
Total		**17.2**

2.4.3. Total study sample and use of weights

As indicated above, results from the pilot study and the wave1 study were merged, resulting in a total study sample of 2,768 individuals belonging to 1,768 households. Table 7 provides the distribution of the participants by gender, age group and region in comparison with this distribution in the general Belgian population. The main observation is that the proportion of residents from the Brussels Capital Region is much higher in the study sample than is the case in the Belgian population. This over-representation of the Brussels' population is a consequence of a methodological choice that aimed to have in each of the regions a sufficient number of participants to obtain more or less equally precise results in all regions.

Table 7 | Distribution of participants by gender, age group and region in relation to this distribution in the Belgian population, SalivaHIS total study, Belgium 2021

		SalivaHIS sample		Belgian population (18+)*
		Number	%	%
Gender	Men	1,248	45.1	48.8
	Women	1,520	54.9	51.1
Age group	18-29 years	423	15.3	17.9
	30-49 years	863	31.2	32.6
	50-69 years	825	29.8	32.1
	70 + years	657	23.7	17.3
Region	Flanders	1,160	41.9	58.2
	Brussels	820	29.6	10.3
	Wallonia	788	28.5	31.5
Total		**2,768**	**100.0**	**100.0**

** Source: Statbel*

To mitigate the unbalanced study sample, post stratification survey weights were calculated based on the population structure at 1st January 2021 obtained from Statistics Belgium as auxiliary database.

The principle behind estimating population parameters using a probability sample is that each person in the sample represents besides himself or herself, an entire slice of the population. For example, in a simple random sample of 1% of a population of 100,000 individuals, each person in the sample represents 1,000 persons in the population. In this case, each person will be attributed a weight of 1,000.

The weight for each sampled individual in this study is the reciprocal of a post stratification factor for each combination of region, age group and gender. Strata which are underrepresented in the sample will receive a higher weight, and those who are overrepresented a lower one. The application of weights cannot exclude selection bias, but ensures that the weighted distributions of the sample by age group, gender and region matches exactly these distributions in the Belgian population.

2.4.4. Assessment of time trends in the prevalence of anti-SARS-CoV-2 antibodies in the SalivaHIS study

One of the aims of the study was to look at time trends in the prevalence of anti-SARS-CoV-2 antibodies in the general population during the study period. However, as is shown in Figure 5 the collection of samples was not equally spread over this period. Too few saliva samples were collected in the weeks between 12th April and 16th May, and after 11th July to have sufficiently precise estimates for those time periods. It was therefore decided to focus for the trend analysis on 5 periods of two weeks for which sufficient data were available (Table 8).

Figure 5 | Number of saliva samples collected in the SalivaHIS study per week*, Belgium 2021

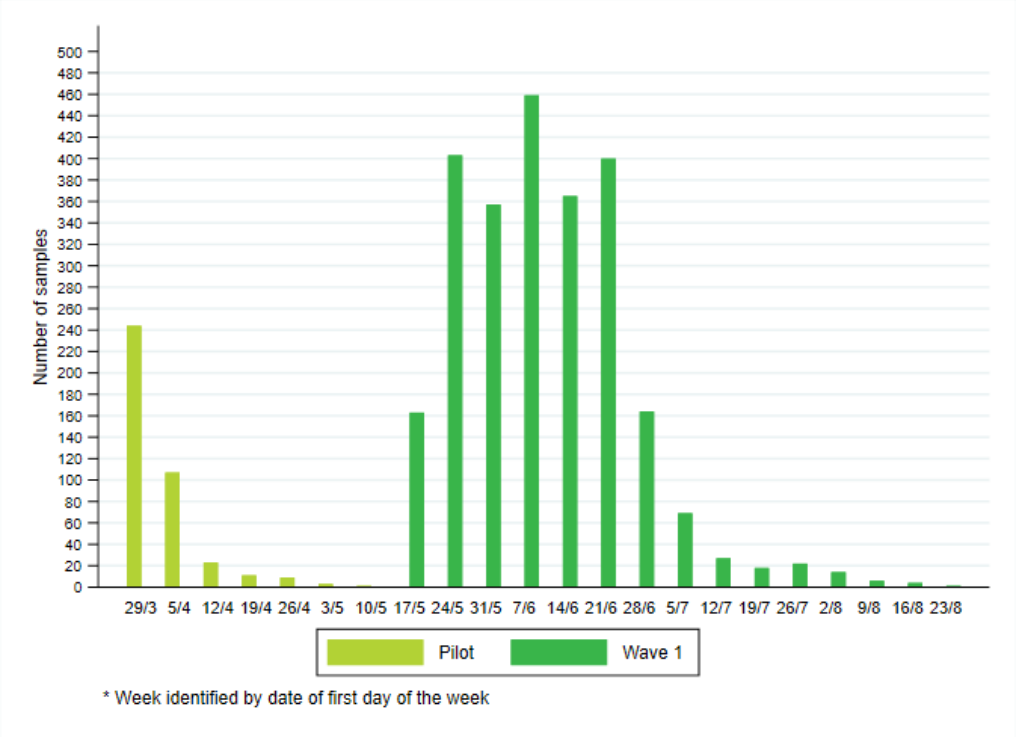


Table 8 | Periods considered for the time trend analyses, SalivaHIS study, Belgium 2021

Period	Week number	Dates
1	13-14	29/3 to 11/4
2	20-21	17/5 to 30/5
3	22-23	31/5 to 13/6
4	24-25	14/6 to 27/6
5	26-27	28/6 to 11/7

During the data collection period, the vaccination campaign in Belgium was running at full speed. On 29th March, 1,327,410 people had received a first vaccination dose. By 11th July this number had increased to 7,628,206 (1). This had a major impact on the evolution of the prevalence of anti-SARS-CoV-2 antibodies among the population during the SalivaHIS study period. To reduce the bias in the estimates because of a differential participation rate between vaccinated and not vaccinated people, weights to assess the trends in the prevalence of anti-SARS-CoV-2 antibodies did not only take into account regional, age and gender differences between the sample and the general population, but also differences in the vaccination status. This was done by multiplying the initial weight with a correction factor. The correction factor was obtained by dividing the number of people by region and vaccination status in the population by the same number of people in the sample. In this way the weighted sample distribution by vaccination status and region matched this distribution in the general population.

3. Socio-economic and COVID-19 relevant health and biological characteristics of the study population

Key findings

- The majority of the study population lives together with a partner without (36.6%) or with (29.4%) children.
- Almost half (47.4%) of the study population has as highest education degree a secondary diploma, 27.7% has a bachelor's diploma and 24.9% has a master diploma. Low educated people are underrepresented in our study, especially in Brussels.
- More than half of the study population (56.0%) are workers (employed or self-employed). Among the workers population, 16.4% are health care workers.
- One third of the study population (33.1%) has overweight and 18.8% is obese.
- Less than one in ten (8%) women of reproductive age in the study population (18-49 years) declares to be pregnant.
- 55.7% of the study population has an O blood type and 18.8% has a negative rhesus type.
- Most of the study population (76.7%) does not report any chronic disease, 17.9% reports one chronic disease, 4.4% has two and 1.0% at least three chronic diseases.
- One third of the study population (34.5%) was vaccinated against influenza during the year 2020-2021.

This section of the report presents the key characteristics of the SalivaHIS study population. First, it provides information on the socio-economics characteristics, living situation, household composition, education level and employment situation. Then, it covers the health related and biological factors which may be relevant for infection with the SARS-CoV-2 virus, such as body mass index (BMI), pregnancy status, blood type, the presence of chronic diseases and influenza vaccination status.

It is important to consider that the information in this chapter is based on self-reported data. For some information (e.g. educational attainment or household composition) more accurate population-based data are available, e.g. with Statbel. However, the aim of this chapter is not to give information on the distribution of socio-economic and health-related characteristics in the general Belgian population, but to assess the distribution of those characteristics in the SalivaHIS study population after weighting for age, gender and region. Knowledge of this distribution and, where possible, comparison with other data sources, will help to assess the eventual bias of our study, despite the fact that we have applied survey weights that make that our weighted study population matches the age, gender and regional distribution of the Belgian population.

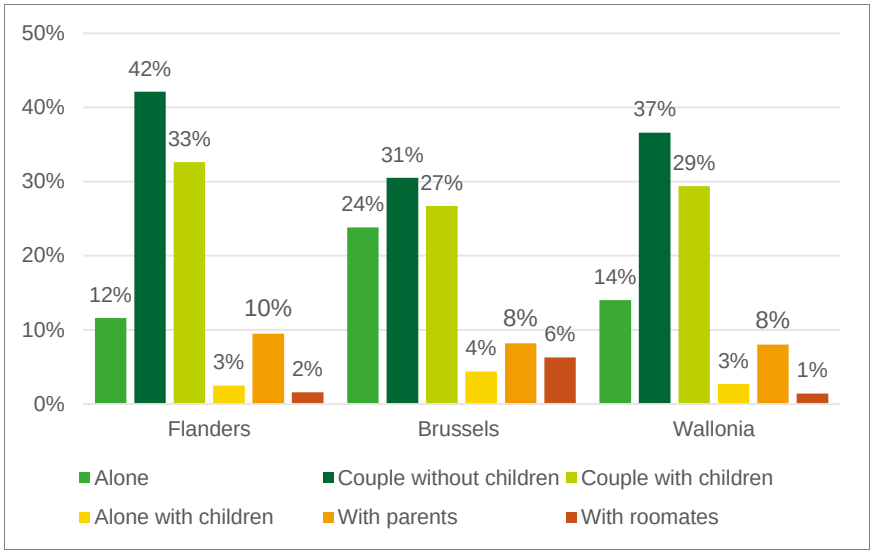
3.1. SOCIO-ECONOMIC CHARACTERISTICS AND LIVING SITUATION

To determine the composition of the household, the participants were asked if they lived alone or together with a partner, with or without children, with their parents or with roommates. The majority of the study population lives together with a partner without (36.6%) or with (29.4%) children. The others live alone without (14.0%) or with (2.7%) children, with their parents (8.0%) or with roommates (1.0%). The household situation is quite similar between Flanders and Wallonia. In Brussels, however, there are more people living alone without children (15.2%) or with roommates (6.3%) (Figure 6).

To a certain extent it is possible to compare the household composition in the SalivaHIS study population with the household composition in the HIS 2018. Also in the HIS 2018 study population the majority of the population aged 18 years and above lives together with a partner, 28.4 % without children and 37.9% with children, 19.6% lives alone and 9.6% in a single parent household. Other households account for only 4.6% of the study

population. From these figures it appears that households with children seem to be somewhat underrepresented in the SalivaHIS study population.

Figure 6 | Distribution of the study population (18 years and above) according to the household composition, by region, SalivaHIS study, Belgium 2021



Regarding the socio-economic characteristics of the population, participants were first asked for their highest level of education and then for their current employment status.

Regarding the education level, almost half (47.4%) of the study population has as highest education degree a secondary diploma, 27.7% a bachelor's diploma and 24.9% a master diploma. The distribution of the education level is quite comparable between Flanders and Wallonia. In Brussels, however, the situation is reversed with the majority of the population having at least a master diploma (Table 9). Regarding employment, more than half of the population (56.0%) are workers (employed or self-employed). The proportion of workers is higher in Brussels (63.5%) than in Flanders (56.1%) and Wallonia (53.5%). Most non-workers are retired (69.7%). Other categories of non-workers are students (13.8%), people with disability (5.9%), people doing household work (5.8%), and unemployed people(4.8%). Specifically in Brussels, there are proportionally more unemployed people (11.2%) and students (21.7%) than in the other two regions. There is more disability in Wallonia (9.7%) and more retirement in Flanders (72.3%). Finally, around 8.9% of the population works in the health care sector, with a higher proportion of health care workers in Wallonia (10.5%). Among the working population 16.4% are health care workers.

Table 9 | Distribution of study population (18 years and above) according to socio-economics characteristics, by region, SalivaHIS study, Belgium 2021

Socio-economics characteristics	Flanders (n = 1,160) N (%)	Brussels (n = 820) N (%)	Wallonia (n = 788) N (%)	Total (n = 2,768) N (%)
Education level				
Secondary diploma	585 (51.9)	202 (22.3)	352 (47.0)	1,139 (47.4)
Bachelor diploma	314 (27.6)	179 (22.5)	229 (29.7)	722 (27.7)
Master diploma	227 (20.5)	404 (55.2)	176 (23.3)	807 (24.9)
Employment				
Workers	585 (56.1)	407 (63.5)	386 (53.5)	1,378 (56.0)
Non-workers	521 (43.9)	375 (36.5)	372 (46.5))	1,268 (44.0)
Status of the non-worker				
Unemployment	19 (4.1)	28 (11.2)	15 (4.4)	62 (4.8)
Student	56 (13.7)	43 (21.7)	39 (12.0)	138 (13.8)
Household work	29 (5.8)	12 (3.8)	23 (6.2)	64 (5.8)
Invalidity	19 (4.1)	13 (4.4)	32 (9.7)	64 (5.9)
Retirement	398 (72.3)	279 (59.0)	263 (68.8)	940 (69.7))
Health care sector				
Health care workers	89 (8.3)	43 (6.5)	82 (10.5)	214 (8.9)
Not a health care workers	1,106 (91.7)	736 (93.5)	682 (89.5)	2,424 (91.1)

Also here a comparison can be made with an indicator in the HIS 2018. From the HIS it appears that 60.4% of the population aged 18 years and above has as highest education degree a secondary diploma. In the SalivaHIS study population this is only 47.4%. Moreover the regional differences for this indicator vary substantially between the HIS 2018 and the SalivaHIS. In the HIS 2018 the proportion of people with a highest education degree a secondary diploma is 50.0% in Brussels, 60.8% in Flanders and 62.1% in Wallonia. Even though also the HIS is biased towards more educated people and has difficulties to reach the low educated people, especially in Brussels, the huge difference between the percentage of people with as highest education degree a secondary diploma in Brussels between the SalivaHIS study (22.5%) and the HIS 2018 (50.0%) is striking.

3.2. HEALTH RELATED AND BIOLOGICAL FACTORS RELEVANT FOR COVID-19 INFECTION

The SARS-CoV-2 virus does not affect individuals in the same way. In addition to age and gender, some health characteristics and biological factors may have an influence on the COVID-19 infection. Being overweight or obese or having one or more chronic diseases are recognized as risk factors for COVID-19 infection and its severity (9). In addition, having a O blood type and a rhesus negative could be considered as protective factors against COVID-19 infection (10,11).

In February 2021, the Belgian Superior Health Council has established a priority status regarding vaccination for people younger than 65 years who are at risk of developing a severe form of COVID-19. People aged 65

years and above were already considered as a priority group[6]. Based on these recommendations, 3 levels were defined for the priority status for vaccination.

- Level 1 concerns all people aged 65 and older.
- Level 2 concerns all people younger than 65 years belonging to priority A1 group for vaccination due to an underlying condition.
- Level 3 concerns all people younger than 65 years not belonging to priority A1 group for vaccination.

A person belongs to priority group A1 if he/she is between 45 and 64 years old and suffers from one of the following conditions: chronic lung disease, chronic cardiovascular disease, obesity, diabetes, chronic neurological disease, cancer (except blood cancer) or is between 18 and 64 years old and suffers from a chronic renal disease or blood cancer or is an immune compromised (except HIV) or transplant patient.

The results in Table 10 show that half (50.2%) of the study population is overweight (33.1%) or obese (17.1%). A higher percentage of overweight and obese people is found in Flanders and Wallonia than in Brussels. In Brussels, more than half of the study population has a normal weight.

Results on the percentage of people with overweight and obesity in the SalivaHIS study population do not substantially differ from the results in the HIS2018 with percentages of respectively 33.4% and 15.9%, but the percentage of obese people is somewhat lower.

Among women of reproductive age in the study population (18-49 years), 8.2% declare to be pregnant. Concerning the blood type, 55.7% of the study population has an O blood type and 18.8% has a negative rhesus type. The majority of the study population (76.7%) does not report any chronic disease, 17.9% reports one chronic disease, 4.4% has two and 1.0% has at least three chronic diseases. One third of the study population (34.5%) was vaccinated against influenza during the year 2020-2021, with a higher proportion in Flanders (38.6%) than in Brussels (29.3%) or Wallonia (28.4%). With respect to the priority status of vaccination, 30.1% of the study population belongs to the level 1 group, the highest priority group, 10.5% to the level 2 group and 59.4% to the level 3 group. Finally, the presence of chronic disease is more prominent in Wallonia than in Flanders or Brussels.

[6] Levels were defined on the basis of the « Recommendations for prioritizing subgroups of patients younger than 65 for vaccination against SARS-CoV-2 (phase 1b) » from the Belgian Superior Health Council - https://www.health.belgium.be/en/report-9618-prioritization-risk-groups-SARS-CoV-2-vaccination-phase-1b. **Level 1**: People over 65 years old. **Level 2:** People under 65 years old but belonging to priority A1 group for vaccination due to underlying condition. **Level 3**: People under 65 years old and not belonging to priority A1 group for vaccination.

Table 10 | Distribution of study population (18 years and above) according to health characteristics, by region, SalivaHIS study, Belgium 2021

Health characteristics	Flanders (n = 1,160) N (%)	Brussels (n = 820) N (%)	Wallonia (n = 788) N (%)	Total (n = 2,768) N (%)
Body mass index				
Underweight	19 (1.8)	29 (3.8)	20 (2.7)	68 (2.3)
Normal weight	527 (47.3)	422 (56.8)	348 (45.3)	1,297 (47.6)
Overweight	387 (34.0)	222 (27.6)	249 (33.2)	858 (33.1)
Obesity	192 (17.0)	105 (11.8)	145 (18.8)	442 (17.1)
Pregnancy[7]				
Yes	21 (7.7)	19 (9.6)	19 (8.5)	59 (8.2)
No	251 (98.3)	177 (90.4)	199 (91.5)	627 (91.8)
Blood type				
O	427 (55.3)	296 (60.2)	298 (55.3)	1,021 (55.7)
B	89 (11.4)	54 (11.0)	68 (12.7)	211 (11.8)
A	229 (29.1)	113 (23.2)	137 (26.0)	479 (25.6)
AB	32 (4.2)	27 (5.7)	31 (6.0)	90 (4.9)
Rhesus type				
+	593 (79.0)	385 (82.4)	434 (84.7)	1,412 (81.2)
-	152 (21.0)	85 (17.6)	76 (15.3)	313 (18.8)
Chronic diseases				
No chronic disease	885 (79.0)	609 (82.7)	529 (70.5)	2,003 (76.7)
One chronic disease	182 (16.1)	134 (14.4)	176 (22.4)	492 (17.9)
Two chronic diseases	53 (4.2)	22 (1.9)	43 (5.4)	118 (4.4)
Three or more chronic diseases	9 (0.7)	11 (1.0)	13 (1.7)	33 (1.04)
Influenza Vaccine in 2020-2021				
Vaccinated	473 (38.6)	303 (29.3)	235 (28.4)	1011 (34.5)
Not vaccinated	663 (61.4)	492 (70.7)	539 (71.6)	1,694 (65.5)
Priority status for vaccination[8]				
Level 1	410 (31.6)	297 (22.7)	257 (29.8)	964 (30.1)
Level 2	101 (9.3)	66 (8.2)	95 (10.7)	262 (10.5)
Level 3	625 (59.1)	432 (69.2)	421 (52.8)	1,478 (59.4)

[7] In women of reproductive age in SalivaHIS population (18-49 years).

[8] Levels were defined on the basis of the « Recommendations for prioritizing subgroups of patients younger than 65 for vaccination against SARS-CoV-2 (phase Ib) » from the Belgian Superior Health Council - https://www.health.belgium.be/en/report-9618-prioritization-risk-groups-SARS-CoV-2-vaccination-phase-1b. **Level 1**: People over 65 years old. **Level 2:** People under 65 years old but belonging to priority A1 group for vaccination due to underlying condition. **Level 3**: People under 65 years old and not belonging to priority A1 group for vaccination.

4. Prevalence of anti-SARS-CoV-2 antibodies (March-August 2021)

Key findings

- A small majority (53.5%) of the study population aged 18 years and above with a valid saliva sample had developed anti-SARS-CoV-2 antibodies.
- 95.0% of the fully vaccinated population, 69.4% of the partially vaccinated population and 18.0% of the not vaccinated population had anti-SARS-CoV-2 antibodies.
- The prevalence of anti-SARS-CoV-2 antibodies was comparable in the 3 regions.
- Being a women was significantly associated with a higher prevalence of anti-SARS-CoV-2 antibodies, also after adjusting for age, health care worker and vaccination status.
- The prevalence of anti-SARS-CoV-2 antibodies is higher in people of 50 years and above than in the younger population.
- People with a bachelor diploma or higher are more likely to have anti-SARS-CoV-2 antibodies than people with a secondary diploma or lower education, but this difference can be explained by the lower vaccination rate in the latter group.
- 30% of the variability in the prevalence of anti-SARS-CoV-2 antibodies is accounted for at the household level. Important differences were observed between the regions, where the variability in the prevalence of SARS-CoV-2 antibodies accounted for at the household level was 25% in Flanders, 30% in Brussels and 41% in Wallonia.

This section of the report presents the main results on the prevalence of anti-SARS-CoV-2 antibodies in the study population. For the interpretation, it is important to take into account that samples were collected between the end of March and mid-August 2021 as detailed in the methods section.

The prevalence was assessed by measuring antibodies through a SARS-CoV-2 RBD[9] IgG ELISA test in saliva samples. Saliva was self-collected by participants using an Oracol® (Malvern Medical Developments Ltd) salivary swab. The presence of antibodies against SARS-CoV-2, corresponding to a positive salivary test, means that the participant has been infected with the SARS-CoV-2 virus at some point or that he/she has been vaccinated against the SARS-CoV-2 virus. The absence of anti-SARS-CoV-2 antibodies, corresponding to a negative saliva test means that the participant has not been in contact with the SARS-CoV-2 virus, or that he/she has been infected with SARS-CoV-2 virus at some point but he/she never developed antibodies or no longer has antibodies, or that he/she has recently been in contact with the virus or was vaccinated but his/her immune system has not yet produced anti-SARS-CoV-2 antibodies.

For this part of the report a participant was considered as fully vaccinated if he/she had received the Johnson&Johnson vaccine or both doses of one of the other vaccines since at least 2 weeks before being tested. Two weeks are needed to develop sufficient anti-SARS-CoV-2 antibodies following the vaccination (12). The partially vaccinated population consists of participants who have received only one dose of a non Johnson&Johnson vaccine or received the second dose of this vaccine less than 2 weeks before being tested. The not vaccinated population consists of participants who did not receive any vaccination dose.

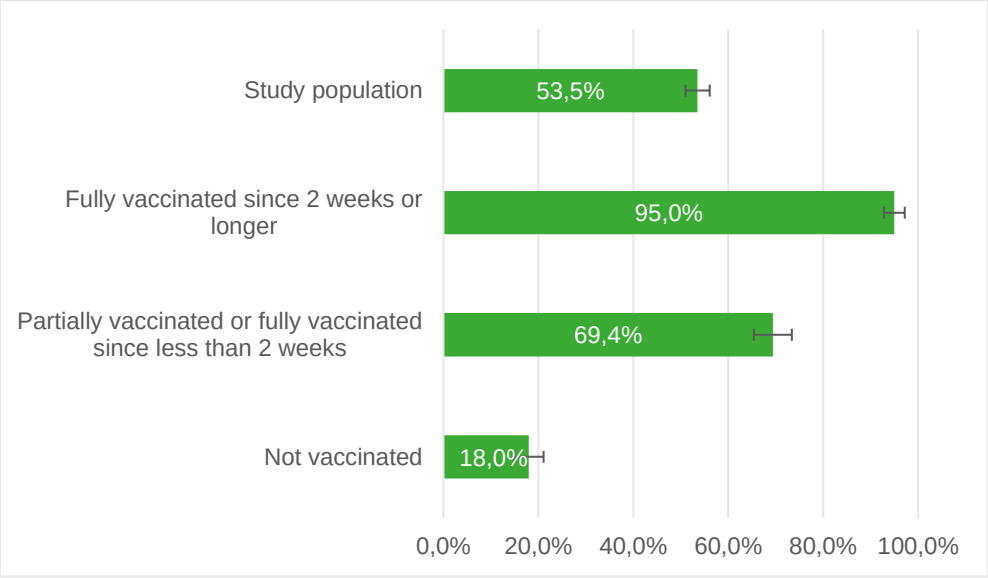
[9] RBD: Receptor-binding Domain

4.1. THE OVERALL PREVALENCE OF ANTI-SARS-COV-2 ANTIBODIES

4.1.1. Prevalence of anti-SARS-CoV-2 antibodies among the valid saliva sample

Taking into account only the 2288 valid saliva samples (Figure 7), 53.5% (95%CI: 50.9%-56.0%) of the population had developed anti-SARS-CoV-2 antibodies. In Figure 7, the prevalence of anti-SARS-CoV-2 antibodies is also presented by vaccination status. The vaccination status has been classified into 3 groups: fully vaccinated 2 weeks or longer before being tested, partially vaccinated or fully vaccinated since less than 2 weeks and not vaccinated. Among the fully vaccinated population, the prevalence of anti-SARS-CoV-2 antibodies is 95.0% (95%CI: 92.8%-97.2%) whereas this percentage is 69.4% (95%CI: 65.4%-73.4%) in the partially vaccinated population and 18.0% (95%CI: 14.9%-21.1%) in the not vaccinated population.

