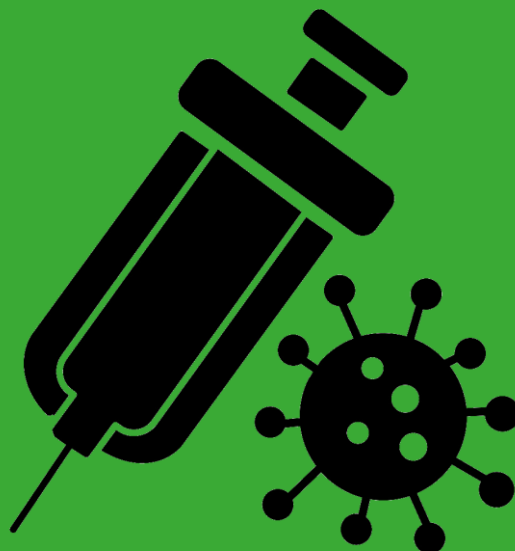


EPIDEMIOLOGY OF COVID-19 MORTALITY IN BELGIUM

from wave 1 to wave 7
(March 2020 – 11 September 2022)



WHO WE ARE

Sciensano can count on more than 900 staff members who are committed to health every day. 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.

Sciensano

Epidemiology and public health

•

Epidemiology of infectious diseases

June 2023 • Brussels • Belgium

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KEY FINDINGS

Based on the epidemiological surveillance of COVID-19 mortality, the observations on the first seven waves combined of the epidemic in Belgium (01/03/2020 – 11/09/2022) are as follows:

Waves

- 66.8% of the COVID-19 deaths occurred during the first two waves of the epidemic. In absolute numbers, most deaths took place in wave 2 due to its length, but the highest peak of weekly COVID-19 deaths was observed during wave 1 (1,985 deaths during week 15 2020).

Age and sex

- 91.8% of the COVID-19 deaths were 65 years and older.
- The median age of COVID-19 deaths was 84 years old and the average age was 81.6 years old.
- In all age groups up to 80-84 years old, males represented the highest fraction of COVID-19 deaths.

Places of death

- Most of the COVID-19 deaths took place in hospitals (67.7%), followed by nursing homes (31.9%). During wave 1, there was an even distribution (50.2% and 48.7% respectively).

Case classification

- 87.7% of the COVID-19 deaths in Belgium were laboratory-confirmed cases. In 2021 and 2022 around 96% of the COVID-19 deaths were laboratory-confirmed cases. During wave 1, 4.0% of COVID-19 deaths were radiologically-confirmed cases and 26.8% were possible cases.

Nursing home residents

- 44.7% of the COVID-19 deaths were nursing home (NH) residents and 71.3% of them died in NH. While in waves 1 and 2, a quarter of all the NH deaths took place in hospital, in the following waves, it shifted to a more equal distribution of deaths between NH and hospitals.

COVID-19 mortality rate

- The overall crude mortality rate (CMR) due to COVID-19 in Belgium, reached 281 per 100,000 inhabitants. It was higher in Wallonia (331 per 100,000 inhabitants), followed by Brussels-Capital Region (297 per 100,000 inhabitants) and Flanders (252 per 100,000 inhabitants).

- At provincial level (and Brussels-Capital Region), Hainaut had the highest overall COVID-19 CMR (385 per 100,000 persons), while Walloon Brabant had the lowest (213 per 100,000 inhabitants). When taking the age structure into account, Brussels-Capital Region had the highest and Flemish Brabant the lowest COVID-19 age standardized mortality rate.
- Among NH residents (all ages) the COVID-19 CMR in Belgium reached 7,500 per 100,000 inhabitants and 923 per 100,000 inhabitants among non-NH residents (65+).

COVID-19 case fatality ratio

- The COVID-19 case-fatality ratio (CFR) in Belgium was estimated to be 0.65%, but it increased exponentially with age (4.92% for 75-84 years old and 9.87% above 85 years old for both sex). During wave 1, when testing capacity was limited and only severe and hospitalized patients were tested, it reached 11.3%.
- The risk of dying from COVID-19 was larger and consistent for men, across all age groups.
- COVID-19 CFR decreased over time.

All-cause and excess mortality

- The all-cause CMR for Belgium was the highest for wave 2 (522 per 100,000 inhabitants).
- The number of deaths in excess for wave 1 was roughly comparable to those caused by COVID-19 obtained via the epidemiological surveillance.
- Excess mortality was also the highest during wave 1, with a 26.6% excess of death (8,410 deaths in excess). Brussels-Capital Region experienced the highest excess mortality among the three regions (1,379 deaths in excess, 57.2%).
- The percentage of excess mortality was relatively high in all regions during the first two waves and then dropped drastically. There was an under mortality in Flanders in wave 3, suggesting a harvesting effect.