Figure 7 | Prevalence of anti-SARS-CoV-2 antibodies in valid saliva samples for the study population (18 years and above) and according to vaccination status, SalivaHIS study, Belgium 2021



4.2. PREVALENCE OF ANTI-SARS-COV-2 ANTIBODIES BY SOCIO-DEMOGRAPHIC CHARACTERISTICS

4.2.1. Regional differences

Among the whole study population, the prevalence of anti-SARS-CoV-2 antibodies is slightly lower in Flanders (49.9%; 95%CI 46.3%-53.5%) than in Wallonia (57.7%; 95%CI 53.3%-62.1%) and Brussels (59.7%; 95%CI 55.3%-64.1%) (Figure 8). Among the not vaccinated population, this prevalence is higher in Brussels (23.3%; 95%CI 16.9%-29.6%) and Wallonia (19.6%; 95%CI 12.6%-26.6%) than in Flanders (16.4%; 95%CI 12.6%-20.1%). The prevalence of anti-SARS-CoV-2 antibodies in vaccinated and partially vaccinated population is comparable in the three regions. As presented in Table 11, results show that among the whole study population, the odds of having antibodies is significantly higher in people living in Brussels and in Wallonia. Also after adjustment for age, sex and vaccination status, the association is still significant for people living in Brussels. However, no significant association was observed between the prevalence of anti-SARS-CoV-2 antibodies and region in the not vaccinated population (Table 11). The differences in the prevalence of anti-SARS-CoV-2 antibodies at the regional level can mainly be explained by a bias in our sample, where participants in Brussels are more educated and vaccinated than in the other 2 regions.

Figure 8 | Prevalence of anti-SARS-CoV-2 antibodies among the study population (18 years and above) and according to vaccination status, by region, SalivaHIS study, Belgium 2021

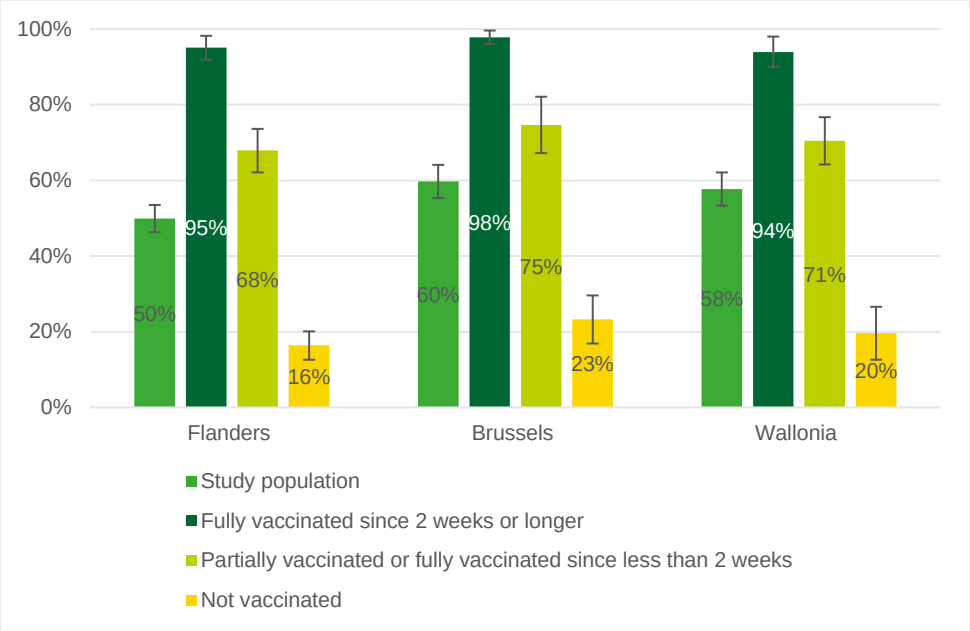


Table 11 | Association of region and prevalence of anti-SARS-CoV-2 antibodies among the study population (18 years and above), SalivaHIS study, Belgium 2021

Variable	Categories	OR (95%CI) crude	OR (95%CI) Adjusted for age and sex	OR (95%CI) Adjusted for age, sex and vaccination status
Study population				
Region	Flanders	Ref	Ref	Ref
	Brussels	**1.48 (1.18-1.88)**	**1.87 (1.46-2.40)**	**1.54 (1.12-2.11)**
	Wallonia	**1.37 (1.09-1.73)**	**1.44 (1.13-1.85)**	1.14 (0.83-1.57)
Not vaccinated population				
Region	Flanders	Ref	Ref	Not applicable
	Brussels	1.55 (0.99-2.42)	1.46 (0.92-2.30)	Not applicable
	Wallonia	1.25 (0.74-2.10)	1.22 (0.72-2.07)	Not applicable

4.2.2. Gender differences

Figure 9 shows that the prevalence of anti-SARS-CoV-2 antibodies is comparable between men and women. This is however not the case in the partially vaccinated population where more women (73.9%; 95%CI 68.9%-78.4%) than men (65.2%; 95%CI 59.6%-70.8%) have anti-SARS-CoV-2 antibodies. The same is observed in the not vaccinated population where also more women (21.0%; 95%CI 16.8%-25.1%) than men (15.4%; 95%CI 11.4%-19.4%) have anti-SARS-CoV-2 antibodies. As presented in Table 12, results show that among the total population and among the not vaccinated population being a woman is positively and significantly associated with a higher prevalence of anti-SARS-CoV-2 antibodies, even after adjusting for age, health care worker status and vaccination status. Although further research is needed, this difference could be explained by a different immune responses in women compared to men (13).

Figure 9 | Prevalence of anti-SARS-CoV-2 antibodies among the total population (18 years and above) and according to vaccination status, by sex, SalivaHIS study, Belgium 2021

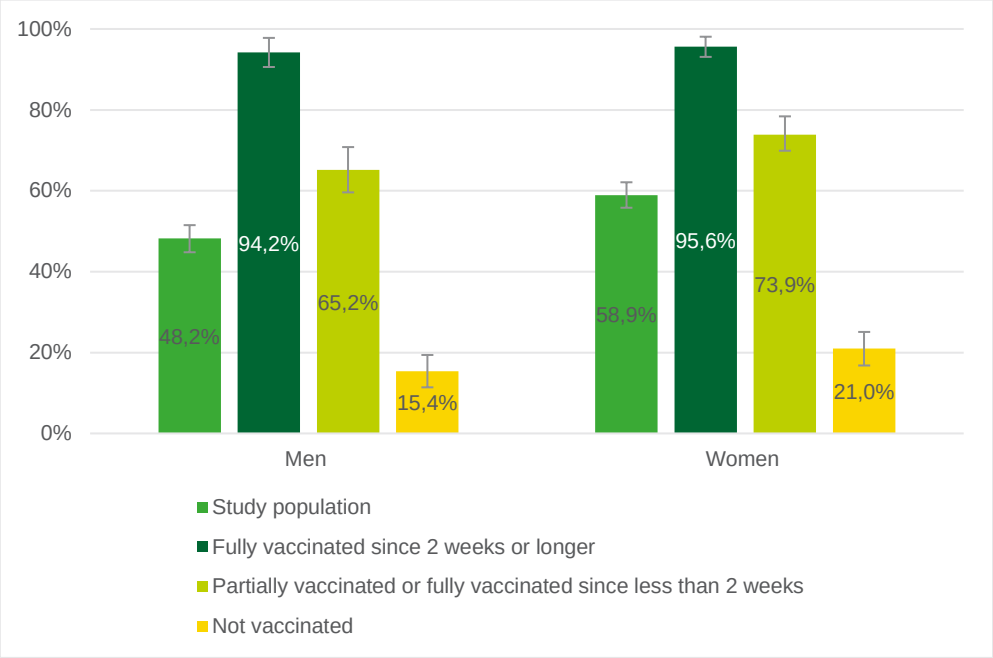


Table 12 | Association of gender and prevalence of anti-SARS-CoV-2 antibodies among the total population (18 years and above), SalivaHIS study, Belgium 2021

Variable	Categories	OR (95%CI) crude	OR (95%CI) Adjusted for age	OR (95%CI) Adjusted for age and HCW	OR (95%CI) Adjusted for age, HCW and vaccination status
Study population					
Sex	Men	Ref	Ref	Ref	Ref
	Women	**1.54 (1.31-1.82)**	**1.58 (1.33-1.87)**	**1.40 (1.16-1.67)**	**1.46 (1.14-1.86)**
Not vaccinated population					
Sex	Men	Ref	Ref	Ref	Not applicable
	Women	**1.46 (1.01-2.10)**	**1.47 (1.02-2.13)**	**1.62 (1.09-2.42)**	Not applicable

4.2.3. Age differences

The prevalence of anti-SARS-CoV-2 antibodies varied by age category (Figure 10). This variation can be explained by the vaccination campaign strategy implemented in Belgium at the time of the SalivaHIS study. The campaign was targeting people in risk groups and was gradually enrolled in function of the age of the people: older people were vaccinated earlier than younger people. As a result people of 50 years and above in the study population are more likely to have antibodies than those under the age of 50 (Table 13). Among the not vaccinated population, people between 18-29 are more likely to have anti-SARS-CoV-2 antibodies than those in the other age groups. Among fully vaccinated population, all people aged 18 to 29 years have antibodies, with a slight gradual decrease of the prevalence of anti-SARS-CoV-2 antibodies by age category. Finally, among partially vaccinated people those aged 50-69 years are more likely to have antibodies than others. In the total population, after adjustment for sex and vaccination status, the odds of having anti-SARS-CoV-2 antibodies is significantly lower in people aged 30-49 than in people aged 18-29 years. Age differences in the prevalence of anti-SARS-CoV-2 antibodies are thus mainly a reflection of the age differences in the

vaccination rate. However, no association between age and prevalence of anti-SARS-CoV-2 antibodies could be highlighted in the not vaccinated population.

Figure 10| Prevalence of anti-SARS-CoV-2 antibodies among the study population (18 years and above) and according to vaccination status, by age, SalivaHIS study, Belgium 2021

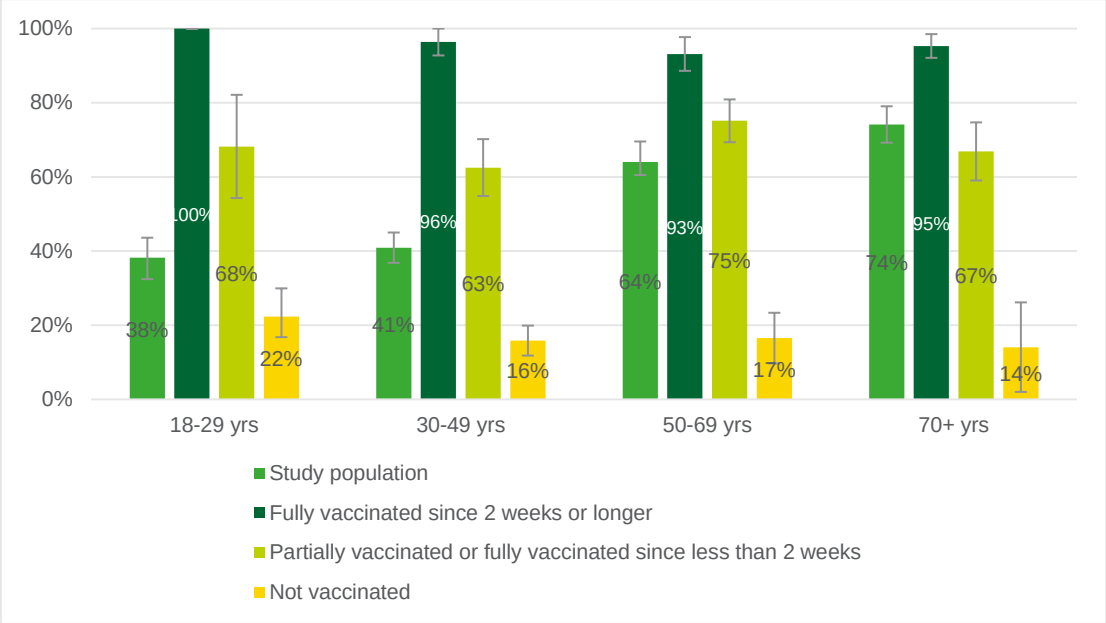


Table 13 | Association of age and prevalence of anti-SARS-CoV-2 antibodies among the study population (18 years and above), SalivaHIS study, Belgium 2021

Variable	Categories	OR (95%CI) crude	OR (95%CI) Adjusted for sex	OR (95%CI) Adjusted for sex and vaccination status
Study population				
Age	18-29	Ref	Ref	Ref
	30-49	1.13 (0.85-1.51)	1.12 (0.84-1.50)	**0.64 (0.44-0.94)**
	50-69	**3.03 (2.24-4.10)**	**3.08 (2.27-4.18)**	0.90 (0.60-1.34)
	70+	**4.67 (3.30-6.62)**	**4.65 (3.27-6.60)**	0.70 (0.44-1.10)
Not vaccinated population				
Age	18-29	Ref	Ref	Not applicable
	30-49	0.66 (0.43-1.00)	0.65 (0.42-1.00)	Not applicable
	50-69	0.68 (0.40-1.21)	0.68 (0.39-1.20)	Not applicable
	70+	0.57 (0.19-1.63)	0.56 (0.19-1.63)	Not applicable

4.2.4. Education level differences

The prevalence of anti-SARS-CoV-2 antibodies varies by level of education in the study population (Figure 11). Indeed, people with a bachelor diploma have significantly more often antibodies (56.9%) than people with a secondary diploma or lower education (58.7%) (OR: 1.38; 95%CI: 1.09-1.74). After adjustment for age and sex, both having a bachelor degree and having a master degree is positively associated with a higher prevalence of anti-SARS-CoV-2 antibodies compared to having a secondary diploma as highest education degree, with ORs of respectively 1.61; 95%CI 1.26-2.07 and 1.46; 95%CI: 1.13-2.89. However after additional adjusting for the vaccination status the magnitude of the association decreases and is no longer significant (Table 14). Moreover, no association between education level and prevalence of anti-SARS-CoV-2 antibodies was found in the not vaccinated population. This indicates that educational differences in the vaccination status largely explain educational differences in the prevalence of anti-SARS-CoV-2 antibodies.

Figure 11 | Prevalence of anti-SARS-CoV-2 antibodies among the study population (18 years and above) by education level, SalivaHIS study, Belgium 2021

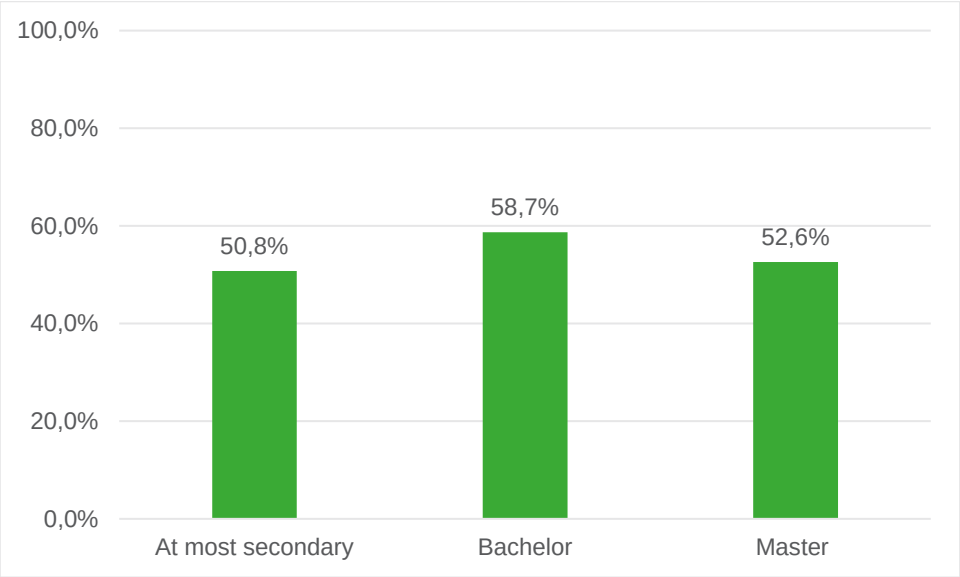


Table 14 | Association of education level and prevalence of anti)SARS-CoV-2 antibodies in the study population (18 years and above), SalivaHIS study, Belgium 2021

Variable	Categories	OR (95%CI) crude	OR (95%CI) Adjusted for age and sex	OR (95%CI) Adjusted for age, sex and vaccination status
Study population				
Education level	Secondary	Ref	Ref	Ref
	Bachelor	**1.38 (1.09-1.74)**	**1.61 (1.26-2.07)**	1.24 (0.89-1.73)
	Master	1.08 (0.85-1.37)	**1.46 (1.13-1.89)**	1.34 (0.99-1.83)
Not vaccinated population				
Education level	Secondary	Ref	Ref	Not applicable
	Bachelor	1.27 (0.80-2.00)	1.18 (0.74-1.89)	Not applicable
	Master	0.97 (0.60-1.55)	0.98 (0.59-1.60)	Not applicable

4.2.5. Household clustering of prevalence of anti-SARS-CoV-2 antibodies

In order to explore the impact of the household clustering on the prevalence of SARS-CoV-2 antibodies, hierarchical generalized linear models were used. The results show that 30% of the variability in the prevalence of SARS-CoV-2 antibodies is accounted for at the household level. Important differences were observed between the regions: the variability in the prevalence of anti-SARS-CoV-2 antibodies accounted for at the household level is 25% in Flanders, 30% in Brussels and 41% in Wallonia.

4.3. EVOLUTION OF PREVALENCE OF ANTI-SARS-COV-2 ANTIBODIES

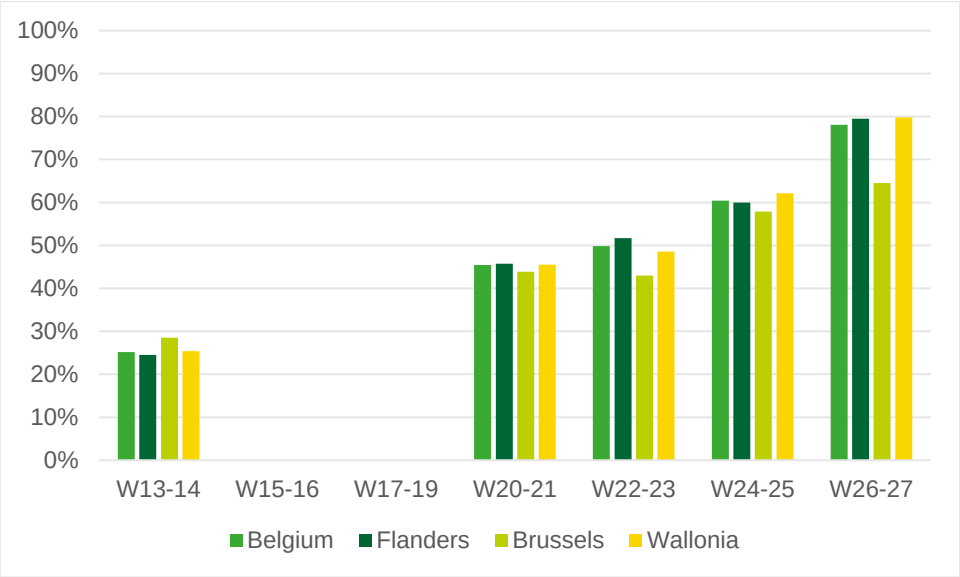
4.3.1. For study population and by region

Table 15 and Figure 12 show how the prevalence of anti-SARS-CoV-2 antibodies among the study population increased during the study period. Results are shown for five periods of two weeks during which enough saliva samples were collected to obtain sufficiently precise population estimates. Looking at the results by region it appears that, a part from the first period (w13-14), the prevalence of anti-SARS-CoV-2 antibodies in Flanders and Wallonia is always higher than in Brussels. This is particularly the case during the last period, where this prevalence is 64.5% in Brussels compared to 79.5% in Flanders and 79.8% in Wallonia.

Table 15 | Evolution of prevalence of anti-SARS-CoV-2 antibodies in the study population (18 years and above) by week of saliva collection and according to vaccination status, SalivaHIS study, Belgium 2021

Periods	Flanders (N=881) % (95%CI)	Brussels (N=637) % (95%CI)	Wallonia (N=607) % (95%CI)	Study population (N=2125) % (95%CI)
1 (week 13-14)	24.5 (16.8-32.2)	28.5 (14.4-42.5)	25.4 (11.4-39.3)	25.2 (18.8-34.7)
2 (week 20-21)	45.7 (36.8-54.6)	43.9 (32.9-55.0)	45.5 (36.6-54.4)	45.4 (39.5-51.3)
3 (week 22-23)	51.7 (45.6-57.8)	43.0 (34.1-51.9)	48.6 (39.3-57.9)	49.8 (45.1-54.5)
4 (week 24-25)	60.0 (52.9-67.0)	57.9 (49.1-66.7)	62.1 (52.8-71.3)	60.4 (55.3-65.5)
5 (week 26-27)	79.5 (66.8-92.2)	64.5 (49.2-79.8)	79.8 (64.9-94.7)	78.1 (69.2-87.0)

Figure 12 | Evolution of prevalence of anti-SARS-CoV-2 antibodies in the study population (18 years and above) by week of saliva collection, by region, SalivaHIS study, Belgium 2021



4.3.2. Evolution of prevalence of anti-SARS-CoV-2 antibodies by vaccination status

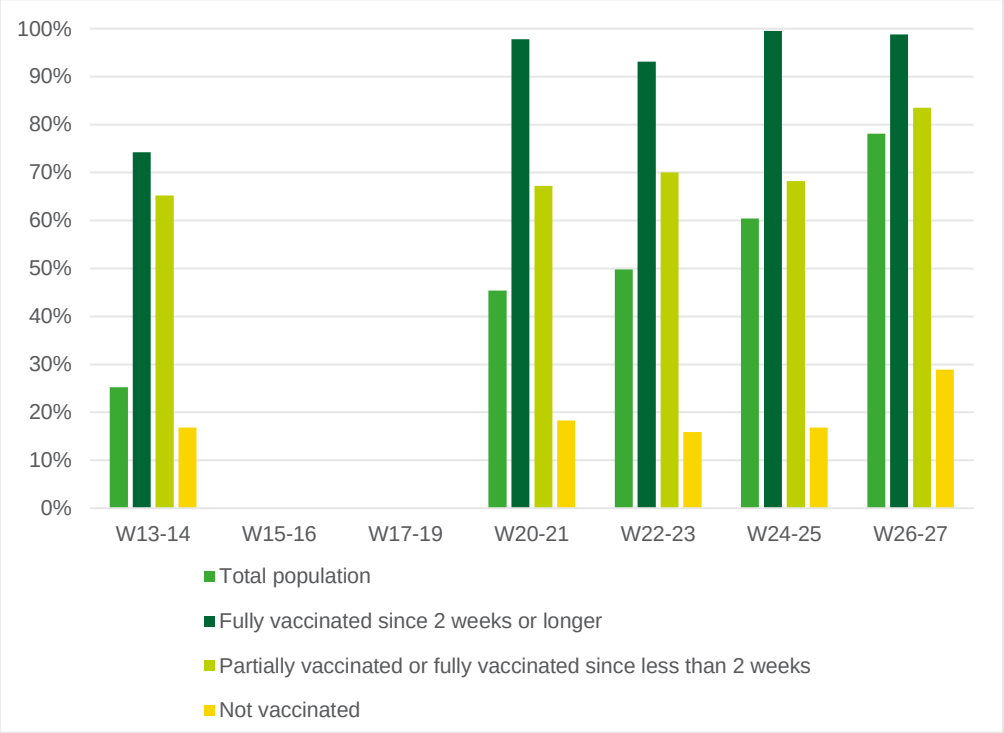
Table 16 and Figure 13 present the evolution of the prevalence of anti-SARS-CoV-2 antibodies by vaccination status and by two week period of saliva collection. With the exception of the first period (w13-14), the prevalence of anti-SARS-CoV-2 antibodies among the vaccinated population is rather high and stable between the periods. During the first period (w13-14), vaccination in Belgium focused mainly on the older population and health care professionals. The lower percentage in the beginning of April could be related to the fact that at that time the majority of vaccinated people were older people, with a lower immune response than younger people. In the partially vaccinated population the evolution of the prevalence of anti-SARS-CoV-2 antibodies was quite stable. Among the not vaccinated population a large, but no significant increase in the prevalence of anti-SARS-CoV-2 antibodies was observed during the last study period (w26-27), but caution is needed to interpret this increase, because the number of saliva samples for this study period was rather limited.

These results can be compared to those obtained in the study on the presence of anti-SARS-CoV-2 antibodies among Belgian blood donors (1). In week 13 the prevalence among Belgian blood donors was 31.3%, whereas we found 25.2% in our study. In week 21 these percentages were respectively 59.8% and 45.8%.

Table 16 | Evolution of prevalence of anti-SARS-CoV-2 antibodies in the study population (18 years and above) by week of saliva collection and according to vaccination status, SalivaHIS study, Belgium 2021

Periods	Fully vaccinated population (N=537) % (95%CI)	Partially vaccinated population (N=688) % (95%CI)	Not vaccinated population (N=803) % (95%CI)	Total study population (N=2125) % (95%CI)
1 (week 13-14)	74.2 (52.2-96.1)	65.2 (43.7-86.6)	16.7 (10.1-23.3)	25.2 (18.8-34.7)
2 (week 20-21)	97.9 (93.9-100.0)	67.2 (57.3-77.1)	18.4 (12.1-24.6)	45.4 (39.5-51.3)
3 (week 22-23)	93.1 (88.3-97.8)	70.0 (63.4-76.7)	16.0 (10.8-21.1)	49.8 (45.1-54.5)
4 (week 24-25)	99.5 (98.4-100.0)	68.2 (60.3-76.2)	16.8 (9.8-23.7)	60.4 (55.3-65.5)
5 (week 26-27)	98.88 (96.5-100.0)	83.5 (72.3-94.7)	28.9 (4.0-53.7)	78.1 (69.2-87.0)

Figure 13 | Evolution of prevalence of anti-SARS-CoV-2 antibodies in the study population (18 years and above) by week of saliva collection and according to vaccination status, SalivaHIS study, Belgium 2021



5. Factors associated with the presence of anti-SARS-CoV-2 antibodies detected though a saliva test

Key findings

- Among the study population, the univariate analyses show that being a woman, living in Brussels, having a bachelor degree, having a larger household size, being a health care worker, having at least one chronic disease, being overweight or obese, having reported being in good health, being fully or partially vaccinated, having been vaccinated against influenza in 2020-2021, having an history of positive COVID-19 test result or an insufficiently adherence to preventive measure was significantly associated with having anti-SARS-CoV-2 antibodies. The results of the multivariable analysis show that having anti-SARS-CoV-2 antibodies is significantly associated with being a women, having a bachelor degree, having a larger household size, being partially and fully vaccinated, having been vaccinated against influenza in 2020-2021 and having a history of positive COVID-19 test result.
- Among the vaccinated population, having at least one chronic disease, the type of vaccine received and the vaccination against influenza in 2020-2021 were significantly associated with having anti-SARS-CoV-2 antibodies. These associations remain significant in the multivariable model.
- In the not vaccinated population being a woman, the household size, having a non-O bloodtype, having a positive rhesus, an history of positive COVID-19 test result were significantly associated with having anti-SARS-CoV-2 antibodies. Having a non-O bloodtype and an history of positive COVID-19 test remains significant in the multivariable model.

5.1. POTENTIAL FACTORS ASSOCIATED WITH HAVING ANTI-SARS-COV-2 ANTIBODIES

The aim of this section is to identify factors associated with prevalence of SARS-CoV-2 antibodies. Logistic regression has been used to test the association between having anti-SARS-CoV-2 antibodies and socio-demographic, and health related characteristics. This was done in two steps. First, the association of each independent variable with having anti-SARS-CoV-2 antibodies was assessed individually by univariate logistic regression. Second, variables found to be significantly associated with having anti-SARS-CoV-2 antibodies in the univariate analyses were modeled in a multivariable logistic regression. Associations were quantified using Odds Ratio (ORs) with 95% confidence intervals (95%CI). For all these analyses, a significance level of 5% was used (p-value <0.05).

Because vaccination status is an obvious determinant of having anti-SARS-CoV-2 antibodies, and because associations between having anti-SARS-CoV-2 antibodies and other potential determinants may differ for the vaccinated and not vaccinated population, results were presented for the study population and by vaccination status. As for the previous chapter on the prevalence of anti-SARS-CoV-2 antibodies, the fully vaccinated population consists of those who had received two doses of vaccine or the Johnson&Johnson vaccine since 2 weeks or longer. The partially vaccinated population consists of participants who have received only one dose of a non Johnson&Johnson vaccine or received the second dose of this vaccine less than 2 weeks before being tested. The not vaccinated population consists of participants who did not receive any vaccine dose.

To better understand the results presented in this chapter, Table 17 shows the prevalence of anti-SARS-CoV-2 antibodies in different population subgroups, based on characteristics that may be potential determinants of having anti-SARS-CoV-2 antibodies. Results are presented for the total the study population (18 years and above) and for vaccinated and not vaccinated people separately.

Table 17 | Prevalence of anti-SARS-CoV-2 antibodies by population subgroup, in the total study population, the fully vaccinated population and the not vaccinated population (18 years and above), SalivaHIS study, Belgium 2021

	Total study population (N = 2288)		Fully vaccinated population since 2 weeks (N = 593)		Not vaccinated population (N = 803)	
	%	Total N	%	Total N	%	Total N
Gender						
Man	48.2	1,075	94.2	250	15.4	399
Woman	58.9	1,213	95.6	343	21.0	440
Region						
Flanders	49.9	938	97.7	196	16.3	388
Brussels	59.7	693	97.8	228	23.2	226
Wallonia	57.7	657	93.9	169	19.6	225
Education						
<= Secondary	50.8	916	93.8	219	17.3	359
Bachelor	58.7	615	95.9	169	20.9	206
>= Master	52.6	675	96.4	177	16.8	254
Health care worker						
Yes	81.5	180	95.2	103	17.4	33
No	50.8	1,997	95.2	470	17.6	771
Presence of at least one chronic disease						
Yes	63.0	496	90.4	173	21.0	125
No	50.8	1,692	97.0	400	14.1	685
Presence of at least two chronic disease						
Yes	63.3	113	93.9	41	17.7	27
No	36.7	2,075	95.0	532	17.6	783
Overweight						
Yes	56.7	1,075	93.8	306	18.6	336
No	50.0	1,131	96.3	271	16.8	481
Obesity						
Yes	59.6	218	95.0	108	17.5	104
No	52.2	1,047	94.9	469	17.6	713

Blood type						
O blood type	53.9	852	92.7	218	13.8	292
Non- O blood type	55.5	625	96.2	165	22.5	236
Rhesus type						
Positive	53.0	1,158	94.2	290	15.7	423
Negative	57.8	258	93.0	70	24.9	90
Good subjective health						
Good to very good health	51.4	1831	96.1	452	17.5	730
Fair, bad to very bad health	63.5	406	91.2	129	20.7	100
Long term limitation (GALI)						
Limited	58.1	308	88.6	104	12.6	81
Non limited	52.6	1,912	96.4	473	18.2	743
Influenza vaccine (2020-2021)						
Vaccinated	73.7	796	96.8	361	15.5	104
Non vaccinated	43.4	1,440	92.0	222	17.9	723
Close contact with COVID-19 positive person						.
Yes	56.8	606	97.7	133	29.9	282
No	52.0	1,246	94.2	355	11.6	389
I don’t know	52.4	1,284	93.3	93	14.2	159
History of positive COVID-19 test result						
Yes	85.2	258	100.0	62	68.7	103
No	49.6	1,899	95.2	507	11.1	691
Preventive measures						
Strictly followed the measures	60.2	447	96.5	145	16.1	118
Moderately followed the measures	55.8	692	91.9	185	19.6	262
Insufficiently followed the measures	39.9	385	94.8	365	22.3	212

5.1.1. Factors associated with having anti-SARS-COV-2 antibodies among the total study population

In a first step we investigated the factors associated with having anti-SARS-CoV-2 antibodies in the study population using a univariate logistic regression (Table 18). First, we assessed the potential association of having anti-SARS-CoV-2 antibodies with socio-demographic variables such as age, gender, region, level of education, number of household members or being a health care worker. The results showed that the odds of having anti-SARS-CoV-2 antibodies versus not having antibodies is significantly higher with age (OR 1.04; 95%CI 1.03-1.04), in women (OR 1.55; 95%CI 1.31-1.82) compared to men, among people living in Brussels (OR 1.49; 95%CI 1.18-1.88) compared to those living in Flanders, among people having a bachelor degree (OR 1.38; 95%CI 1.09-1.74) compared to people having at most a secondary diploma or among people working in the health care sector compared to the rest of the population (OR 4.26; 95%CI 2.82-6.44). Furthermore, and more surprisingly, having anti-SARS-CoV-2 antibodies decreases significantly with an increasing household size (OR 0.87; 95%CI 0.79-0.94).

Second, the association with health status related variables (presence of chronic diseases, overweight and obesity) and blood type and rhesus factor, two biological parameters that may influence the development of anti-SARS-CoV-2 antibodies (10,11) were explored. The results showed that the odds of having anti-SARS-CoV-2 antibodies is significantly higher in people having at least one chronic disease (OR 1.65; 95%CI 1.31-2.09) and in overweight (OR 1.31; 95%CI 1.08-1.58) or obese (OR 1.35; 95%CI 1.05-1.75) people. Furthermore, the association of having anti-SARS-CoV-2 antibodies with subjective heath was investigated. The result showed that being in good to very good health compared to those who reported being in a fair to very bad health is significantly associated with having anti-SARS-CoV-2 antibodies (OR 1.65; 95%CI 1.28-2.13).

Finally, the association of having anti-SARS-CoV-2 antibodies with COVID-19 vaccination status, being vaccinated against influenza in 2020-2021, having had a close contact with a COVID-19 positive person, having a history of positive COVID-19 test result, and adherence to prevention measures were explored. Not surprisingly, all those variables, with the exception of having a close contact with COVID-19 positive person, were found to be potential factors associated with having anti-SARS-CoV-2 antibodies. Results showed a strong association with being fully vaccinated for at least 2 weeks (OR 86.95; 95%CI 52.58-143.81) or partially vaccinated (OR 10.33; 95%CI 7.81-13.66), having been vaccinated against influenza in 2020-2021 (OR 3.67; 95%CI 2.91-4.62) and having a history of positive COVID-19 test result (OR 5.82; 95%CI 3.87-8.58). The analyses regarding the adherence to preventive measures, as an unexpected result, showed that having anti-SARS-CoV-2 antibodies decreased with an insufficiently adherence to preventive measure (OR 0.44; 95%CI 0.32-0.60) probably due to confounding factors.

Table 18 | Factors associated with having anti-SARS-CoV-2 antibodies among the study population (aged 18 years and above), using a univariate logistics regression, SalivaHIS study, Belgium 2021

Variable	Categories	OR (CI95%)	p-value
Socio-demographics			
Age		**1.04 (1.03-1.04)**	**<0.0001**
Gender	Man	Ref	Ref
	Woman	**1.55 (1.31-1.82)**	**<0.0001**
Region	Flanders	Ref	Ref
	Brussels	**1.49 (1.18-1.88)**	**0.030**
	Wallonia	1.37 (1.09-1.73)	0.291
Education	<= Secondary	Ref	Ref
	Bachelor	**1.38 (1.09-1.74)**	**0.008**
	>= Master	1.08 (0.85-1.37)	0.419
Household size	**1 – 6 member(s)**	**0.87 (0.79-0.94)**	**<0.0001**
Health care worker	**Yes vs no**	**4.26 (2.82-6.44)**	**<0.0001**
Health status			
At least one chronic disease	**Yes vs no**	**1.65 (1.31-2.09)**	**<0.0001**
At least two chronic diseases	Yes vs no	1.53 (1.00-2.35)	0.051
Overweight (BMI>25-30kg/m²)	**Yes vs no**	**1.31 (1.08-1.58)**	**0.005**
Obesity (BMI>30kg/m²)	**Yes vs no**	**1.35 (1.05-1.75)**	**0.022**
Blood-type	O blood-type	Ref	Ref
	Non-O blood-type	1.07 (0.85-1.34)	0.590
Rhesus	Positive	0.82 (0.61-1.11)	0.205
	Negative	Ref	Ref
Subjective health			
Good subjective health	**Good to very good health**	**1.65 (1.28-2.13)**	**0.0001**
	Fair, bad to very bad health	Ref	Ref
Long term limitation (GALI)	Limited	1.25 (0.94-1.65)	0.120
	Not limited	Ref	Ref
Covid-19 related health factors			
Vaccination	**Fully vaccinated**	**86.95 (52.58-143.81)**	**<0.0001**
	Partially vaccinated	**10.33 (7.81-13.66)**	**<0.0001**
	Not vaccinated	Ref	Ref
Influenza vaccine in 2020-2021	**Vaccinated**	**3.67 (2.91-4.62)**	**<0.0001**
	Not vaccinated	Ref	Ref
Close contact with COVID-19 positive person	Yes vs no	1.21 (0.96-1.53)	0.114
	I don't know vs no	1.02 (0.77-1.33)	0.544
History of positive COVID-19 test result	**Yes vs no**	**5.82 (3.87-8.58)**	**<0.0001**
Preventive measure	Strictly followed the measures	Ref	Ref
	Moderately followed the measures	0.83 (0.63-1.10)	0.051
	Insufficiently followed the measures	**0.44 (0.32-0.60)**	**<0.0001**

All variables found to be significantly associated with having anti-SARS-CoV-2 antibodies in the univariate analyses were modeled in a multivariable model. Results are listed in Table 19.

The results of the multivariate analysis show that, taking into account confounding, the adjusted odds of having anti-SARS-CoV-2 antibodies versus not having antibodies is significantly higher in partially vaccinated people (OR 15.24; 95%CI 9.47-24.50) and fully vaccinated people (OR 111.65; 95%CI 50.97-244.54). Furthermore, being a woman (OR 1.70; 95%CI 1.19-2.41), a larger household size (OR 1.27; 95%CI 1.07-1.51), having been vaccinated against influenza in 2020-2021 (OR 1.66; 95%CI 1.04-2.65) and having a history of a positive COVID-19 test result (18.06; 95%CI 9.49-34.38) were also significantly associated with the presence of anti-SARS-CoV-2 antibodies.

Table 19 | Factors associated with having anti-SARS-CoV-2 antibodies among the study population (aged 18 years and above) using a multivariate logistics regression, SalivaHIS study, Belgium 2021

Variable	Categories	OR (95%CI)	p-value
Age		1.01 (0.99-1.02)	0.256
Gender	Man	Ref	Ref
	Woman	**1.70 (1.19-2.41)**	**0.003**
Region	Flanders	Ref	Ref
	Brussels	1.31 (0.78-2.20)	0.298
	Wallonia	1.03 (0.66-1.59)	0.617
Education	<= Secondary	Ref	Ref
	Bachelor	**1.73 (1.12-2.66)**	**0.013**
	>= Master	1.38 (0.84-2.25)	0.845
Household size	**1 – 6 member(s)**	**1.27 (1.07-1.51)**	**0.008**
Health care worker	Yes vs no	1.69 (0.79-3.60)	0.173
Vaccination	**Fully vaccinated**	**111.65 (50.97-244.54)**	**<0.0001**
	Partially vaccinated	**15.24 (9.47-24.50)**	**<0.0001**
	Not vaccinated	Ref	Ref
Influenza vaccine in 2020-2021	**Vaccinated**	**1.66 (1.04-2.65)**	**0.034**
	Not vaccinated	Ref	Ref
At least one chronic disease	Yes vs no	1.02 (0.62-1.66)	0.948
Overweight (BMI>25kg/m²)	Yes vs no	1.23 (0.80-1.88)	0.349
Obesity (BMI>30kg/m²)	Yes vs no	0.82 (0.49-1.37)	0.442
Good subjective health	Good to very good health	1.03 (0.63-1.70)	0.895
	Fair, bad to very bad health	Ref	Ref
History of positive COVID-19 test result	**Yes vs no**	**18.06 (9.49-34.38)**	**<0.0001**
Preventive measure	Strictly followed the measures	Ref	Ref
	Moderately followed the measures	1.48 (0.93-2.35)	0.184
	Insufficiently followed the measures	1.32 (0.76-2.29)	0.730

5.1.2. Factors associated with Having anti-SARS-CoV-2 antibodies in vaccinated population

Potential determinants of having anti-SARS-CoV-2 antibodies in the vaccinated population were also first assessed via a univariate analysis. The results are presented in Table 20. Age, sex, region, level of education, household size, health care worker, being overweight or obese were not significantly associated with having anti-SARS-CoV-2 antibodies in vaccinated population. The odds of having anti-SARs-CoV-2 antibodies is lower among vaccinated people with a least one chronic disease (OR 0.30; 95%CI 0.12-0.76) compared to those without chronic disease. Further research is needed to explore if this could be related to a lower immune response of people with certain chronic diseases. Furthermore, the odds of having anti-SARS-CoV-2 antibodies is higher in people who had received a nucleic acid vaccine compared to those who received a viral-vectored vaccine (OR 3.87; 95%CI 1.05-14.22) or had been vaccinated against influenza in 2020-2021 (OR 2.62; 95%CI 1.06-6.49). However, no association was found with the number of days since the last COVID-19 vaccination.

Table 20 | Factors associated with having anti-SARS-CoV-2 antibodies in vaccinated population (aged 18 years and above) using a univariate logistics regression, SalivaHIS study, Belgium 2021

Variable	Categories	OR (CI95%)	p-value
Socio-demographics			
Age		0.98 (0.96-1.01)	0.133
Gender	Man	Ref	Ref
	Woman	1.32 (0.57-3.12)	0.509
Region	Flanders	Ref	Ref
	Brussels	2.27 (0.78-6.60)	0.058
	Wallonia	0.81 (0.30-2.15)	0.167
Education	<= Secondary	Ref	Ref
	Bachelor	1.54 (0.51-4.70)	0.799
	>= Master	1.78 (0.50-6.32)	0.561
Household size	1 – 6 member(s)	1.08 (0.78-1.50)	0.635
Health care worker	Yes vs no	0.99 (0.31-3.13)	0.987
Health status			
At least one chronic disease	**Yes vs no**	**0.30 (0.12-0.76)**	**0.012**
At least two chronic diseases	Yes vs no	0.81 (0.18-3.72)	0.788
Overweight (BMI>25-30kg/m²)	Yes vs no	0.59 (0.23-1.48)	0.258
Obesity (BMI>30kg/m²)	Yes vs no	1.02 (0.36-2.88)	0.973
Covid-19 related health factors			
Type of vaccination	**Nucleic acid**	**5.10 (1.89-13.79)**	**0.001**
	Viral-vectored	Ref	Ref
Influenza vaccine in 2020-2021	**Vaccinated**	**2.62 (1.06-6.49)**	**0.037**
	Not vaccinated	Ref	Ref
Number of days since the last vaccination		1.00 (0.99-1.02)	0.496

All variables found to be significantly associated with having anti-SARS-CoV-2 antibodies in the univariate analyses for vaccinated population were modeled in a multivariate model (Table 21). The results showed that after adjustment for the other variables, the presence of at least one chronic disease (OR 0.21; 95%CI 0.12-0.76), the type of vaccine received (OR 5.79; 95%CI 1.81-18.50) and the influenza vaccination in 2020-2021 (OR 4.57; 95%CI 1.55-13.46) remained significantly associated with having anti-SARS-CoV-2 antibodies.

Table 21 | Factors associated with having anti-SARS-CoV-2 antibodies in the vaccinated population (aged 18 years and above) using a multivariate logistics regression, SalivaHIS study, Belgium 2021

Variable	Categories	OR (CI95%)	p-value
Age		0.97 (0.93-1.00)	0.057
Gender	Man	Ref	Ref
	Woman	1.12 (0.45-2.77)	0.813
Region	Flanders	Ref	Ref
	Brussels	2.05 (0.59-7.10)	0.272
	Wallonia	1.21 (0.40-3.66)	0.739
At least one chronic disease	**Yes vs no**	**0.21 (0.12-0.76)**	**0.004**
Type of vaccination	**Nucleic acid**	**5.79 (1.81-18.50)**	**0.003**
	Viral-vectored	Ref	Ref
Influenza vaccine in 2020-2021	**Vaccinated**	**4.57 (1.55-13.46)**	**0.006**
	Not vaccinated	Ref	Ref

5.1.3. Factors associated with having anti-SARS-CoV-2 antibodies among the not vaccinated population

Finally, factors associated with having anti-SARS-CoV-2 antibodies among the not vaccinated population (Table 22) were investigated. Therefore, the same variables as the ones considered in the analysis for the total study population were assessed, with the exception of the vaccination status.

In the univariate analyses, first the association with socio-demographics variables was investigated. The results revealed that only being a woman (OR 1.46; 95CI% 1.01-2.10) and the household size (OR 1.29; 95%CI 1.09-1.53) were positively associated with having anti-SARS-CoV-2 antibodies. Age, region, education and health care worker were not significantly associated with having anti-SARS-CoV-2 antibodies. Regarding the factors related to the health status, only having a non-O blood type (OR 1.81; 95%CI 1.10-2.98) and a positive rhesus factor were associated with having anti-SARS-CoV-2 antibodies. More specifically, having anti-SARS-CoV-2 antibodies is negatively associated with a positive rhesus factor (OR 0.49; 95%CI 0.24-0.99). The presence of at least one chronic disease and being overweight or obese were not significantly associated with having anti-SARS-CoV-2 antibodies and there was neither an association with subjective health. Conversely, except for the adherence to preventive measures and being vaccinated against the influenza in 2020-2021, all COVID-19 related variables were found to be significantly associated with having anti-SARS-CoV-2 antibodies. This applied more specifically to having been in close contact with a positive person (OR 3.25; 95%CI 2.07-5.12) and having had a history of a positive COVID-19 test result (OR 17.53; 95%CI 10.10-30.40).

Table 22 | Factors associated with having anti-SARS-CoV-2 antibodies in the not vaccinated population (aged 18 years and above) using a univariate logistics regression, SalivaHIS study, Belgium 2021

Variable	Categories	OR (95%CI)	p-value
Socio-demographics			
Age		0.99 (0.98-1.00)	0.147
Gender	Man	Ref	Ref
	Woman	**1.46 (1.01-2.10)**	**0.045**
Region	Flanders	Ref	Ref
	Brussels	1.55 (0.99-2.42)	0.145
	Wallonia	1.25 (0.74-2.10)	0.994
Education	<= Secondary	Ref	Ref
	Bachelor	1.27 (0.80-2.00)	0.237
	>= Master	0.97 (0.60-1.55)	0.487
Household size	**1 - 6**	**1.29 (1.09-1.53)**	**0.003**
Health care worker	Yes vs no	0.99 (0.38-2.57)	0.975
Health status			
At least one chronic disease	Yes vs no	1.29 (0.78-2.13)	0.328
At least two chronic diseases	Yes vs no	1.14 (0.42-3.10)	0.793
Overweight	Yes vs no	1.13 (0.76-1.67)	0.553
Obesity	Yes vs no	0.99 (0.57-1.75)	0.985
Blood type	O bloodtype	Ref	Ref
	Non- O blood type	**1.81 (1.10-2.98)**	**0.019**
Rhesus	**Positive**	**0.56 (0.32-0.99)**	**0.045**
	Negative	Ref	Ref
Subjective health			
Good subjective health	Good to very good health	1.23 (0.67-2.27)	0.505
	Fair, bad to very bad health	Ref	Ref
Long term limitation (GALI)	Limited	0.65 (0.31-1.36)	0.250
	Not limited	Ref	Ref
COVID-19 related health factors			
Influenza vaccine in 2020-2021	Vaccinated	0.84 (0.45-1.57)	0.590
	Not vaccinated	Ref	Ref
Close contact with COVID-19 positive person	**Yes vs no**	**3.25 (2.07-5.12)**	**<0.0001**
	I don't know	1.27 (0.69-2.31)	0.201
History of positive COVID-19 result	**Yes vs no**	**17.53 (10.10-30.40)**	**<0.0001**
Preventive measures	Strictly followed the measures	Ref	Ref
	Moderately followed the measures	1.27 (0.69-2.32)	0.871
	Insufficiently followed the measures	1.50 (0.80-2.80)	0.223

As done previously, all variables found to be significantly associated with having anti-SARS-CoV-2 antibodies in the univariate analyses were modeled in a multivariate model (Table 23). After adjustment for cofounding, the results showed that having a non-O blood type is positively and significantly associated with having anti-SARS-CoV-2 antibodies. The results also showed that a history of a positive COVID-19 test (OR 14.36; 95%CI 5.84-35.27) is significantly associated with having anti-SARS-CoV-2 antibodies.

Table 23 | Factors associated with having anti-SARS-CoV-2 antibodies in the not vaccinated population (aged 18 years and above) using a multivariate logistics regression, SalivaHIS pilot study, Belgium 2021

Variable	Categories	OR (95%CI	p-value
Age		0.99 (0.97-1.01)	0.355
Gender	Man	Ref	Ref
	Woman	1.58 (0.80-3.13)	0.191
Region	Flanders	Ref	Ref
	Brussels	0.89 (0.38-2.10)	0.982
	Wallonia	0.77 (0.32-1.88)	0.641
Household size	1 - 6	1.30 (0.96-1.77)	0.092
Bloodtype	O blood type	Ref	
	Non- O blood type	**1.95 (1.04-3.68)**	**0.038**
Rhesus	Positive	0.58 (0.25-1.32)	0.191
	Negative	Ref	Ref
Close contact with COVID-19 positive person	Yes vs no	1.27 (0.64-2.53)	0.256
	I don't know	0.74 (0.31-1.75)	0.305
History of positive COVID-19 test result	**Yes vs no**	**14.36 (5.84-35.27)**	**< 0.0001**

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6. Perceived, mental and social health of the study population during the study period (March-August 2021)

6.1. PERCEIVED HEALTH

Key findings

- 17.9% of the study population aged 18 and above reports a poor subjective health.
- In general, the prevalence of poor subjective health, of having chronic health conditions or having limitations due to health conditions is lower in the SalivaHIS study than in the HIS 2018.
- Poor subjective health is most reported in the two oldest age groups: 23.8% of the 50-69 year-old and 33.9% of the 70 years and above.

This section of the report contains findings related to self-perceived health, based on the Minimum European Health Module (MEHM) (14). This set of three questions is also included in the Belgian HIS 2018 (5), the European Health Interview Survey (EHIS) (15) and the EU Statistics on Income and Living Conditions (EU-SILC) (16), and is thus used in all EU Member States to collect data on self-perceived health in the general population.

The aim of the MEHM is to obtain information about 3 health domains based on three indicators: subjective health, chronic health conditions and long term limitations.

Subjective health

The indicator of subjective health is based on the individual's own assessment of his or her health condition. This indicator is based on the WHO recommendations (17), it is a global approach that includes the physical, mental and social dimensions of health.

The subjective heath indicator is based on the question: "How is your health in general?" with the five answering categories: "very good – good – fair – bad – very bad". The indicator is dichotomized to represent "poor health" (i.e., very bad, bad or fair) on the one hand, and "good health" (i.e., good or very good) on the other hand.

Chronic health conditions

This indicator defines the prevalence of chronic health conditions in the population. Chronic health conditions affect the health-related quality of life and are an important cause of the utilisation of health services.

The defining chronic health conditions indicator is based on the question: "Do you suffer from any chronic (long standing) illness or condition (health problem)?", with answer categories "yes" and "no".

Long term Limitations

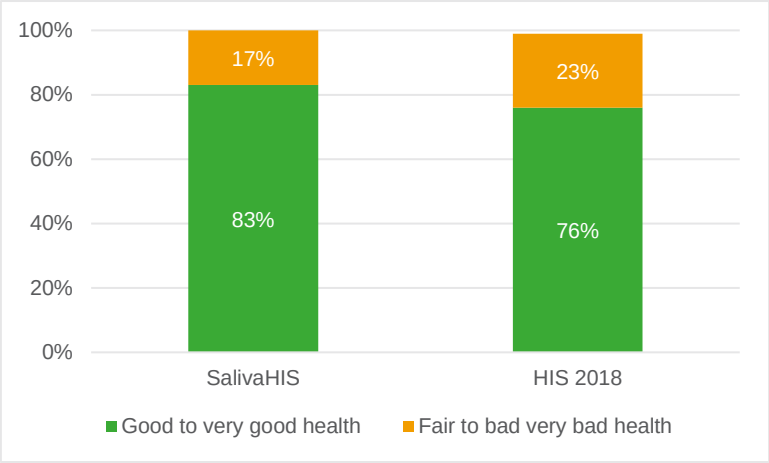
Also known as the Global Activity Limitation Indicator (GALI) (18), this indicator allows to estimate the prevalence of perceived health-related limitations that people may experience in carrying out their usual activities.

The GALI indicator is based on the question: "Since at least the past 6 months, have you been limited because of a health problem in activities people usually do?", with the following answer categories: "yes, strongly limited – yes, limited – no, not limited". The indicator is dichotomized into "limited" (I.e., yes, strongly limited or yes limited) and "not limited (i.e.; no, not limited).

6.1.1. Prevalence

The results in Figure 14 show that 17.9% of the study population aged 18 and above reported being in poor health, which is lower compared to the HIS 2018 results (23.0%).

Figure 14 | Distribution of the study population (18 years and above) according to subjective health (poor health vs. good health), by survey, SalivaHIS study and HIS 2018, Belgium 2021



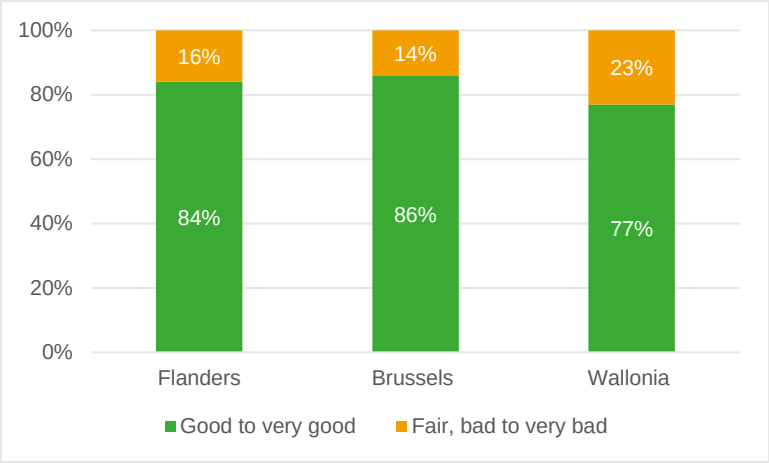
Besides, 25.4% of the population reported having a chronic health condition and 14.2% indicated having a long term limitation due to their health conditions. These numbers are lower in comparison to the results from the HIS 2018 (29.3% reported chronic health conditions and 22.6% indicated having a long term limitation due to health conditions).

The results indicate that the SalivaHIS study is biased towards a healthier population than the HIS population. It can be explained by the fact that participants actively had to take their saliva sample themselves, fill in the questionnaire without any assistance, and take action to return their sample via the post. In the HIS 2018 participation is guided by an interviewer, who visits selected people at home. This approach guarantees that relatively more ill people or people with limitations participate.

6.1.2. Regional differences

As shown in Figure 15, poor subjective health is more often reported in Wallonia (23.3%) than in Flanders (15.6%) (significant after correction for age and sex, except for Brussels) and Brussels (14.2%).

Figure 15 | Distribution of the study population (18 years and above) according to subjective health (poor health vs good health), by region, SalivaHIS study, Belgium 2021



In addition, 32.8% of the study population in Wallonia reports having chronic health conditions, which is the highest of the three regions (21.5% in Flanders and 24.7% in Brussels). Finally, 16.7% of the study population in Wallonia reports having a limitation due to a chronic health conditions, which is the highest of the three regions (13.2% in Flanders and 11.3% in Brussels).

The regional differences observed in the SalivaHIS study population are similar as the ones observed in the HIS 2018.

6.1.3. Distribution by age and by sex

Poor subjective health is most prevalent in the two oldest age groups: 23.8% of the 50-69 year-old and 33.9% of the 70 years and above. Chronic conditions are also more frequently reported among these age groups (36.3% of the 50-69 year-old and 36.6% of the 70 years and above) and so are the limitations due to chronic health conditions (17.6% of the 50-69 year-old and 27.8% of the 70 years and above). The differences between the four age groups is statistically significant for the subjective health , chronic conditions and limitations due to chronic disease.

Women report more often a poor health than men (18.8% vs.16.9%, ns), but regarding the reporting of chronic diseases or limitation due to chronic diseases, no gender disparities was observed.

6.2. MENTAL HEALTH

Key findings

During the time period of the total study, among the population aged 18 years and above…:

- Nine out of ten (89.0%) report to be (fairly to highly) satisfied with their current life;
- A majority (86.5%) are exempt of depressive and anxiety disorders.

However…:

- 11.0% reports being (very) unsatisfied with their life;
- 10.5% presents symptoms of an anxiety disorder;
- 8.6% suffers from a depressive disorder;
- 12.0% reports having mental health problems that disrupt their daily life and social activities.

Some population differences emerge:

- High life satisfaction and good mental health are more common in Flanders and least common in Brussels;
- Elderly people (70+ years old) are more often in good mental health than those from younger age groups;
- Relatively more women (especially under 30) than men experience anxiety (no difference for depression);
- Anxiety and/or depression appear more often among the lower educated;
- People living together with a partner are less often affected by anxiety and depression than people living in other household types.

This section considers some aspects of the population's mental health and well-being that can be hampered due to the COVID-19 crisis and its impact on people's lives. Three aspects were taken into account in the survey: global life satisfaction, anxiety disorders and depressive disorders.

Life satisfaction

Life satisfaction is a key dimension of subjective well-being. It is measured using an 11-point intensity scale ranging from 0 = *not satisfied at all* to 10 = *extremely satisfied*. The indicators show: 1. the average life satisfaction within a population, and 2. the percentage of the population falling in the categories of "low" satisfaction (0 to 5), "fair to good" satisfaction (6 to 8) and "high" satisfaction (9 and 10).

Anxiety disorders

Anxiety can be a normal reaction to stressful circumstances. It is considered a disorder when anxiety is disproportionate to the situation (real or projected) or when the fears persist for several months and cannot be controlled. Anxiety disorders prevent people from functioning properly in their daily lives and social interactions. Anxiety disorder in the previous two weeks was measured using the GAD-7 (19). The indicator presented hereafter refers to the point prevalence of generalized anxiety in the population aged 18 years and above.

Depressive disorders

There are different types of depressions, with similar symptoms but varying in number, timing, severity, persistence and course. They involve impaired functioning characterized by a drop in mood (ex. sadness) and/or a loss of interest or pleasure in activities, a loss of energy, self-esteem and/or concentration, as well as feelings of guilt, sleep disturbances, weight changes and/or thoughts of death. Depressive disorders in the two weeks preceding the survey completion were assessed with the PHQ-9 (20). The indicator shows the percentage of the population aged 18 years and above who suffered from major depression or other depressions.

Impact on daily functioning

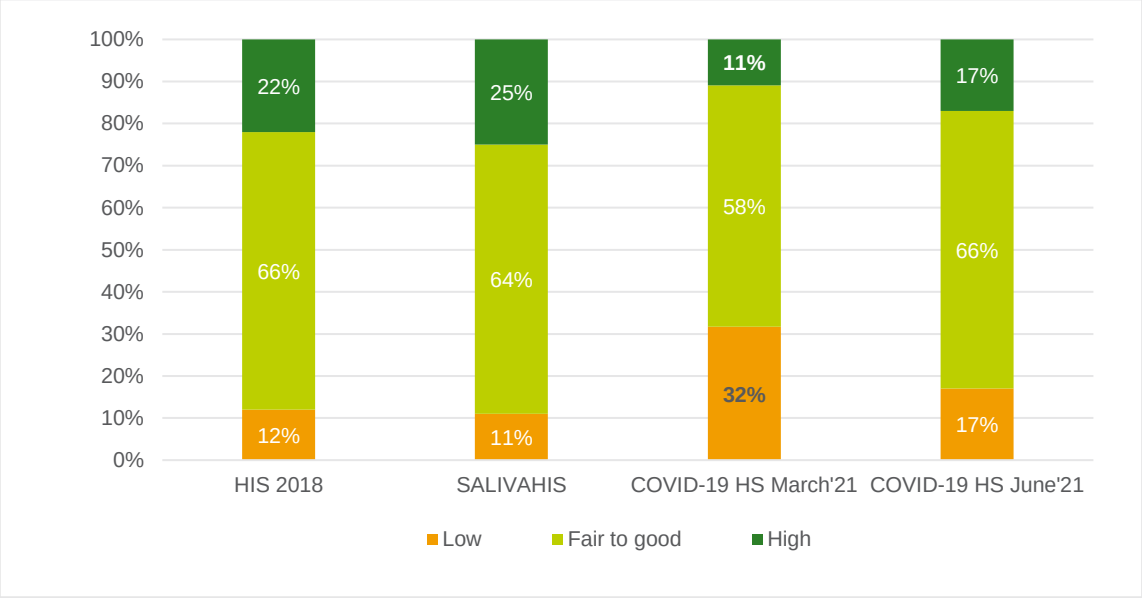
The last indicator of this section estimates the extent to which individuals were impeded in their daily activities and relationships as a result of their symptoms (if any). It is a proxy for impact of the disorders and varies from 0 = *did not disturb* to 4 = *disturbed very much* their daily activities and social contacts. People who did not suffer from mental disorders were included in the analyses as not being disturbed in their daily and social activities.

6.2.1. Life satisfaction

The results display an average life satisfaction of 7.4 among the adult population with scores ranging from 0 to 10 and a median score of 7.2. The average life satisfaction in this study corroborates the result obtained in 2018 from the national health interview survey (mean = 7.4 among the 18 years and above). However, these results are slightly higher than the average satisfaction obtained in the COVID-19 health surveys (COVID-19 HS) that were carried out in March 2021 (mean = 6.2) and in June 2021 (mean = 6.9).

Figure 16 illustrates that most people report a 'fair to good' level of life satisfaction (64.2%), while nearly one in four (24.7%) indicates being highly satisfied with life at the time of the survey. A smaller group of people (11.1%) regard their life as (very) dissatisfying. Again, these results tend to better reflect the situation in 2018 than what was observed from the COVID-19 health surveys carried out in March and June 2021 (Figure 16).

Figure 16 | Distribution of the study population (18 years and above) according to their level of life satisfaction (low, fair to good, high), by survey, HIS 2018, SalivaHIS study, 6th & 7th COVID-19 health surveys, Belgium 2021



6.2.2. Mental health disorders

In total, 10.5% of the adults presented symptoms of an anxiety disorder and 8.6% presented those of a depressive disorder. Because some people suffer from both anxiety and depression (here, 5.7% comorbid cases), the share of the population with any one of these mental health problems at the moment of the survey was 13.5%. These prevalence numbers are closer, and even slightly lower, than those of the HIS2018 (11.4% for anxiety and 9.5% for depression) and those from the COVID-19 health surveys in March 2021 (21.2% for anxiety and 21.3% for depression) or June 2021 (16.3% and 15.1% respectively). Finally, 12.4% of the population report that their daily functioning and relationships are (very) much affected by their mental health condition.

6.2.3. Regional differences

Regarding life satisfaction, Flanders shows a better outcome in comparison to the two other regions (significant after correction for age and sex) with a higher proportion of individuals being very satisfied with their life (27.6%) and much fewer who claim being unsatisfied (7.1%) (Figure 17). Beside inter-regional comparison, the largest intra-regional inequality in the distribution of individuals according to their life satisfaction level is found in Wallonia, with 21.2% being very satisfied with their life versus 17.2% being (very) unsatisfied.

Figure 17 | Distribution of the study population (18 years and above) according to their level of life satisfaction (low, fair to good, high) by Region, SalivaHIS study, Belgium 2021

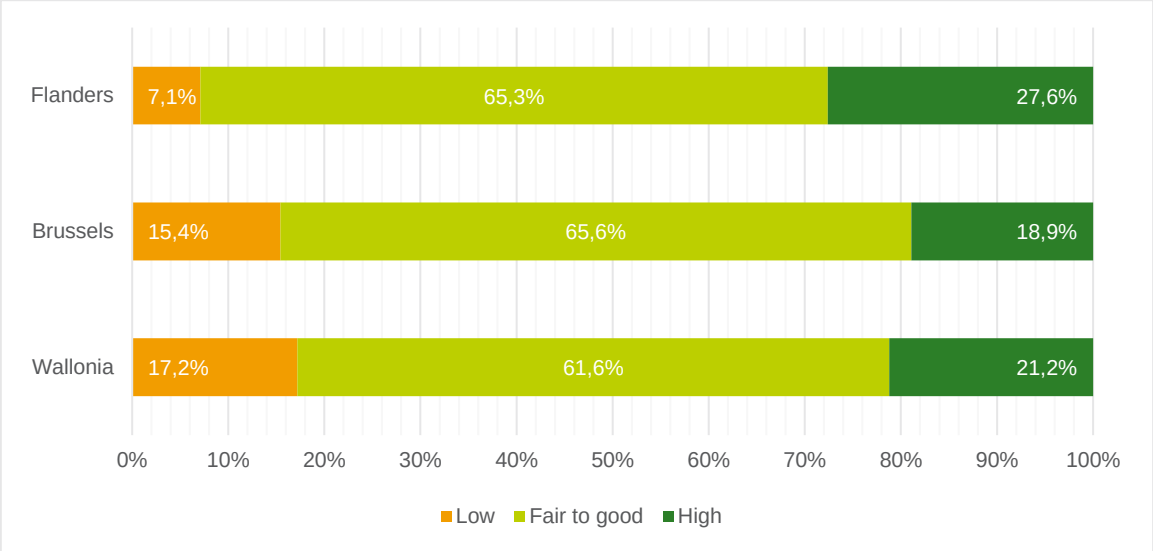
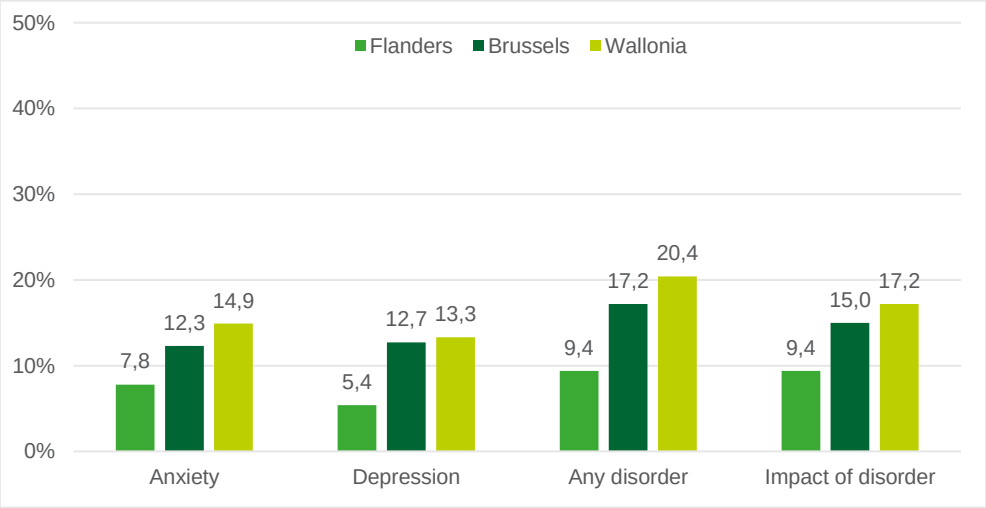


Figure 18 | Percentage of the study population (18 years and above) with mental disorders and percentage of the study population for whom their mental condition impacts their daily activities and relationships, by Region, SalivaHIS study, Belgium 2021



Flanders' residents are also significantly fewer than those of the other two regions to suffer from anxiety and/or depression and having their daily activities and social relations disturbed by such disorders (Figure 18). Differences between regions are statistically significant after correction for age and sex for all indicators.

6.2.4. Distribution by age and sex

The age and sex distribution of individuals who exert low or high life satisfaction are shown in Figure 19. Regardless of age, men are a less often dissatisfied (10.2%) and more often very satisfied (28.0%) with their life than women are (respectively 11.9%, n.s. and 21.6%). In both genders, dissatisfaction with life tends to decrease with age, while high satisfaction with life clearly increases with age. However, the age slope varies among men and women, as seen in the graph below.

Figure 19 | Percentage of the study population (18 years and above) with low and with high life satisfaction, by age and sex, SalivaHIS study, Belgium 2021

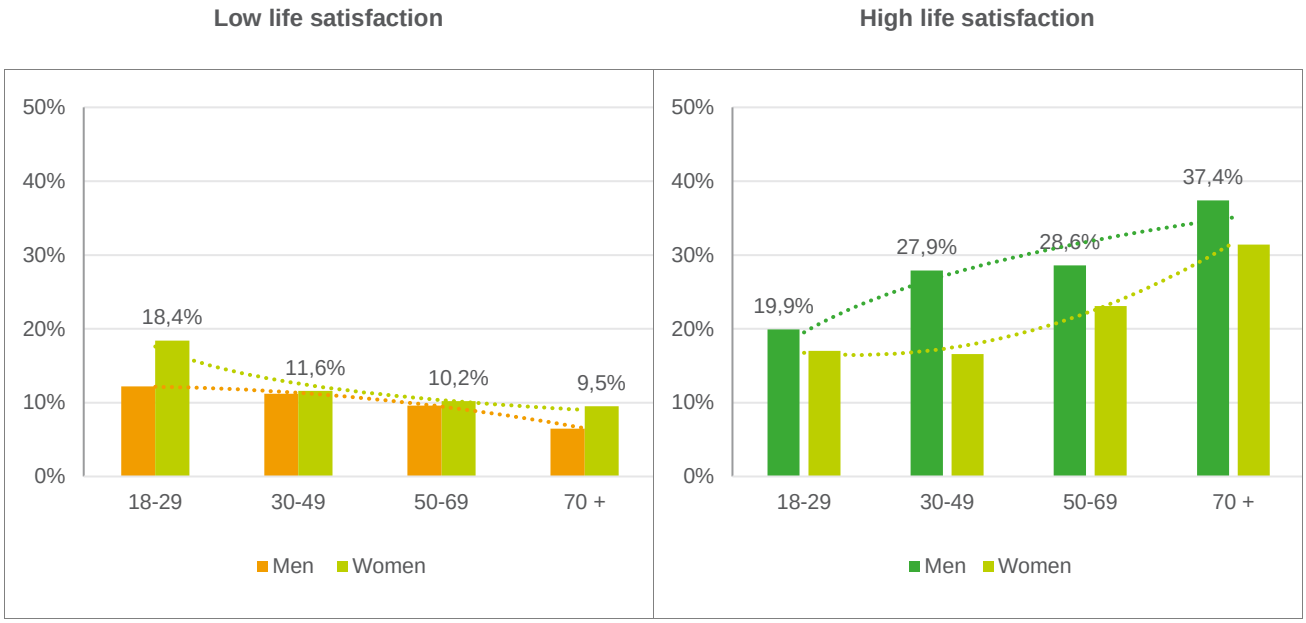
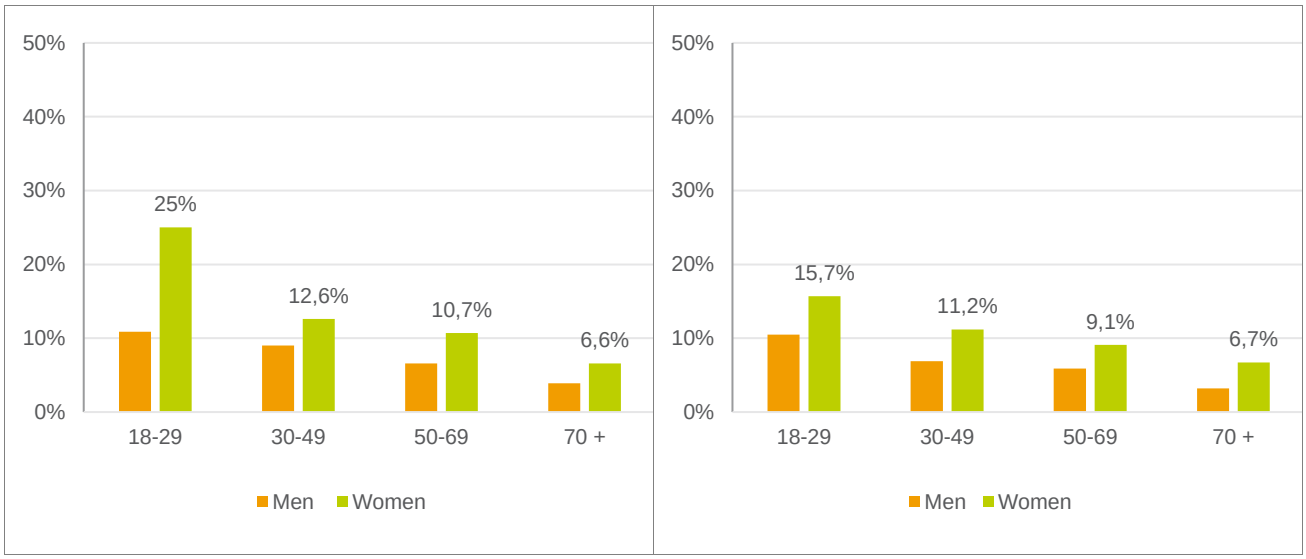


Figure 20 | Percentage of the study population (18 years and above) with anxiety or depressive disorders, by age and sex, SalivaHIS study, Belgium 2021



Concerning mental disorders, women are more vulnerable to anxiety than men, with a significant overall difference in prevalence (7.9% men for 13.1% women). Under the age of 30, one in four women present anxiety symptoms (25.0%) for half as many men (10.9%) (Figure 20). There is also a significant age trend in the mental health status of men and women. As for anxiety, the prevalence of depression is highest among young men (10.5%) and young women (15.7%) and declines with age in both genders.

The impact of mental conditions on the daily and social activities are also function of age and gender. Younger men are more often affected in their social and daily activities (16.6% of the 18-29 years) than the older men (e.g. 4.5% of the 70+). Age is also discriminant in women: the younger reported more often that their symptoms interfered with their life (26.9%) than those of the older age groups (e.g. 8.8% of the 70+).

6.2.5. Evolution over time

In order to examine the possible changes in mental health during the study period, an indicator was created based on the reception date of the survey questionnaires and saliva samples. Two time periods were defined using the median of these dates. The two periods correspond roughly to the spring period and the summer period.

It was observed that the percentage of people who present anxiety problems is less important during the summer period (9.4%) compared to the spring period (11.5%) but the difference is not statistically significant, also after adjustment for age and sex. Depression is a little more common during the summer period (9.1%) than during the spring period (8.2%) but here again, the difference is not significant, even after adjustment for age and sex.

6.2.6. Vulnerability and protective factors

Mental disorders are not equally distributed in the population. A number of resources play in favor of maintaining good mental health despite difficult times, while others constitute fertile grounds for psychic decompensation. This study points out to the following results with regard to the presence of any of the two disorders considered, i.e. anxiety and/or depression:

- Living together with a partner is favorable to resilience during this crisis: 10.4% who live as a couple without children and 11.7% who live as a couple with children meet the threshold for anxiety and/or depressive disorders, while these disorders are more frequent among people living alone (16.3%), alone with children (29.6%) and living with parents (23.9%). These differences in proportions remain significant after correction for age and sex.
- Education is also associated with better resilience, as illustrated by the following trend: people who have a master's degree or higher suffer proportionally less from anxiety and/or depression (11.3%) than those with a bachelor's degree (13.6%, n.s.) or those with at most a secondary education (14.7%, p=0.004).
- The proportion of individuals with a mental disorder is higher among students (29.6%, p=0.005) or disabled people (45.5%, p<0.0001) than among the working class (13.3%) or the retired (8.3%).
- The relative number of individuals with disorders is higher among those who have experienced a financial loss due to the COVID-19 crisis (17.6%, p=0.015) than among those who did not report such a loss (11.6%).
- People working in the health care sector seem to be more prone to mental health problems (18.3%) than the rest of the adult population (13.5%), but the difference is not statistically significant after correcting for age and sex.
- Having had a close friend/family member hospitalized with COVID-19 is associated with a higher prevalence of anxiety and/or depression (18.9% against 12.9%, p=0.02). Anxiety and/or depression is also more frequent amongst people who have lost a close friend/family member due to Covid-19 (21.1% against 12.9%, p=0.002).
- The prevalence of anxiety and/or depression disorders rises as the number of risky physical conditions for severe Covid-19 increases: 12.3% among people with no prior risk condition, 19.3% among those with

one risk condition, 20.7% among those with two risk conditions and 28.1% among those with three or more risk conditions for severe Covid-19.

- Having been infected with COVID-19 did not seem to enhance the likelihood of suffering from anxiety and/or depression (11.9% against 14.4% in those that have not been infected, n.s.).
- The vaccination status: having had at least one dose of a vaccine (against Covid-19) or none at the time of the survey did not discriminate people in terms of mental disorders (respectively 12.0% vs. 15.8%, n.s.) after correction for age and sex.

6.3. SOCIAL HEALTH

Key findings

- 27.2% of the population is dissatisfied with their social contact.
- 22.9% of the population reports a poor social support.
- Compared to before the corona crisis, 11.1% of the population reports a decline in their social support.

This section of the report contains the findings pertaining to social health. It covers the dissatisfaction with social contacts, the degree of perceived social support and feelings of support or loneliness in comparison to before the COVID-19 crisis.

Social contacts

The indicator of satisfaction with social contact is based on a standard question that is also used in the HIS 2018 (5) and in the COVID-19 health surveys: “How do you judge your social contacts in the last 2 weeks?”, with 4 response options: “Really satisfying – Rather satisfying – Rather unsatisfying – really unsatisfying”. The indicator is dichotomized to represent on the one hand people who replied their social contacts were “really” or “rather” satisfying versus people who considered their social contacts as “rather” or “really” unsatisfying”.

Quality of social support

The indicator of quality of social support has been used in the HIS 2018 and in the COVID-19 health surveys. The questions are from the OSLO-scale (11) adding a timeframe of “the last two weeks” in this study: Over the last 2 weeks…, 1) “how many people were so close to you that you could have counted on them if you had had serious personal problems?”, 2) “how much concern and interest have people shown in what you were doing?”, and 3) “how easy would it have been to get practical help from neighbours if you needed it?”.

A summary score, ranging from 3 to 14, can be calculated on the basis of the reply categories, leading to a dichotomised indicator of “poor social support” (score 3 to 8) versus “moderate to strong social support” (score 9 to 14).

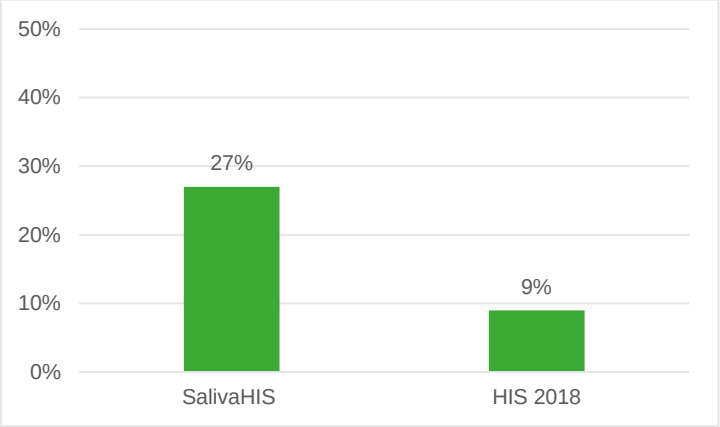
First, the results regarding social health will be observed throughout the whole period from March to August 2021. Second, we will briefly examine whether there are differences between different time sections within this period.

6.3.1. Prevalence

6.3.1.1. Social contacts

In the SalivaHIS study, 27.2% of the population aged 18 and above states being unsatisfied with their social contacts. Nonetheless, the surveys conducted during the COVID-19 crisis generally show higher proportions of people unsatisfied with their social contacts than in "normal times". This is noticeable when the comparison is made with the HIS 2018 where only 8.4% indicated that they were unsatisfied with their social contacts (Figure 21).

Figure 21 | Percentage of the study population (18 years and above) reporting being unsatisfied with their social contacts, by survey, SalivaHIS study and HIS 2018 study, Belgium 2021



The results regarding the dissatisfaction with social contacts by demographic factors (gender and age) displays some disparities.

Women indicate being more often unsatisfied with their social contacts in comparison to men (28.3% vs 26.1%). Concerning the age categories, the highest percentage of dissatisfaction with social contact is found among the 30-49 year-olds (30.7%), followed by the age group of 50-69 years (28.7%).

In addition to analyzing the dissatisfaction with social contacts by demographics, disparities also appear across the regions and in function of the household composition. The population living in Wallonia are most unsatisfied with their social contacts (30.4%) compared to those living in Brussels (28.2%) or Flanders (25.3%).The difference in regions are not statistically significant after correction for age and sex.

Regarding the differences in function of the household composition, people who reported living with a partner without children have the lowest dissatisfaction with their social contacts (24.1%) compared to those living with a partner with children, where 29.9% reported having a dissatisfaction with their social contacts. Among people living alone with children 32.7% report to be dissatisfied with their social contacts, which is comparable with this percentage among people living with their parents, where 33.8% reported to be dissatisfied with their social contacts. Difference in function of the household composition are not statistically significant after correction for age and sex for all indicators.

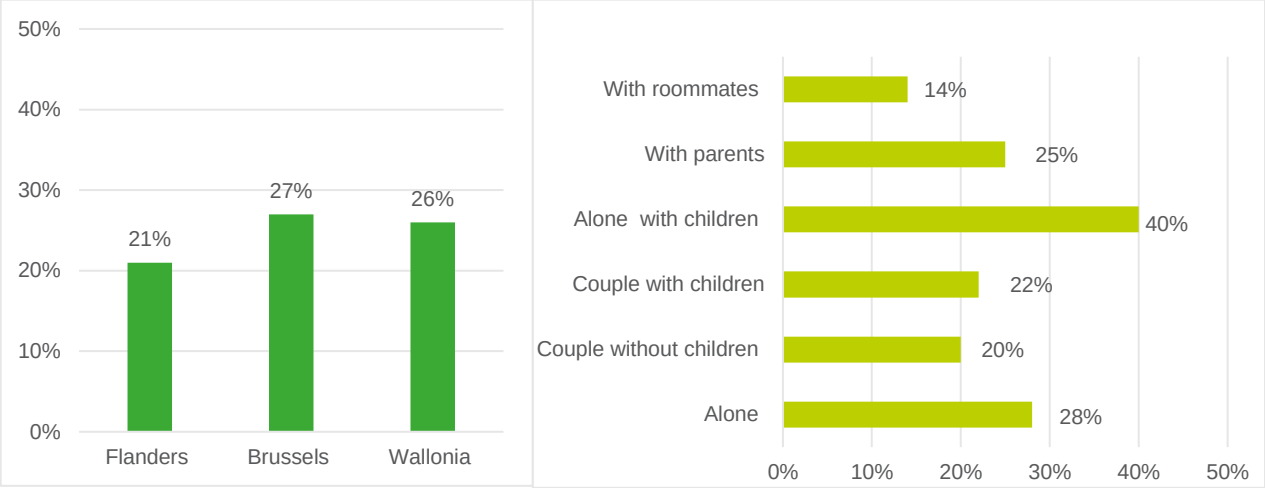
6.3.1.2. Quality of social support

The SalivaHIS results show that 22.9% of the population aged 18 and above report poor social support. In the HIS 2018 this percentage was only 15.6%.

There was no noticeable difference between gender regarding poor social support. Concerning the age categories, the highest percentage of poor social support is found among the 50-69 year old (25.7%), followed by the age group of 70 and above (23.5%).

As show in Figure 22, 27.3% of the population in Brussels indicates having a poor social support, which is similar to the result in Wallonia (25.7%) and higher than for Flanders (20.5%). The difference in regions are statistically significant after correction for age and sex. Regarding the household composition, 39.9% of the people living alone with children reported having a poor social support compared to 22.1% of the people living in couple with children.

Figure 22 | Percentage of the study population (18 years and above) reporting poor social support by region (first) and by household composition (second), SalivaHIS study, Belgium 2021



People were also asked for their perceived social report at the time of the survey compared to before the COVID-19 crisis with as answer categories: much more social support, more social support, no change in social support, less or much less social support. This results show that 11.1% of the population received (much) less social support than before the COVID-19 crisis**.** There is no significant difference by gender. However, there are differences by age group. In particular the youngest age group (18-29 years) reported more frequently (17.3%) than the other age groups that they received (much) less support than before the COVID-19 crisis.

6.3.2. Evolution in social health over time

As for depression and anxiety changes were explored for the satisfaction with social contacts between the first half of the study period (spring period) and the second half (summer period).

Changes were observed for the satisfaction with social contacts: overall, dissatisfaction with social contacts was significantly lower in the summer period compared to the spring period (OR 0.42; 95%CI 0.33 - 0.52). Social support did not show a significant change between the two periods (OR 0.95; 95%CI 0.76 -1.19).

7. Impact of COVID-19 on life and lifestyle (March-August 2021)

7.1. IMPACT OF THE CRISIS IN DIFFERENT LIFE DOMAINS

Key findings

- Among the study population who has a paid job, a majority (69.9%) continued to work under the usual conditions, 28.1% were mainly teleworking and 2.0% have temporarily or permanently lost their jobs.
- In the study population aged 18 years and above, 21.4% declared that they encountered a financial loss as a consequence of the crisis.
- 17.0% had to delay health care during the COVID-19 crisis.

The following results concern the changes that occurred in lifestyle habits since the COVID-19 crisis:

- Among those who use social networks and the internet for their daily tasks, almost half reported having increased the use of these media during the crisis. Only 5.7% of social network users and 2.2% of the internet users for daily tasks reported having decreased their usage.
- A large part of the users have decreased their physical activity (38.6%) and leisure time activity (54.8%) compared to before the crisis.
- 13.7% of the consuming population have increased their consumption of fruit and vegetables and 21.7% have increased their consumption of sweet and salty snacks.
- 24.8% of the people who consume alcoholic beverages indicated that they decreased their consumption since the crisis, while 20.9% have increased it.
- Around one in five people who consume tobacco, illegal drugs, sedatives or antidepressants reported having increased their consumption during the crisis.

The different measures taken by the government during the COVID-19 crisis have had a number of consequences on our daily life habits. This section of the report investigates the potential impact of the COVID-19 crisis on different domains of life, which in turn may influence health outcomes. As part of this study, we were interested in evaluating changes occurring in the participants' work situation, the financial situation, the access to health care and lifestyle.

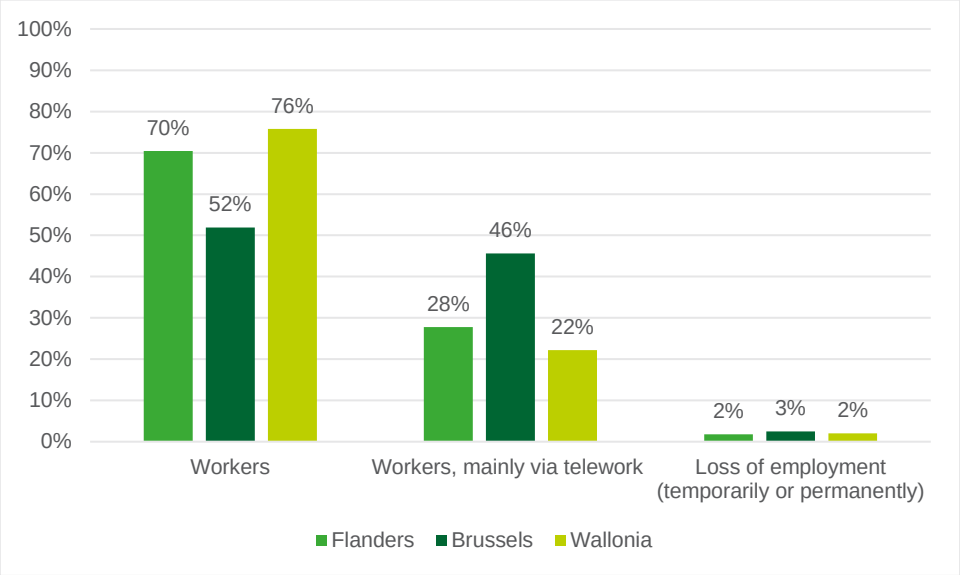
7.1.1. Impact of coronacrisis on work situation

To explore the impact of the SARS-CoV-2 virus on the work situation, participants were first asked about their professional occupation during the COVID-19 crisis. Those who were currently in paid employment were then asked whether the measures taken to limit the spread of the SARS-CoV-2 virus allowed them to continue to work.

As presented in the description of the study population (Table 9), a small majority of the adult population (56.1%) is currently in paid employment.

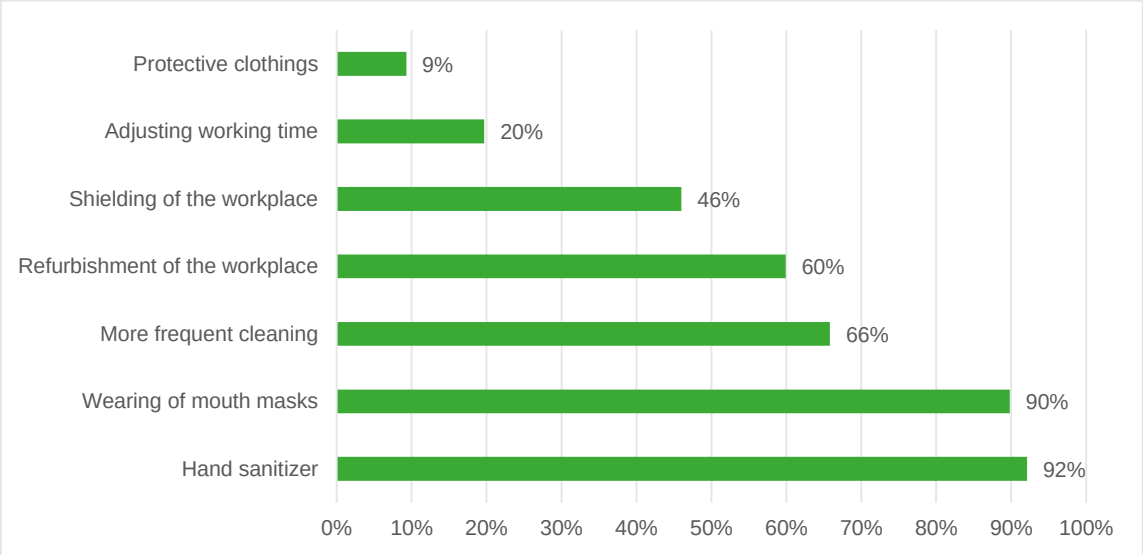
The results illustrated in Figure 24 show that among the study population that has a paid job during the COVID-19 crisis, 69.9% continued to work as under the usual conditions, 28.1% reported being "mainly" teleworking and 2.0% have temporarily or permanently lost their jobs. Almost half of the workers in Brussels (45.6%) were able to continue working mainly via telework. Conversely, only about a quarter of the study population was able to continue working mainly via telework in Flanders (27.8%) and in Wallonia (22.2%).

Figure 24 | Distribution of the working population (18 years and above) according to their employment situation during the COVID-19 crisis, by region, SalivaHIS study, Belgium 2021



Some measures were implemented in the workplace to limit the spread of the SARS-CoV-2 virus (Figure 25). The measures most often encountered in the workplace were: to make hand sanitizers available (92.1%), to wear a face mask (89.8%), to clean more frequently the work area (65.8%), to refurbish the workplace (59.9%) and to implement extra protection at the workplace (e.g. Plexiglas, walkway directions, 46.0%). In total, 97.0% of the working population were satisfied with the measures implemented at their workplaces.

Figure 25 | Percentage of the working population (18 years and above) reporting that the following protective measures were applied at their workplace, SalivaHIS study, Belgium 2021



7.1.2. Impact of the COVID-19 crisis on personnal finances

In order to evaluate the impact of the COVID-19 crisis on their personal financial situation, participants were asked if they had suffered a financial loss due to the pandemic. Three response options were proposed: no financial loss, a financial loss that didn't (yet) put them in difficulty and financial loss that put them in great difficulty. For the purpose of this report, we have combined the two last categories of responses on financial loss.

More than one in five people (21.4%) declared a financial loss as a consequence of the crisis (Table 24). The percentage of the study population financially impacted by the crisis varied by age. Younger people reported more frequently having suffered a financial loss: 30.4% of the 18-29 year-old and 26.7% of the 30-49 year-old declared to have endured a financial loss due to the COVID-19 crisis.

The results do not show a large difference between men and women, however more men than women report financial loss, regardless of the age groups. At the regional level, 23.0% of the population in Flanders declare to have suffered a financial loss as a result of the COVID-19 crisis, followed by 21.2% in Brussels and 18.8% in Wallonia.

Table 24 | Percentage of the study population (18 years and above) that suffered a financial loss, by sex and age, SalivaHIS study, Belgium 2021

Indicator / age group		Women (%)	Men (%)	Total (%)
Financial loss				
Age:	18-29	30.2	30.7	30.4
	30-49	23.4	30.1	26.7
	50-69	16.7	20.5	18.6
	70+	4.2	6.2	5.1
Total:		**19.2**	**23.7**	**21.4**
No financial loss				
Age:	18-29	69.8	69.3	69.6
	30-49	76.6	69.9	73.3
	50-69	83.3	79.5	81.4
	70+	95.8	93.8	94.9
Total:		**80.8**	**76.3**	**78.6**

7.1.3. Impact of the COVID-19 crisis on access to health care

To explore the impact of the COVID-19 crisis on access to health care, participants were asked if they had to delay important but non-urgent care due to restrictions in accessibility to health services. As presented in table 25, 17.0% of the study population confirmed a delay in health care during the COVID-19 crisis.

Although there are no major differences in the delayed care between men (14.8%) and women (19.1%), there are variations between different age groups. Adults aged between 50-69 years (20.3%) and between 30-49 years (17.8%) have more often delayed their health care than the younger age group (11.0% of the 18-29 year-old). Among people over 70, 15.5% had to delay their health care because of the COVID-19 crisis. Interestingly, among the younger age group (18-29 year-old), 16.2% of women had to postpone their care compared to 5.9% of men.

At the regional level, the COVID-19 crisis had a more important impact on delaying health care in Brussels (24.0%) and in Wallonia (22.7%) than in Flanders (12.7%)

Table 25 | Percentage of the study population (18 years and above) that had to delay their health care due to restrictions in accessibility to health services, by sex and age, SalivaHIS study, Belgium 2021

Indicator / age group		Women (%)	Men (%)	Total (%)
Delaying health care				
Age:	18-29	16.2	5.9	11.0
	30-49	19.0	16.6	17.8
	50-69	23.2	17.3	20.3
	70+	15.2	15.9	15.5
Total:		**19.1**	**14.8**	**17.0**
Not delaying health care				
Age:	18-29	83.8	94.1	89.0
	30-49	81.0	83.4	82.2
	50-69	76.8	82.7	79.7
	70+	84.2	84.1	84.5
Total:		**80.9**	**85.2**	**83.0**

7.1.4. Impact of COVID-19 crisis on lifestyle

This section explores potential changes in lifestyle habits during the crisis, and more specifically in the use of social media networks, internet, physical activity and leisure time activities, as well as in the consumption of alcohol, tobacco, illegal drugs, sedatives, antidepressants, fruit and vegetables, and sweet or salty snacks.

The question asked: “Compared to the period prior to the COVID-19 crisis (just before 13 March 2020), have you changed your habits/consumption of (here, the different activities/products considered above).The response categories included: 1. I (re-)started with the crisis / 2. It increased during the crisis / 3. It remained the same as before the crisis / 4. It decreased since the crisis / 5. It stopped since the crisis / 6. Neither before the crisis, nor now. The indicators constructed from these questions are the following:

1. the percentage of current users or consumers (vs. those who “stopped” or “never” used/consumed) in the study population. Current users or consumers are defined as people who (re-)started, increased, continued or decreased their habits during the crisis.

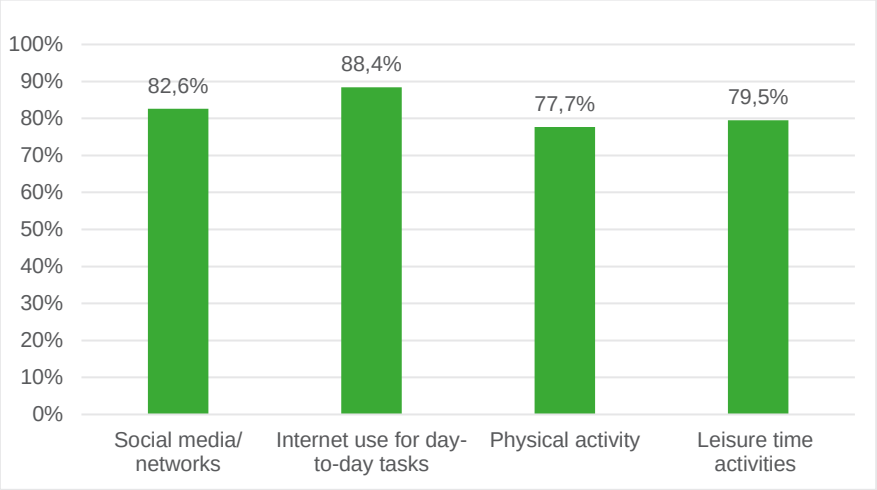
2. the proportion among the users or consumers who have increased (i.e. people who (re-)started or increased during the crisis), decreased (i.e. people who decreased or stopped during the crisis), or maintained (i.e. people whose consumption has remained stable during the crisis) their different lifestyle habits.

7.1.5. Prevalence of current users

At the moment of the survey (March-August 2021), 82.6% of the study population (18 years and above) were currently using social media networks (e.g. Facebook, TikTok, Twitter…) and 88.4% were using internet for day-to-day activities (e.g. shopping, telebanking, administration…).

Furthermore, more than three quarters of the study population was practicing physical activities (77.7%) or had leisure time activities (79.5%) (Figure 26).

Figure 26 | Percentage of the study population (18 years and above) who currently practice the following activities, SalivaHIS study, Belgium 2021

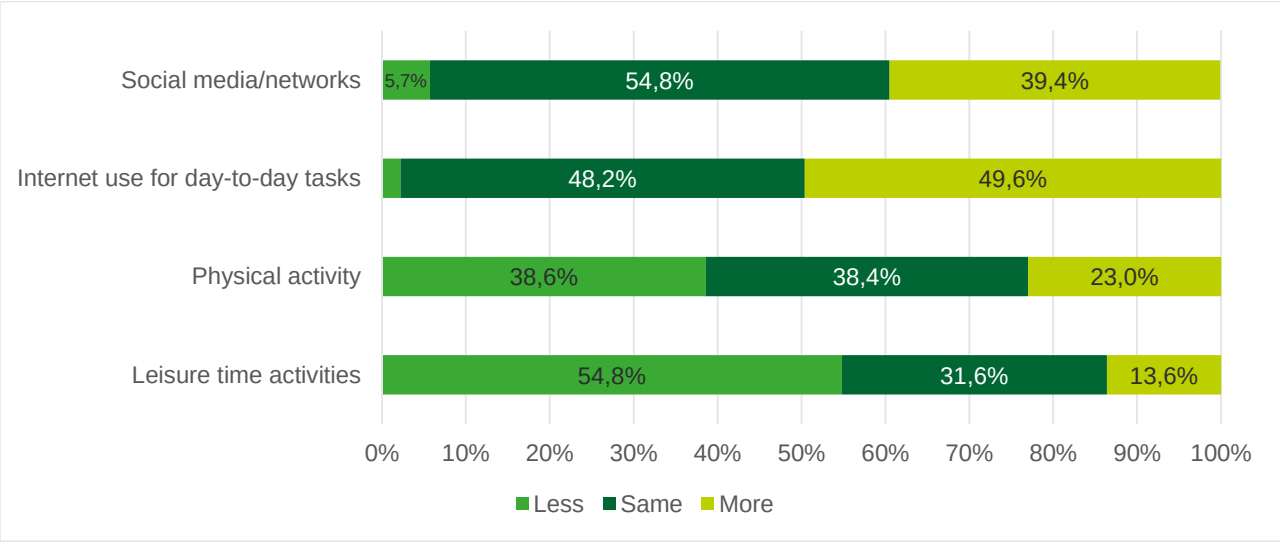


7.1.6. Change in users habits

About half of those who use social networks or the internet for day-to-day tasks indicated using them more often during the crisis than before the start of the crisis (Figure 27). Only 5.7% of social network users and 2.2% of internet users for daily tasks reported having decreased their usage.

The COVID-19 crisis has also influenced the practice of physical and leisure time activities. Nearly 2 out of 5 who practiced physical activity report having reduced it compared to 1 in 5 who report having increased it since the beginning of the crisis. As to leisure time activities, almost 6 in 10 people who did these activities reported having reduced them compared to only 1 in 10 who reported having increased them. As a result, the COVID-19 crisis has a rather negative impact on the behaviors of the study population, as many individuals have increased the time spent behind their screens and have neglected physical and leisure activity practices.

Figure 27 | Distribution of the study population (18 years and above) who currently practice the following activities, according to whether they reduced, maintained or increased their practice since the beginning of the COVID-19 crisis, SalivaHIS study, Belgium 2021



7.1.7. Distribution by age, sex and region

Social media/networks

The analyses concerning behavioral changes among social networks users since the beginning of the crisis show that:

- Almost half of the women (45.4%) have increased their use of social networks since the beginning of the crisis compared to a third of the men (32.9%).
- The 18-29 year-old the most to have increased their use of social networks (45.7%). Very few of the people over 70 declared having decreased their use of social network (1.4%), while 29.9% of them have increased their use.
- Changes in the use of social networks are most often observed in Brussels, where 49.9% have increased their use of social networks compared to 7.2% who have reduced their use.

Internet use for day-to-day tasks

The socio-demographic analyses in the behavioral changes among of the users of the Internet for day-to-day tasks since the beginning of the crisis show that:

- As for the use of social networks, women have increased the most their use of the Internet for day-to-day tasks (54.2%) compared to men (45.0%).
- The proportion of users aged 18-29 and 30-49 years who reported having increased their internet use (57.1% and 56.0% of users respectively) is greater than those who report no change in their use (39.9% and 42.3% of users respectively). The situation is reversed for people over 50, where internet use has not changed since the crisis for the majority of users: 52.3% of the 50-69 year-old and 67.7% of the 70 years and above did not change their use of the internet for their daily tasks.
- Changes in the use of internet are most often observed in Brussels, where 56.9% have increased their use of internet compared to 0.5% who have reduced their use.

Physical activity

Some trends were observed for physical activity practices since the beginning of the crisis:

- There was no substantial difference regarding changes in physical activity practices for men and women.
- Physically active people aged 18-29 (39.8%) and 30-49 (40.0%) were the most to have decreased their activity. It is also in these age groups that the most have increased their physical activities (respectively 30.4% and 26.8%). A third of active people of 70 years and above (36.0%) have decreased their physical activity.
- People living in Brussels and Wallonia have decreased their physical activity the most (with 49.3% and 45.5% respectively) compared to 33.3% of people living in Flanders.

Leisure time activities

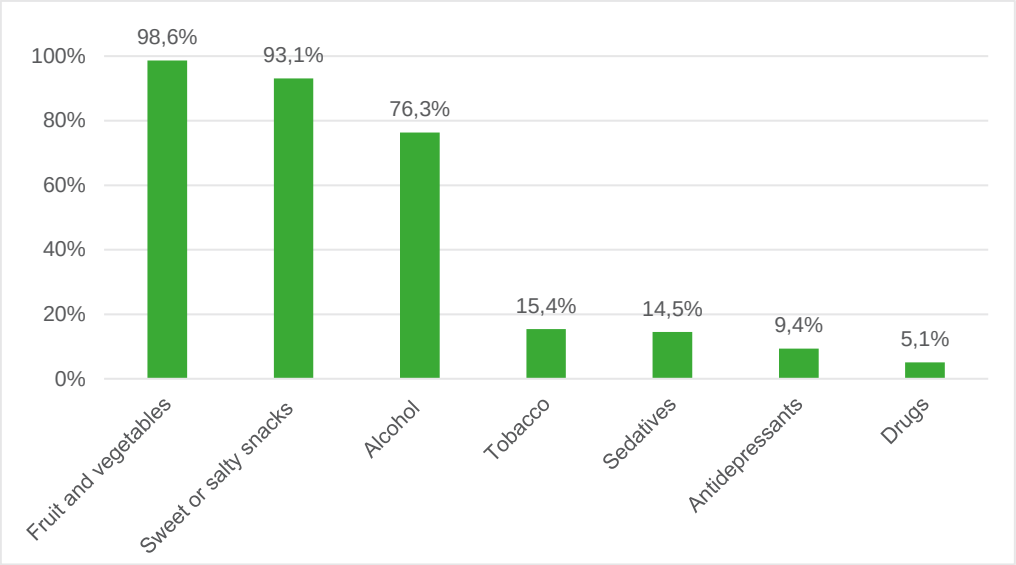
The results regarding changes since the beginning of the crisis in leisure time activities among those who currently practice them show that:

- More women (57.6%) than men (51.8%) have decreased their leisure activities.
- The tendency to decrease leisure activity practices as compared to maintaining or increasing them is observed in all age groups. People aged 30-49 years and 70 years or older were the most to have reduced their activity (respectively 57.0% and 56.6%).
- More people living in Brussels (66.1%) and Wallonia (66.3%) declare to have reduced their leisure activities compared to 46.8% in Flanders.

7.1.8. Percentage of current consumers

At the time of the survey (March-August 2021), almost all the study population (18 years and above) consumed fruit and vegetables (98.6%), but this was also the case for sweet or salty snacks (93.1%). In addition, more than three quarters (76.3%) of the study population consumed alcohol, 15.4% smoked tobacco, 14.5% took sedatives, 9.4% took antidepressants and 5.1% consumed illegal drugs (Figure 28).

Figure 28 | Percentage of the study population (18 years and above) who currently consume the following products, SalivaHIS study, Belgium 2021



7.1.9. Changes in consumption habits

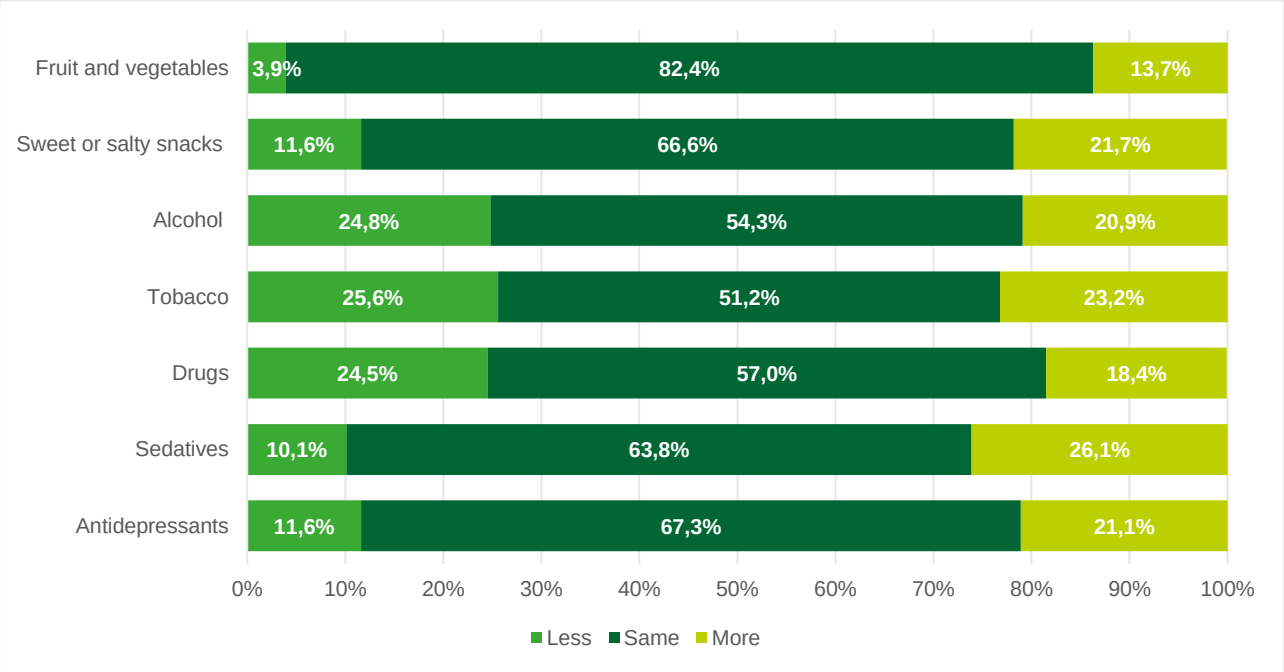
As presented in Figure 29, the COVID-19 crisis has not had a major influence on the eating habits of the study population. The consumption of fruit and vegetables remained stable since the crisis began for 82.4% of the study population, and so did the consumption of sweet or salty snacks (for 66.6%).

Consumption habits of alcohol, tobacco and drugs during the crisis appeared to remain stable among more than half of the consumers (54.3%, 51.2% and 57.0% respectively). Nearly one out of four people also declared that they reduced their consumption since the beginning of the crisis, with respectively 24.8% for alcohol, 25.6% for tobacco and 24.5% for drugs. However, 20.9 % of alcohol consumers have increased their consumption since the beginning of the crisis, as well as 23.2% of smokers have increased their use of tobacco and 18.4% of drugs consumers have increased their use of drugs.

Concerning the use of sedatives or antidepressants, well over 3 out of 5 people have not changed their consumption habits since the beginning of the crisis, but 26.1% of consumers of sedatives have increased their consumption and 21.1% of consumers of antidepressants have increased their consumption.

As a result, the SARS-CoV-2 crisis has had various influences, both positive and negative on consumer habits.

Figure 29 | Distribution of the study population (18 years and above) who currently consume the following products, according to whether they reduced, maintained or increased their consumption since the beginning of the COVID-19 crisis, SalivaHIS study, Belgium 2021



7.1.10. Distribution by age, sex and region

Eating habits: fruit and vegetables and salty or sweet snacks

The results show that eating habits have remained relatively the same since the beginning of the crisis. The changes by socio-demographic characteristics are as follows:

- There was no substantial difference regarding changes in eating habits for men and women.
- Consumers aged 18-29 increased their consumption of fruit and vegetables the most during the crisis (19.4%). However, consumers aged 18-29 are also those who have increased their consumption of salty and sweet snacks the most (32.5%).
- In Brussels, consumers have most frequently increased their consumption of fruit and vegetables (15.6%), but also their consumption of salty and sweet snacks (25.6%).

Alcohol

The socio-demographic analyses regarding the change of the consumption of alcohol among consumers since the beginning of the crisis show us that:

- Although there is no gender difference among those who have increased their drinking habits, more men (26.6%) have decreased their drinking than women (22.8%).
- The older the age group, the smaller the proportion of the consumers that has reduced their alcohol consumption. As a matter of fact, 40.1% of the consumers aged 18-29 compared to only 19.2% of the consumers of 70 years or older have reduced their alcohol consumption. Consumers aged 30-49 have increased their consumption the most (28.2%).

Tobacco

The analyses concerning the changes of the consumption of tobacco among consumers show that:

- There was no substantial difference regarding changes in tobacco use for men and women.
- Tobacco use varied by age categories. Indeed, 32.8% of young smokers (18-29 years old) increased their consumption. Conversely, 22.8% of smokers aged 50 to 69 and 36.7 % of smokers of 70 years or older decreased their tobacco consumption.
- An important change in tobacco consumption is observed among smokers living in Brussels, where 29.0% have decreased and 35.0% have increased their tobacco consumption. The changes are also observed in Wallonia, where 35.3% have decreased and 22.2% have increased their tobacco consumption.

Drugs

Some trends were observed for consumption of drugs among users since the beginning of the crisis:

- Drug use behaviors differ between men and women: 25.0% of the women declare to have increased their drugs consumption compared to 13.5% of the men.
- As observed for tobacco use, illegal drugs consumption changed more among the young consumers, as 26.3% of the 18-29 year-old increased their drugs consumption and 27.5% of them reduced their drugs consumption. As much as 39.5% of consumers aged 50-69 years decreased their drugs consumption.
- Drugs consumption has more often increased in Brussels (30.2%) than in Flanders (16.6%) and Wallonia (15.4%).

Sedatives and antidepressants

The analyses concerning the changes in the consumption of sedatives and antidepressants since the beginning of the crisis show that:

- There was no substantial difference regarding changes in sedatives consumption between men and women. Regarding the consumption of antidepressants, men increased more often their consumption of antidepressants (24.0%) than women (19.2%).
- People aged between 18-29 (37.1%) and 30-49 (38.0%) have increased their consumption of sedatives the most. This trend is also observed for the consumption of antidepressants, with a major increase of antidepressants consumption among 39.1% of young users (18-29 years old).
- The increase in consumption of both, sedatives and antidepressants, was most observed among users living in Brussels and Wallonia.

7.2. POSSIBLE CONTACTS AND INFECTION WITH THE SARS-COV-2 VIRUS AND CONSEQUENCES

Key findings

- About 6 out 10 people (58.3%) in the study population (18+) reported to have been tested for COVID-19.
- 27.3% of the study population reported to have had a close contact with a COVID-19 positive person.
- 20.5% suspected to have been infected with the SARS-CoV-2 virus since the start of the pandemic and 11.5% of the study population confirmed a history of a positive COVID-19 test result.
- 12.3% had a family member or friend who had been admitted to hospital because of COVID-19.
- 6.6% had a family member of friend who died from COVID-19. In Wallonia (10.1%) this was twice as much as in Flanders (4.6%).
- From those who were tested positive for a COVID-19 infection 5.3% had been admitted to hospital, and 1.5%, had stayed in the intensive care unit. This is an underestimation because people who died in the hospital are not counted here.
- The most common symptoms among people who had been tested positive were fatigue or exhaustion (54.7%), loss of taste (51,4%), loss of smell (51,3%), headache (50.8%), cough (43.3%) and muscle pain (42.8%)
- One out of three (33.1%) of people with a positive test result still experienced symptoms which they attributed to their COVID-19 infection. Among those fatigue or exhaustion (60.2%) and memory of concentration problems (28.4%) were most prevalent.
- There are no differences in reporting a close contact with a COVID-19 positive person, a suspected infection with COVID-19, a positive test result prior to the study and a hospitalisation due to COVID-19 in function of educational attainment.

This section of the report describes the study population in function of their COVID-19 testing history, their history of a COVID-19 infection and eventual consequences, and their experiences with respect to COVID-19 infection among family members or friends.

The last information was obtained through the following two questions:

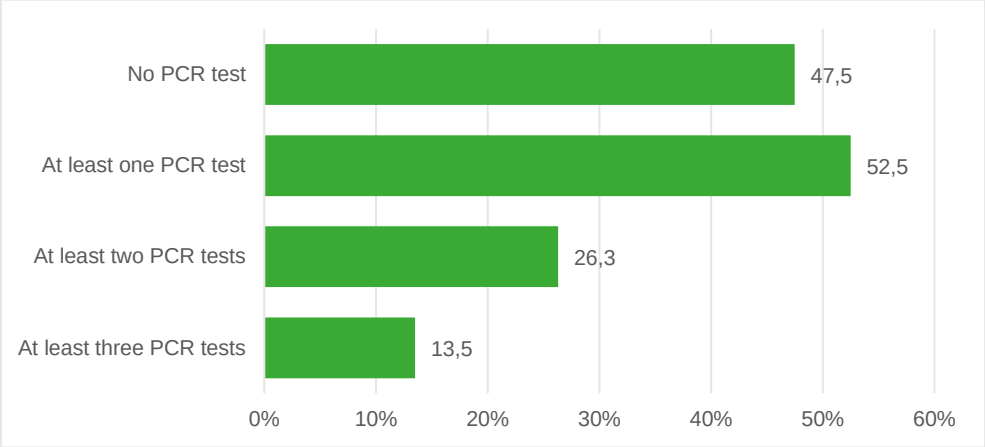
- Has anyone close to you (family, friend) been hospitalized because of the coronavirus (COVID-19)?
- Has anyone close to you (family, friend) passed away because of the coronavirus (COVID-19)?

7.2.1. Overall results

7.2.1.1. COVID-19 testing

About 6 out of 10 people (58.3%) reported to have been tested for COVID-19 and 52.5% reported to have had one or more PCR tests. Figure 30 indicates to which extent people had a PCR test and how many times. Only 9.2% reported to have had one or more antigen rapid tests.

Figure 30 | Percentage of the study population (18 years and above) by number of PCR tests that were done, SalivaHIS study, Belgium 2021



7.2.1.2. History of COVID-19 infection

A quarter of the study population (27.3%) reported to have had a close contact with a COVID-19 positive person and 20.5% suspected to have been infected with the SARS-CoV-2 virus since the start of the pandemic. In most cases a suspected infection took place between March 10 and June 21, 2020 or August 31, 2020 and January 4, 2021 (Figure 31).

A suspected infection was in the study defined as a positive answer to the question: “Do you suspect that you have yourself been infected with the coronavirus (COVID-19) at some time?”.

Only two thirds (65.4%) of those who suspected to have been infected reported a positive COVID-19 test result prior to the participation in the study (any type of test). 11.5% of the study population confirmed a history of a positive COVID-19 test result. From those 7.0% indicated not to have had any symptoms. Among people who suspected to have been infected with COVID-19 and a confirmed positive test the most common symptoms that were reported were fatigue or exhaustion (54.7%), loss of taste (51.4%), loss of smell (51.3%), headache (50.8%), and cough (43.3%) and muscle pain (42.8%) (Figure 32). Among people who suspected to have been infected with COVID-19 and no confirmed positive test typical COVID-19 symptoms, such as loss of taste (23.8%) and loss of smell (20.4%) were less common (Figure 33)

Figure 31 | Percentage of the study population (18 years and above) with suspected infection during a specific time period, SalivaHIS study, Belgium 2021

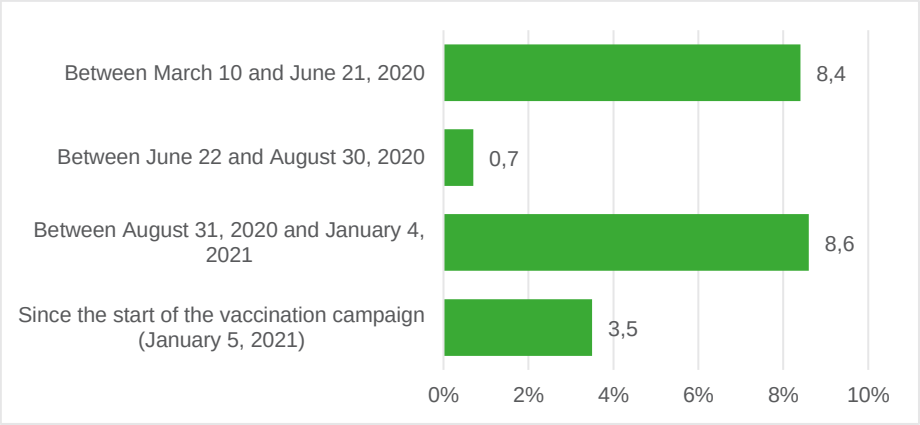


Figure 32 | Percentage of the study population (18 years and above) with suspected infection with SARS-CoV-2 virus and a positive test result with specific symptoms, SalivaHIS study, Belgium 2021

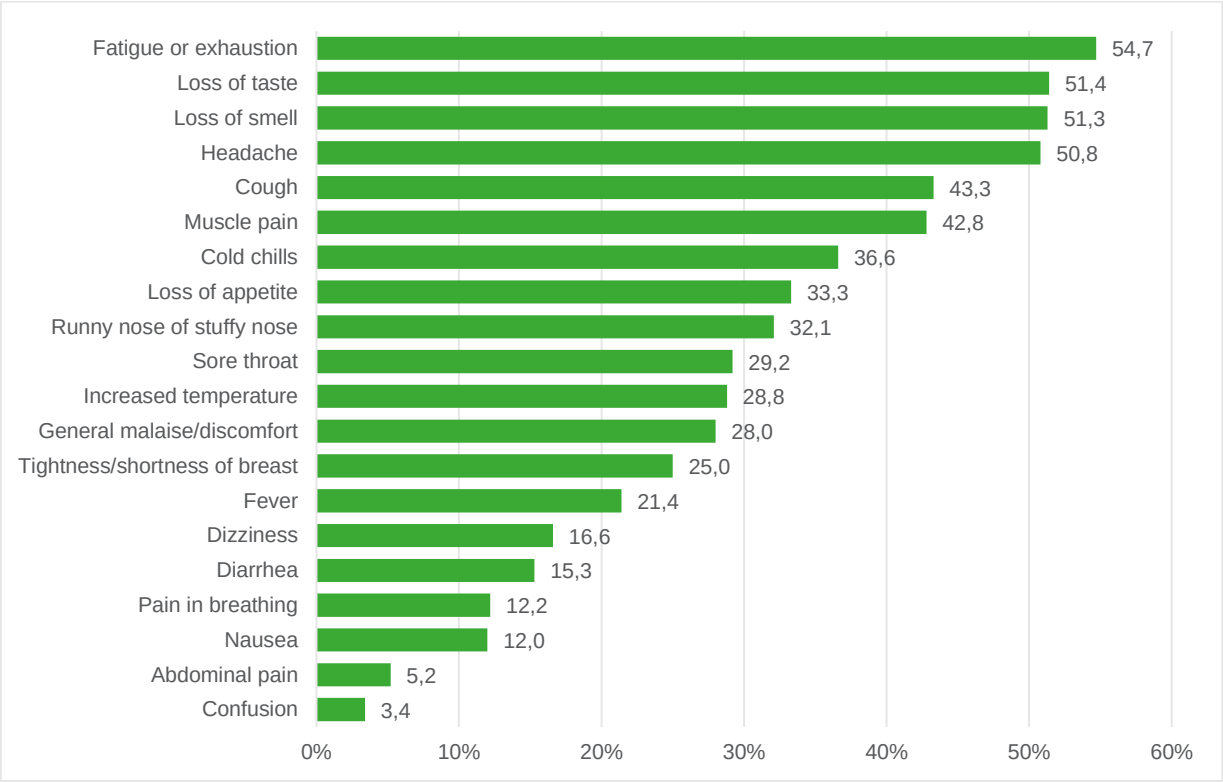
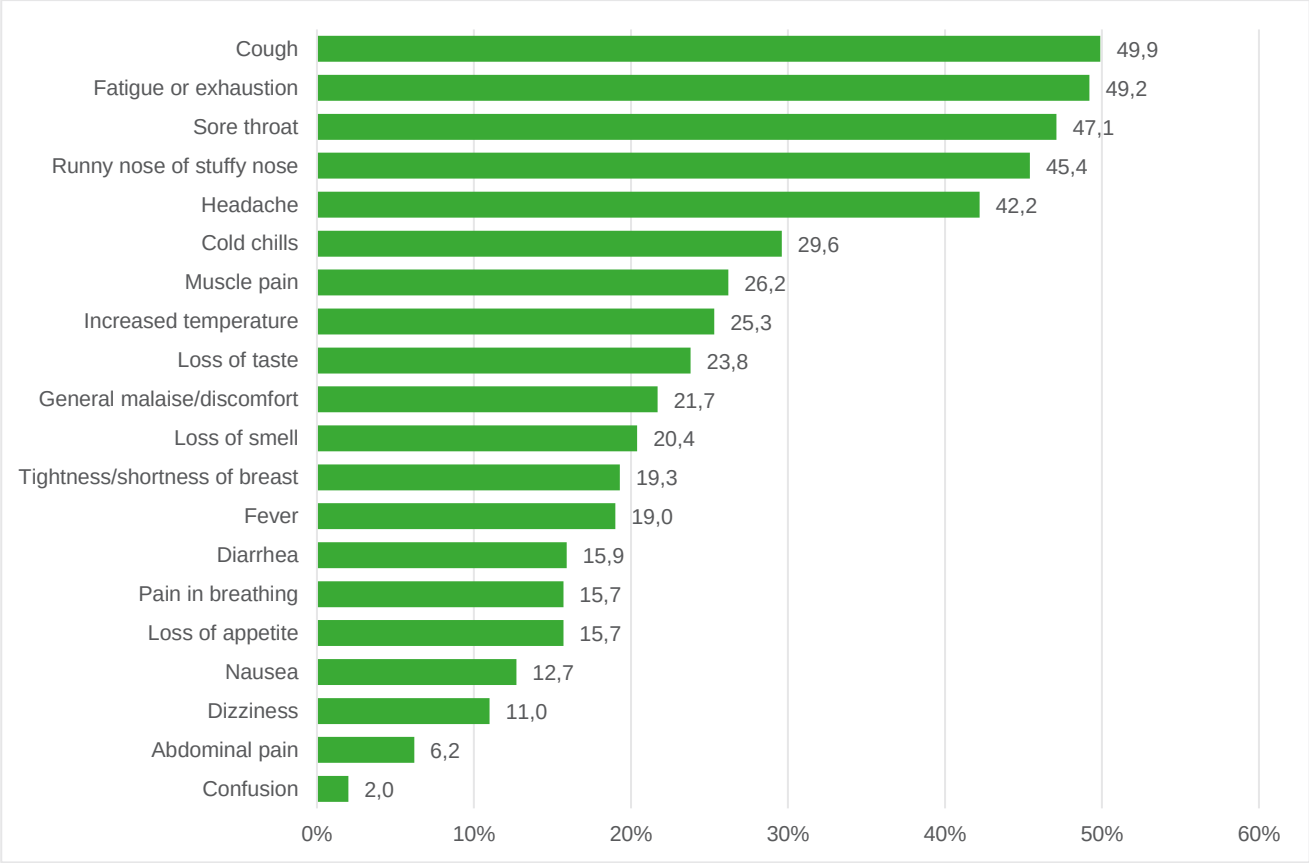


Figure 33 | Percentage of the study population (18 years and above) with suspected infection with SARS-CoV-2 virus and a negative test result with specific symptoms, SalivaHIS study, Belgium 2021

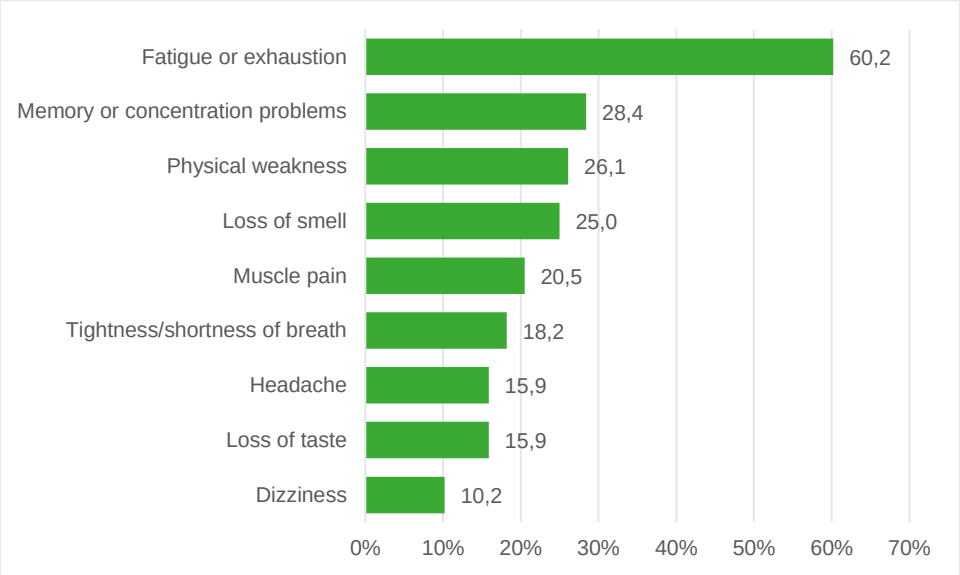


7.2.1.3. Consequences of COVID-19 infection

From those who had been tested positive for a COVID-19 infection 5.3% had been admitted to hospital, and 1.5% stayed in the intensive care unit.

One out of three (33.1%) still experienced symptoms which they attributed to their COVID-19 infection. Among those fatigue or exhaustion (60.2%) and memory of concentration problems (28.4%) were most prevalent (Figure 34).

Figure 34 | Percentage of the study population (18 years and above) with history of a positive COVID-19 test still reporting specific symptoms, SalivaHIS study, Belgium 2021



7.2.1.4. COVID-19 infection among family and friends

Regarding the Covid-19 infection among relatives and friends, 17.3% reported that a household member had been tested positive for COVID-19, 12.3% had a family member or friend that had been admitted to hospital because of COVID-19 and 6.6% had a family member or friend who had died from COVID-19.

7.2.2. Regional differences

The percentage of the study population with a suspected COVID-19 infection in function of the time period of infection varied by region. In Flanders the highest percentage (7.0%) was observed during the first peak period (March/June 2020) whereas in Brussels and Wallonia the highest percentage of people with a suspected infection was observed during the second peak period (end August 2020/beginning January 2021) (Figure 35).

In Flanders 16.0% reported a positive test result. In Brussels and Wallonia this was respectively 22.3% and 27.1%. Wallonia is also the most affected region in terms of COVID-19 infection and consequences among family and friends

In Wallonia almost 1 out of 4 people (23.7%) report that a household member had tested positive for Covid-19, 15.9% had a family member or friend who was admitted to hospital and one out of 10 (10.1%) had a family member or friend who had died from COVID-19. In Flanders these percentages were lower, but still substantial: respectively 13.4%, 10.2% and 4.6%.

Figure 35 | Percentage of the study population (18 years and above) with suspected COVID-19 infection during a specific time period, by region, SalivaHIS study, Belgium 2021

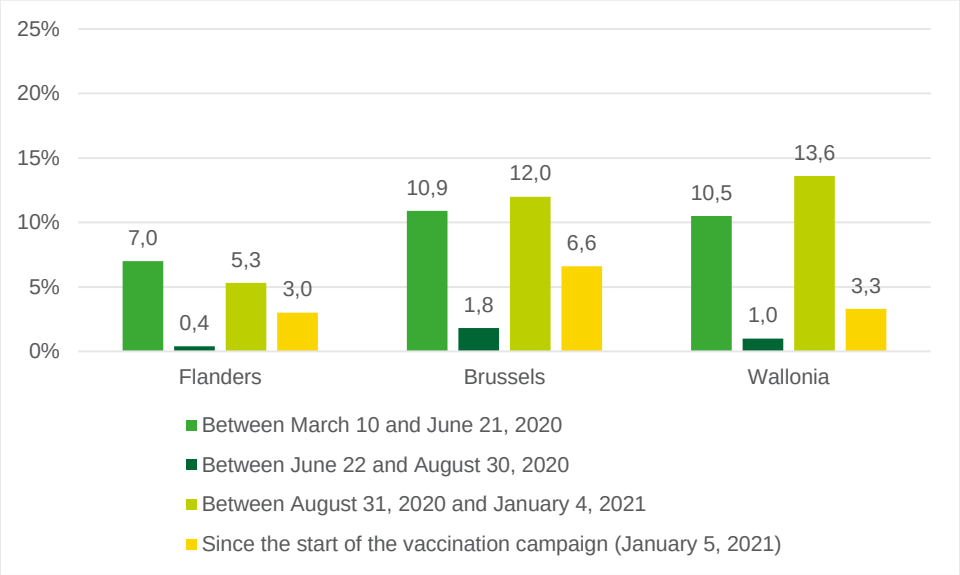
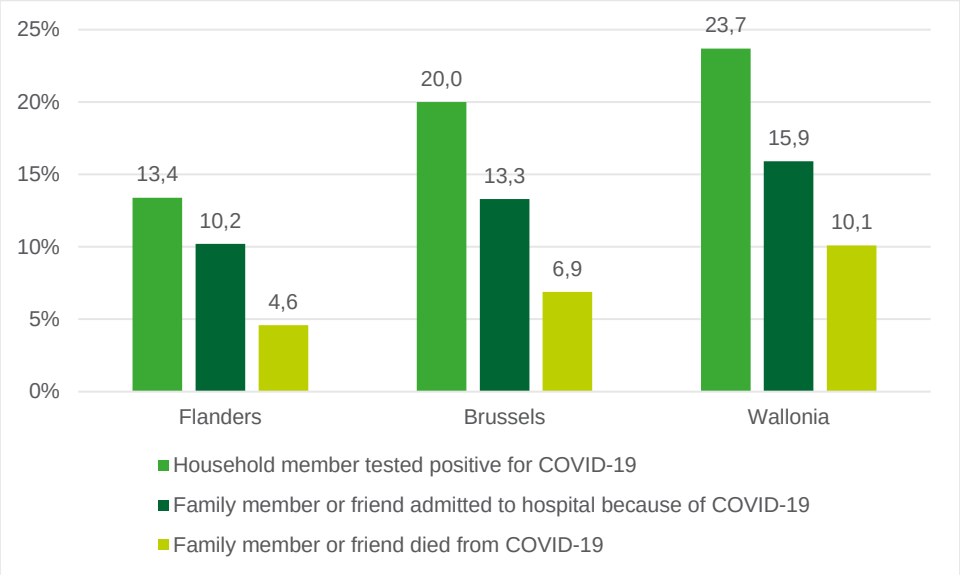


Figure 36 | Percentage of the study population (18 years and above) with COVID-19 related impact in close environment by region, SalivaHIS study, Belgium 2021



7.2.3. Distribution by age and sex

Table 26 provides results on the history of COVID-19 infection by age and sex. No differences are observed by sex. The younger the person, the more often he or she reports to have had a close contact with a COVID-19 positive person. There is also a more or less similar age gradient with respect to a suspected infection with COVID-19, but not the case for having a positive test result.

Table 26 | Percentage of the study population (18 years and above) with close contact with COVID-19 positive person, suspected infection with COVID-19 and positive test result, by age and sex, SalivaHIS study, Belgium 2021

Indicator / age group		Women (%)	Men (%)	Total (%)
Close contact with COVID-19 positive person				
Age:	18-29	45.6	46.1	45.9
	30-49	31.2	32.3	31.7
	50-69	18.6	23.2	20.9
	70+	10.7	11.4	11.1
Total:		**26.7**	**27.9**	**27.3**
Suspected infection with COVID-19				
Age:	18-29	30.4	25.4	27.9
	30-49	22.2	26.0	25.1
	50-69	19.4	16.0	17.7
	70+	9.8	8.7	9.3
Total:		**20.4**	**20,7**	**20.5**
Positive test result prior to the study				
Age:	18-29	20.4	23.2	21.7
	30-49	16.6	19.9	18.2
	50-69	23.4	22.1	22.8
	70+	18.0	20.7	19.3
Total:		**19.5**	**21.3**	**20.4**

Finally it was observed that there are important age differences in the percentage of people with a positive test result who were admitted to hospital. In the age group 18-29 years this was 1.4%, in the age group 30-49 years 3.1%, in the age group 50-69 years 6.6% and in people aged 70 years and above 16.0%. Of course this is an underestimation since people who died in hospital are not counted here.

7.2.4. Socio-economic differences

After adjustment for age and gender no significant differences were observed in reporting a close contact with a COVID-19 positive person, a suspected infection with COVID-19, a positive test result prior to the study and or a hospitalisation due to COVID-19 in function of educational attainment.

7.2.5. Differences over time

For the indicators in this module no significant differences were observed between the spring and summer period.

7.3. ADHERENCE TO COVID-19 MEASURES

Key findings

- The 4 measures to which people in the study population most often did not strictly comply were hygiene measures (31.2%), physical distance measures (46.2%), inviting/meeting a limited number of people (50.2%) and limiting unnecessary travel (48.1%).
- Respondents aged 18-29 years old reported more often not having strictly complied with the measures than the older age groups.
- Overall, men were more likely to report not having strictly complied with the measures than women.

This section of the report deals with the adherence to COVID-19 measures. It refers to the compliance of people in respecting the COVID-19 measures taken by the government in March 2021.

Adherence to COVID-19 measures

The SalivaHIS study examined to what extent the study population was compliant with the different COVID-19 measures that were in place during the past 4 weeks. Indicators were defined as the percentage of people who said they had not strictly respected the measures.

The indicators are based on the questions: “In the past 4 weeks, to what extent have you complied with the following recommendations?” A total of 10 COVID-19 measures were listed with the following answering categories: strict respect of the measure; partial respect of the measure; low respect of the measure; or not applicable.

7.3.1. Outlining the current measures

The SalivaHIS pilot phase took place mainly during the first two weeks of April 2021 (with the mailing of the envelopes on 26th March). The data collection was closed around mid-May. Between mid-March and mid-May the COVID-19 measures were updated due to an increasing number of hospitalizations and the emergence of clusters at workplaces and schools. In order to limit the increase of the number of cases, the Easter break school holiday was used as a “cooling-down period” during which the restrictive rules included: meeting in group in open-air with no more than 4 people, non-essential shops operating only on appointment and the non-medical contact professions closing their doors. The Easter break in schools was extended with one week. Additionally, it was still strongly recommended to properly respect the hygiene measures and keep sufficient distance from others. Besides, night curfews were still in place, i.e., midnight in Flanders and Wallonia and 10:00 pm in Brussels. These rules were into effect until 19th April. Afterward came a period of relaxation of rules, where people were allowed to meet in groups of up to 10 persons outside and both essential and non-essential shops were reopened[10].

This report combines results from the pilot phase and the first wave of the study. The first wave fieldwork took place between May and mid-June 2021. The sending of the envelops started on May 18th and were sent out every 2 weeks until the 15th June. The data collection of the first wave closed on the 27th August. During the summer months (June – July –August) the COVID-19 measures became lenient in function of how many people were vaccinated of the population and if state hospitalization rate was stable or decreased. In this summer period, larger events could take place each month, the catering sector could open until later hours, first only outside (terrace) and later also inside. Cultural events and sports activities (theatre, fitness,...) were possible again under certain terms.

[10] https://www.info-coronavirus.be/nl/news/

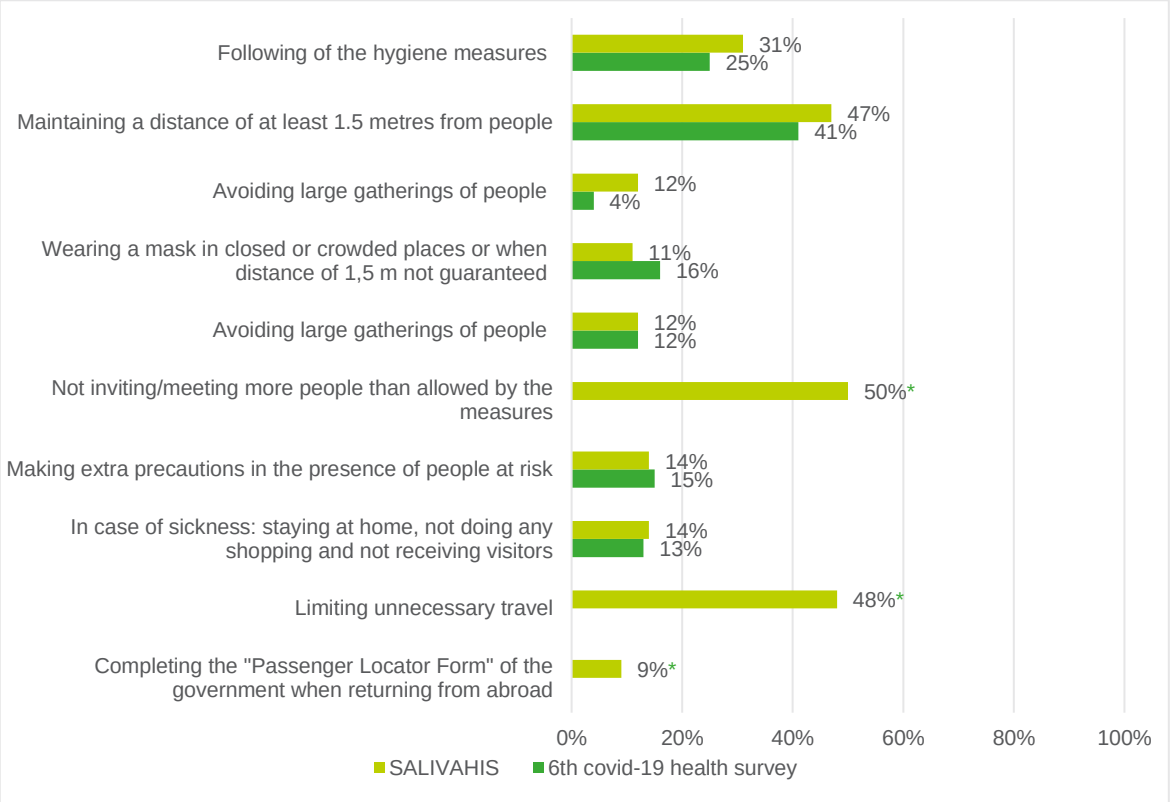
First, the results regarding the adherence to the COVID-19 measures will be observed throughout the whole period from March to August 2021. Second, we will briefly examine whether there are differences between different time sections within this period.

7.3.2. Non-compliance with the COVID-19 measures

From March to August, 31.2% of the people indicated not having strictly complied with the hygiene measures and 46.9% of the people indicated not having strictly complied with the physical distance measures. Both measures show a higher percentage in the SalivaHIS study then in the 6th COVID-19 health survey (hygiene measures 25.3%; physical distance measures 41.2%) (figure 37).

As show in the figure 30, 50.2% of the study population indicates not strictly complying to inviting/meeting a limited number of people. Furthermore, 48.1% of the study population said they had not strictly complied to measure limiting unnecessary travel.

Figure 37 | Percentage of the study population (18 years and above) who do not strictly comply with the measures, by survey, 6th COVID-19 Health Survey (March 2021) and SalivaHIS study, Belgium 2021



**This particular measure was not listed in the 6th COVID-19 health survey questionnaire – no comparison possible*

7.3.3. Non-compliance by sex and age

Compliance with the measures is significantly associated to gender, whereby more men than women generally indicate not strictly comply to the measures (similar to the 6th covid-19 health survey). Results also show that young people aged 18-29 years indicate more often not strictly comply to measures. Almost 3/4 of young people between 18-29 years indicate not strictly comply to rules mainly unnecessary travel, not inviting/meeting more people than the measures allow social distance.

7.3.4. Number measures not strictly followed

Beside the percentage of people who do not strictly comply to each measure listed, the following analysis indicates is based on the indicators with 3 categories: 1. the proportion of individuals who strictly comply, 2. individuals who do not strictly comply with maximum 4 measures out of the 9 and 3. the proportion of those

who do not strictly comply to minimum 5 out of 9 measures (the 10th measures was excluded due to the not applicable percentage which was too high, 63.1%).

The findings show that 44.7% of the study population not strictly comply with maximum 4 out of 9 measures. A quarter (25.8%) do not comply to minimum 4 out of 9 measures. Nonetheless 29.4% of the study population indicates strictly complying to all 9 measures (given in the SalivaHIS study).

7.3.5. Evolution in non-compliance over time

In order to examine the possible changes in compliance to the measures over time, an indicator was created based on the reception date of the survey questionnaires and saliva samples. Two time periods were defined using the median of these dates. The two periods correspond roughly to the spring period and the summer period.

Changes were observed for 3 out of the 10 measures, with significantly higher odds of non-compliance in the summer period as regard to the spring period. This was the case for avoiding large gatherings of people (OR 1.75 (95CI% 1.23-2.35)), which could be due to the fact that this measure was less applicable during the summer. It was also observed in the case of not strictly being extra precautions in the presence of people at risk (OR 1.44 (95%CI 1.10-1.88)) and not strictly observing obligation to fill in the “Passenger Locator Form” (OR 1.91 (95%CI 1.11-3.25)).

7.4. VACCINATION STATUS AND ATTITUDE TOWARDS VACCINATION

Key findings

- In this study the percentage of fully vaccinated people was 34.5%; 23.1% was partially vaccinated and 42.5% not vaccinated.
- From week 13-14 (start 29/3) to week 26-27 (start 28/6) the percentage of people with at least one vaccination dose increased from 15.9% to 85.4% and the percentage of fully vaccinated people from 5.4% to 55.3%.
- For five 'two weeks' time periods the vaccination coverage in this study could be compared with information from the national vaccination database. In Flanders results were quite similar. In Brussels and Wallonia this study overestimates the vaccination coverage.
- 71.6% of people aged younger than 65 years and belonging to priority A1 group because of an underlying condition reported had received at least one vaccine dose and 43.2% were fully vaccinated. For people within the same age group who did not belong to this risk group these percentages were respectively 43.2% and 19.4%.
- The vaccination rate is lower among people with as highest education degree a secondary diploma than among those with a bachelor or master diploma. This is particularly the case in Brussels and is not observed in Flanders.
- Workers are less often fully vaccinated than non-workers.
- There is a strong and positive association between the vaccination status and being a health worker, but in Wallonia the magnitude of this association is much lower than in Flanders and Brussels.
- No association is observed between vaccination status and subjective health.
- In this study 60.3 % of the vaccinated people received the Pfizer vaccine, 28.4% the AstraZeneca vaccine, 10.0% the Moderna vaccine and 1.3% the Johnson&Johnson vaccine.
- Factors associated with unwillingness or hesitance to be vaccinated are being female, a lower age, a lower education and not working. The latter observation is surprising, given the fact that workers are less often fully vaccinated, but this paradox can be explained by regional differences. A lower fully vaccination rate among workers is only observed in Flanders. A lower percentage of unwillingness or hesitance to be vaccinated among workers is only observed in Wallonia.
- The top three reasons why people do not want to be vaccinated against COVID-19 are fear for side effects (66.6%) of the vaccine, suspiciousness about the fact the vaccines were developed so quickly (42,2%) and skepticism about the effectiveness of new vaccines (36.6%).

This section of the report focuses on COVID-19 vaccination. Aspects which are covered are the number of people vaccinated, the type of vaccination received and the intention to get vaccinated.

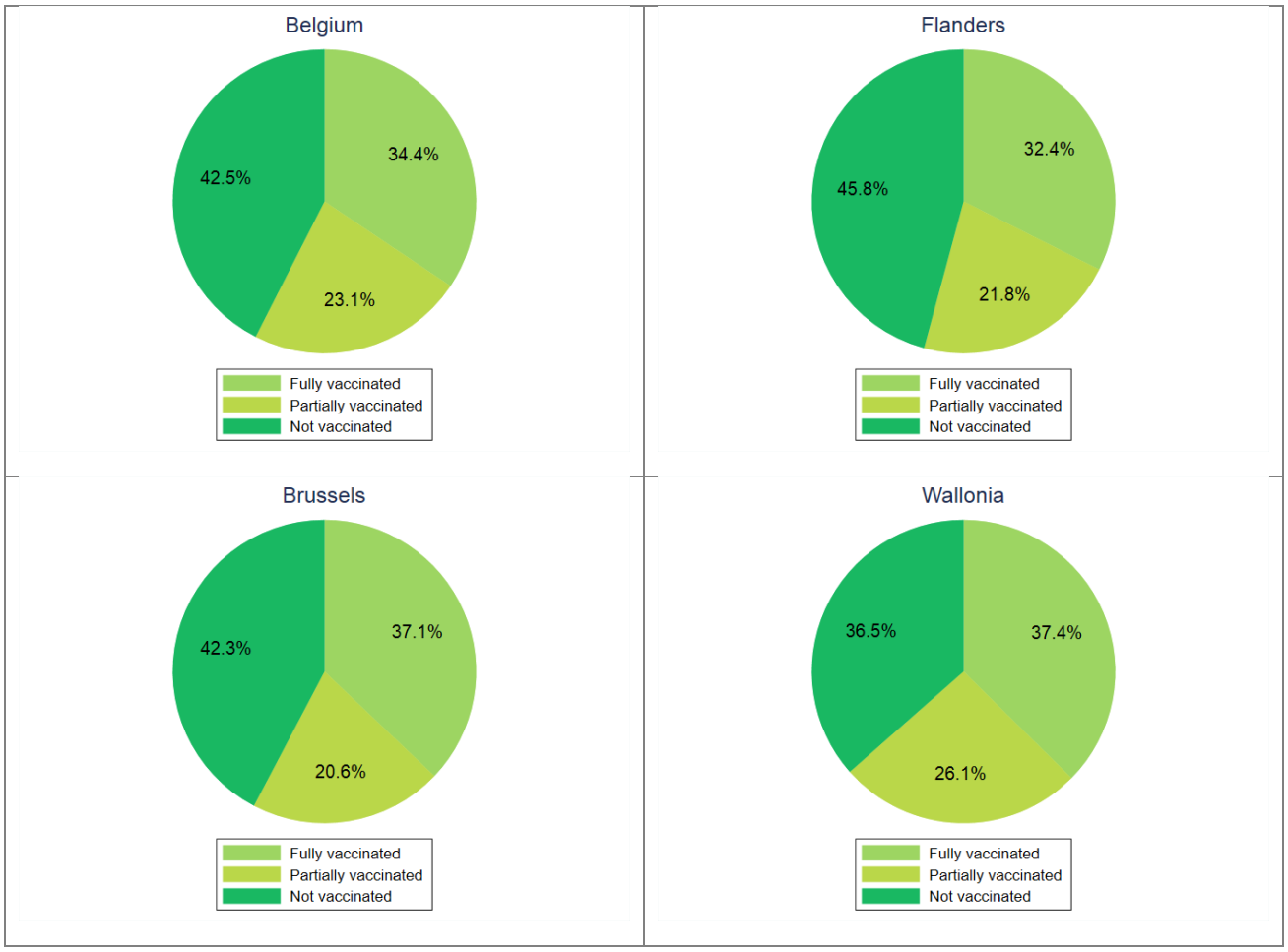
Vaccination status

For the interpretation of the results it is important to consider that people participated in this study between the end of March 2021 and the end of August 2021. During this period the vaccination campaign was running at full speed. On 25th of March, the date that the pilot study was launched 1.238.392 people had received a first dose and 518.501 were fully vaccinated. On 27th of August, the date on which the last saliva sample considered in the study was received, these figures had enormously increased, respectively to 8.415.023 and 8.070.046.

Figure 38 provides information on the distribution of the study population according to their vaccination status, making use of two different definitions: being fully vaccinated and being fully vaccinated since at least 2 weeks.

At the level of Belgium and looking at the whole study period the percentage of fully vaccinated people was 34.4%; 23.1% was partially vaccinated and 42.5% not vaccinated. Figure 38 shows also how these figures vary between the regions.

Figure 38 | Distribution of the study population (18 years and above) by vaccination status for Belgium and its 3 regions, SalivaHIS study, Belgium 2021



As stated in Chapter 1, this study does not allow assessing trends in the vaccination status during the whole study period, but 5 periods of two weeks could be identified with enough observations to assess the vaccination status during these periods. The periods started respectively on 29/3 (week 13-14), 17/5 (week 20-21), 31/5 (week 22-23), 14/6 (week 24-25) and 28/6 (week 26-27).

From week 13-14 to week 26-27, the percentage of people with at least one dose increased from 15.9% to 85.4% and the percentage of fully vaccinated people from 5.4% to 55.3%.

Figure 39 provides for the 3 regions and for the 5 periods a comparison between the percentage of people vaccinated in our study and the same percentage in the study population aged 18 years and above, based on information from the national vaccination database (1). It appears that in Flanders the observed percentages are quite similar, but in Brussels and Wallonia this is not the case. In those two regions a substantially higher vaccination rate was observed in the SalivaHIS study population than in the general population. Because of the strong association between vaccination status and prevalence of anti-SARS-CoV-2 antibodies it is important to take this bias into account. To minimize this bias as much as possible, the trends of the prevalence of anti-SARS-CoV-2 antibodies presented in this report include a correction for the difference in the vaccination rate between the SalivaHIS study population and the global population.

Figure 39 | Evolution of the vaccination status in the Belgian population (18+). Comparison results SalivaHIS study with information from the vaccination database (18 years and above), SalivaHIS study, Belgium 2021

Differences in vaccination status by population characteristics

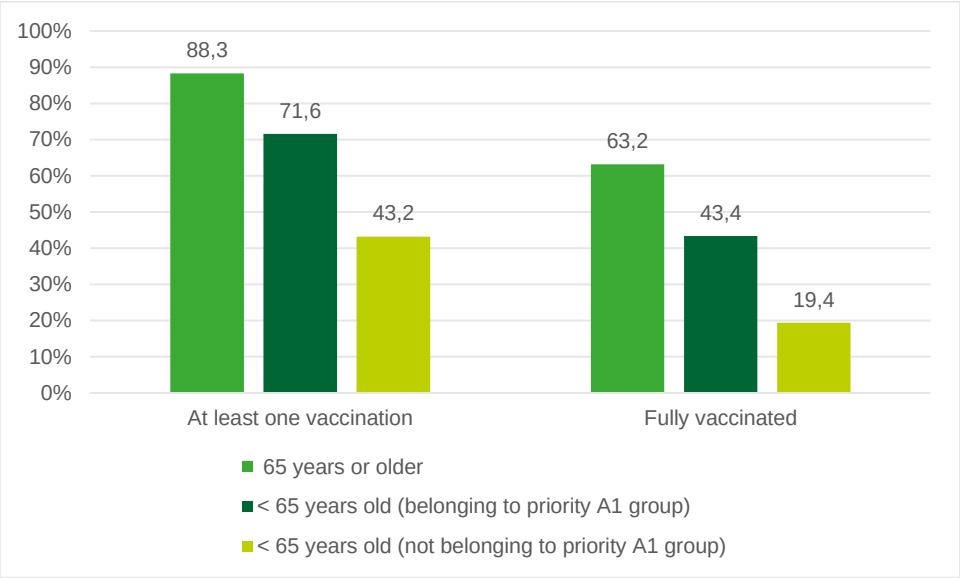
Table 27 provides information on the percentage of people vaccinated by age and gender. It refers to the total study population. Higher percentages are observed in women than in men and the vaccination rate increases with age. The higher vaccination rate in women is however no longer significant if adjustment is made for the health worker status.

Table 27 | Percentage of the study population (18 years and above) of the study population by age, sex and vaccination status, SalivaHIS study, Belgium 2021

	Women (%)			Men (%)			Total (%)		
	Fully vaccinated	Partially vaccinated	Not vaccinated	Fully vaccinated	Partially vaccinated	Not vaccinated	Fully vaccinated	Partially vaccinated	Not vaccinated
Age: 18-29	17.7	14.3	67.9	8.8	12.4	78.8	13.3	13.4	73.4
30-49	23.7	22.3	54.1	12.6	25.0	62.4	18.2	23.6	58.2
50-69	48.3	26.2	25.5	44.7	28.7	26.6	46.5	27.4	26.0
70+	67.0	24.0	9.0	63.2	24.4	12.4	65.4	24.2	10.5
Total	**38.6**	**22.4**	**39.0**	**30.0**	**23.7**	**46.3**	**34.4**	**23.1**	**42.5**

Figure 40 provides information on the vaccination status by age and priority A1 group for vaccination due to underlying condition as defined by the High Superior Health Council. Priority A1 is defined based on the presence of certain chronic diseases in combination with age (21). The results show a significantly higher vaccination status among people less than 65 years belonging to priority A1 group than among the people aged 65 years and above.

Figure 40 | Percentage of the study population (18 years and above) vaccinated by age and priority A1 group for vaccination due to underlying condition , SalivaHIS study, Belgium 2021



Differences in vaccination status were also explored in function of education and working status, health care worker status and subjective health after adjustment for age and gender (Table 28). People with secondary education or lower were significantly less often vaccinated than those with a master diploma. Also the difference with people having a bachelor diploma was significant. Educational differences are most pronounced in Brussels, less in Wallonia, and not significant in Flanders.

Workers were less often fully vaccinated than non-workers, but this was only the case in Flanders. At the level of Belgium there was a very strong association between the vaccination status and being a health care worker.

However in Wallonia this association was weaker than in the other two regions and even not significant when looking at having had at least one vaccination. Finally, no association was found between being vaccinated and subjective health status.

Table 28 | Association of vaccination status with education, occupation, health care worker status and subjective health after adjustment for age and gender for Belgium and the three regions, SalivaHIS study, Belgium 2021

		At least one vaccination		Fully vaccinated	
		OR	95%CI	OR	95%CI
Belgium	Secondary education or lower (ref =Master)	***0.61***	***0.46-0.80***	***0.72***	***0.55-0.93***
	Bachelor (ref = Master)	1.04	0.78-1.38	0.95	0.71-1.28
	Worker (ref = not working)	0.90	0.69-1.17	***0.75***	***0.57-0.98***
	Health care worker (ref = no)	***7.43***	***4.76-11.58***	***12.4***	***7.96-16.25***
	Good subjective health (ref = moderate/bad)	0.85	0.64-1.13	0.95	0.74-1.23
Flanders	Secondary education or lower (ref =Master)	0.70	0.47-1.06	0.85	0.56-1.30
	Bachelor (ref = Master)	0.97	0.64-1.49	1.10	0.69-1.76
	Worker (ref = no)	0.70	0.47-1.04	***0.62***	***0.42-0.93***
	Health care worker (ref = no)	***39.35***	***14.25-108.64***	***25.94***	***12.59-53.44***
	Good subjective health (ref = moderate/bad)	0.76	0.50-1.17	1.00	0.69-1.45
Brussels	Secondary education or lower (ref =Master)	***0.47***	***0.28-0.77***	***0.47***	***0.29-0.76***
	Bachelor (ref = Master)	1.07	0.66-1.74	0.94	0.59-1.50
	Worker (ref = not working)	1.35	0.85-2.16	1.18	0.74-1.87
	Health care worker (ref = no)	***14.10***	***4.11-48.37***	***23.61***	***8.94-62.34***
	Good subjective health (ref = moderate/bad)	1.58	0.91-2.75	1.50	0.96-2.34
Wallonia	Secondary education or lower (ref =Master)	***0.58***	***0.35-0.97***	0.82	0.51-1.31
	Bachelor (ref = Master)	1.25	0.72-2.16	0.96	0.58-1.58
	Worker (ref = not working)	1.30	0.84-2.00	0.89	0.57-1.41
	Health care worker (ref = no)	1.72	0.94-3.12	***4.50***	***2.30-8.78***
	Good subjective health (ref= moderate/bad)	1.00	0.63-1.59	0.89	0.58-1.35

Type of vaccine received

The majority of the vaccinated people (during this study period) received the Pfizer vaccine (60.3%). Some differences are observed in function of the age group, which are in line with the vaccination strategy (Table 29). For example, in the oldest age group relatively more people received the AstraZeneca vaccine.

Table 29 | Distribution of the vaccinated population (18 years and above – at least one dose) according to the vaccine received, by age group, SalivaHIS study, Belgium 2021

	18-29 yrs (%)	30-49 yrs (%)	50-69 yrs (%)	70+ yrs (%)	All (%)
Pfizer BioNTech (COMIRNATY®)	64.4	57.7	61.9	58.9	60.3
Moderna (SPIKEVAX®)	20.0	12.0	9.4	6.0	10.0
AstraZeneca (VAXZEVRIA®)	14.0	27.0	27.9	34.6	28.4
Johnson&Johnson (COVID-19 VACCINE JANSSEN®)	1.6	0.8	0.8	0.5	1.3

The distribution of the type of vaccine that the health care workers received was very similar as this distribution in the general population: 60.1% received the Pfizer vaccine, 9.8% the Moderna vaccine and 30.1% the AstraZeneca vaccine.

Intention to get vaccinated

Table 30 gives the distribution of the population by vaccination status and intention to be vaccinated. Nine out of ten people were vaccinated or had the intention to be vaccinated. Among those for which information was available about their vaccination status or willingness to be vaccinated 6.7% was unwilling or hesitant to be vaccinated.

Table 30 | Distribution of the study population (18 years and above) by vaccination status and intention to be vaccinated, SalivaHIS study, Belgium 2021

Vaccination status and intention to be vaccinated	%
Vaccinated	59.2
Not yet vaccinated - willing to have it done	30.8
Not yet vaccinated - willing to have it done but with another vaccine than the one proposed	0.1
Not yet vaccinated - not sure to have it done	3.4
Not yet vaccinated - not willing to have it done	3.1
Not yet vaccinated - no info on willingness to have it done	3.4

Among those for which this information was available 6.7% was unwilling or hesitant to be vaccinated. This percentage was higher in the first half of the study period (7.8%) than in the second period (5.8%), but after adjustment for age and sex this difference was not significant.

Important regional differences were observed. Unwillingness or hesitance to be vaccinated was highest in Wallonia (11.7%), next in Brussels (8.9%) and lowest in Flanders (3.5%). After adjustment for age and sex only the difference between Flanders and the two other regions remained significant.

Table 31 provides information on the percentage people unwilling or hesitant to be vaccinated by age and sex. Being female and a younger age are significantly associated with more unwillingness or hesitance to be vaccinated. Among women no association was found between unwillingness or hesitance to be vaccinated and pregnancy and this was also not the case after adjustment for age.

Table 31 | Percentage of the study population (18 years and above) that is not sure or not willing to get vaccinated by age and sex, SalivaHIS study, Belgium 2021

Age group	Women (%)	Men (%)	Total (%)
18-29	14.0	9.0	11.5
30-49	11.8	7.2	9.5
50-69	4.0	3.9	4.0
70+	2.4	0.9	1.7
Total	**7.9**	**5.5**	**6.7**

Within the age group younger than 65 years unwillingness or hesitance to be vaccinated was somewhat lower among people belonging to priority A1 group for vaccination due to an underlying condition (6.2%) then among people not belonging to this group (8.7%), but this difference is not significant.

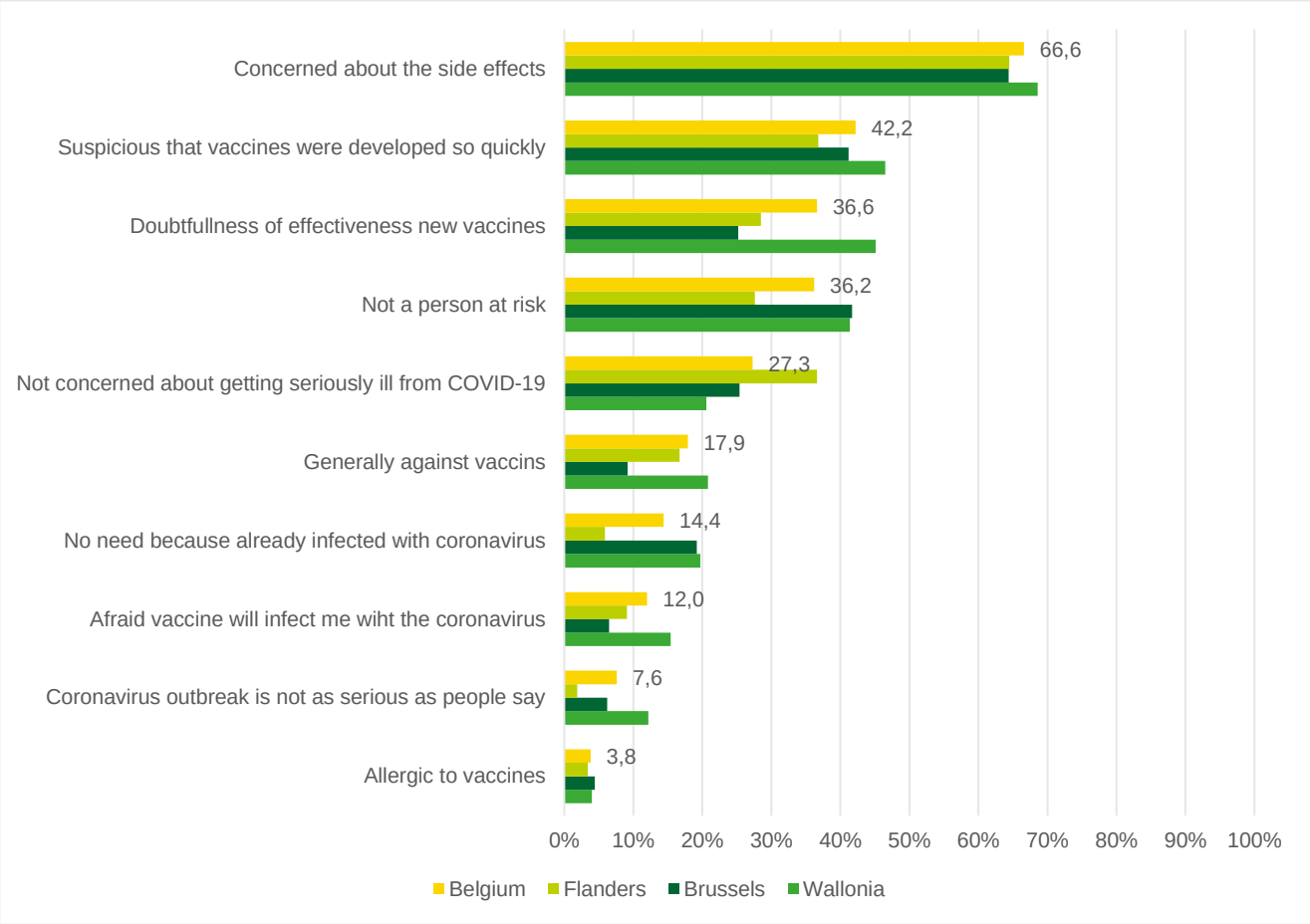
Table 32 shows the association between unwillingness or hesitance to be vaccinated and education, working status, being a health care worker status and subjective health. After correction for age and sex, lower educated people are more likely to be unwilling or hesitant to be vaccinated. Working people are less unwilling or hesitant to be vaccinated than non-workers. No association was found with being a health care worker and subjective health.

Table 32 | Association of unwillingness or hesitance to be vaccinated with education, occupation, health care worker status and subjective health after adjustment for age and gender, SalivaHIS study, Belgium 2021

	OR	95%CI
Secondary education or lower (ref =master)	***2.14***	***1.44-3.18***
Bachelor (ref = master)	1.21	0.74-1.97
Worker (ref = not working)	***0.62***	***0.42-0.93***
Health care worker (ref = no)	0.92	0.54-1.57
Good subjective health (ref = moderate/bad)	1.01	0.61-1.69

Figure 41 provides information on the reason why people do not want to get vaccinated. People are mostly concerned about the side effects (66.6%) of the vaccine, but many are also suspicious about the fact the vaccines were developed so quickly (42.2%) and many others are skeptical about the effectiveness of new vaccines (36.6%) or estimate that vaccination is not needed because they are not a person at risk (36.2%).

Figure 41 | Reason for reluctance to get vaccinated against COVID-19 by descending percentage of people (study population 18 years and above) mentioning this reason for Belgium and the 3 regions, SalivaHIS study, Belgium 2021



Some regional differences are observed. In Wallonia a much higher proportion of the people who are reluctant to be vaccinated have doubtfulness of the effectiveness of new vaccines (45.1% versus 25.2% in Brussels and 28.5% in Flanders). Moreover, the percentage that is afraid that the vaccine will infect them with the SARS-CoV-2 virus is in Wallonia (15.4%) higher than in Brussels (6.5%) and Flanders (9.1%). On the other hand, In Flanders people report more often that being not concerned about getting seriously ill from COVID-19 is a reason for not getting vaccinated (36.6%) than this is the case in Brussels (25.4%) and Wallonia (20.6%).

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