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ABBREVIATIONS

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AViQ	Agence pour une vie de qualité, Wallonia
AZG	Agentschap Zorg en Gezondheid, Flanders
BEL	Belgium
Be-MOMO	The Belgian Mortality Monitoring
BXL	Brussels-Capital Region
CFR	Case fatality ratio
CMR	Crude mortality rate
COVID-19	Coronavirus disease 2019
dSMR	Direct standardized mortality rate
ECDC	European Centre for Disease Prevention and Control
FLA	Flanders
iSMR	Indirect standardized mortality ratio
LTCFs	Long-term care facilities
NH	Nursing home
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
WAL	Wallonia
WHO	World Health Organisation

1. INTRODUCTION

In Belgium, wave 1 of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic started on 1 March 2020 with a confirmed infection in a traveller returning from France. The first death associated with the coronavirus disease 2019 (COVID-19) was dated 10 March 2020, but after an investigation conducted by Sciensano among hospitals during the summer of 2021, the first COVID-19 death in Belgium was advanced to 7 March 2020 (published in the database of December 2021). By 1 March 2021, after one year and two epidemic waves, 22,420 people have died of COVID-19 in Belgium. By 1 March 2022, after five waves, a total of 30,220 deaths were notified and as of 11 September 2022, after seven waves, 32,606 deaths have been reported.

There are three categories of key indicators for [monitoring the epidemic](#): **intensity indicators** relating to diagnosed cases and tests performed, **severity indicators** relating to hospitalizations and deaths, and **vaccination indicators**. Mortality is a late indicator, as the peak of deaths usually occurs two or three weeks after the peak of cases and represents only part of the health burden of COVID-19 on our society (1). Moreover, the consequences of COVID-19 in infected people are not negligible, as some will experience long-term effects after COVID-19 disease with direct and indirect consequences on their lifestyle (2).

This report aims to provide an overview of the characteristics of the COVID-19 deaths that occurred from 1 March 2020 to 11 September 2022 during the first seven waves (Table 1) using the data from the epidemiological surveillance. After an overall analysis of the epidemiology of COVID-19 deaths, **mortality rates for COVID-19** are presented by region of residence for the total population and by profile (being a NH resident or not), as well as **COVID-19 case fatality ratio** (CFR) by age group, sex and region of residence. Finally, we present specific mortality indicators calculated by wave and region of residence, namely, **crude and (age) standardized COVID-19 mortality rates**, **COVID-19 CFR**, **crude and (age) standardized all-cause mortality rates** and **excess mortality**.

Table 1 Date of COVID-19 epidemic waves in Belgium, 2020-2022

	Date	Weeks	Duration in days
Wave 1	1 March 2020 - 21 June 2020	weeks 9 to 25, 2020	112
Interwave 1-2	22 June - 30 August 2020	weeks 26 to 35, 2020	69
Wave 2	31 August 2020 - 14 February 2021	weeks 36, 2020 to 6, 2021	167
Wave 3	15 February 2021 - 27 June 2021	weeks 7 to 25, 2021	132
Interwave 3-4	28 June 2021 - 3 October 2021	weeks 26 to 39, 2021	97
Wave 4	4 October 2021 - 26 December 2021	weeks 40 to 51, 2021	83
Wave 5	27 December 2021 - 27 February 2022	weeks 52, 2021 to 8, 2022	62
Wave 6	28 February 2022 - 29 May 2022	weeks 9 to 21, 2022	90
Wave 7	30 May 2022 - 11 September 2022	weeks 22 to 36, 2022	104

2. METHODOLOGY

The presented daily COVID-19 mortality figures are retrieved from [Sciensano's epidemiological surveillance](#) database. It includes data from **hospital** surveillance (3), **long-term care facilities** (LTCF) (4) and **community-based** surveillance by general practitioners. Data includes COVID-19 deaths of **laboratory-confirmed**, **radiologically-confirmed** and **possible cases** (detailed description in Peeters *et al.* 2021, Chapter 3.1 (1)). Moreover, people who died in a hospital **whose postal code of residence was not in Belgium** were not included in the surveillance (126 deaths, until 11 September 2022) to avoid double counting in the countries concerned. In this report, region refers to the **region of residence**, in case the region of residence is missing, the region of death is used.

For every deceased person, information was collected on: date of death, case classification, place of death, postal code of the place of death, date of birth, sex, type of residence¹, postal code of residence² and vaccination status³. The detailed methodology used to set up this surveillance is described in the article of Renard *et al.* 2021 (5) and in the first report on COVID-19 mortality on data from the first two waves (1).

Several investigations have been conducted by Sciensano since the last report to continuously improve the quality of the data, achieved by **adjusting the data retrospectively**. These are listed in the [COVID-19 open data codebook](#), explained in Renard *et al.* 2021 and visualized in Figure 1.

Excess mortality was calculated via the Be-MOMO project ([The Belgian Mortality Monitoring](#)) conducted by Sciensano, using the data from the National register. Population data is coming from the Belgian statistical office (Statbel).

For the calculation of COVID-19 mortality rates, the **Belgian population** of 1 January 2020 is used as a reference for the analysis for the year 2020, wave 1 and interwave 1-2. The Belgian population of 1 January 2021 is used as a reference for the analysis for year 2021, waves 2, 3, interwave 3-4 and wave 4. And the Belgian population of 1 January 2022 is used as a reference for the analysis for year 2022, waves 5, 6, 7 and the global period.

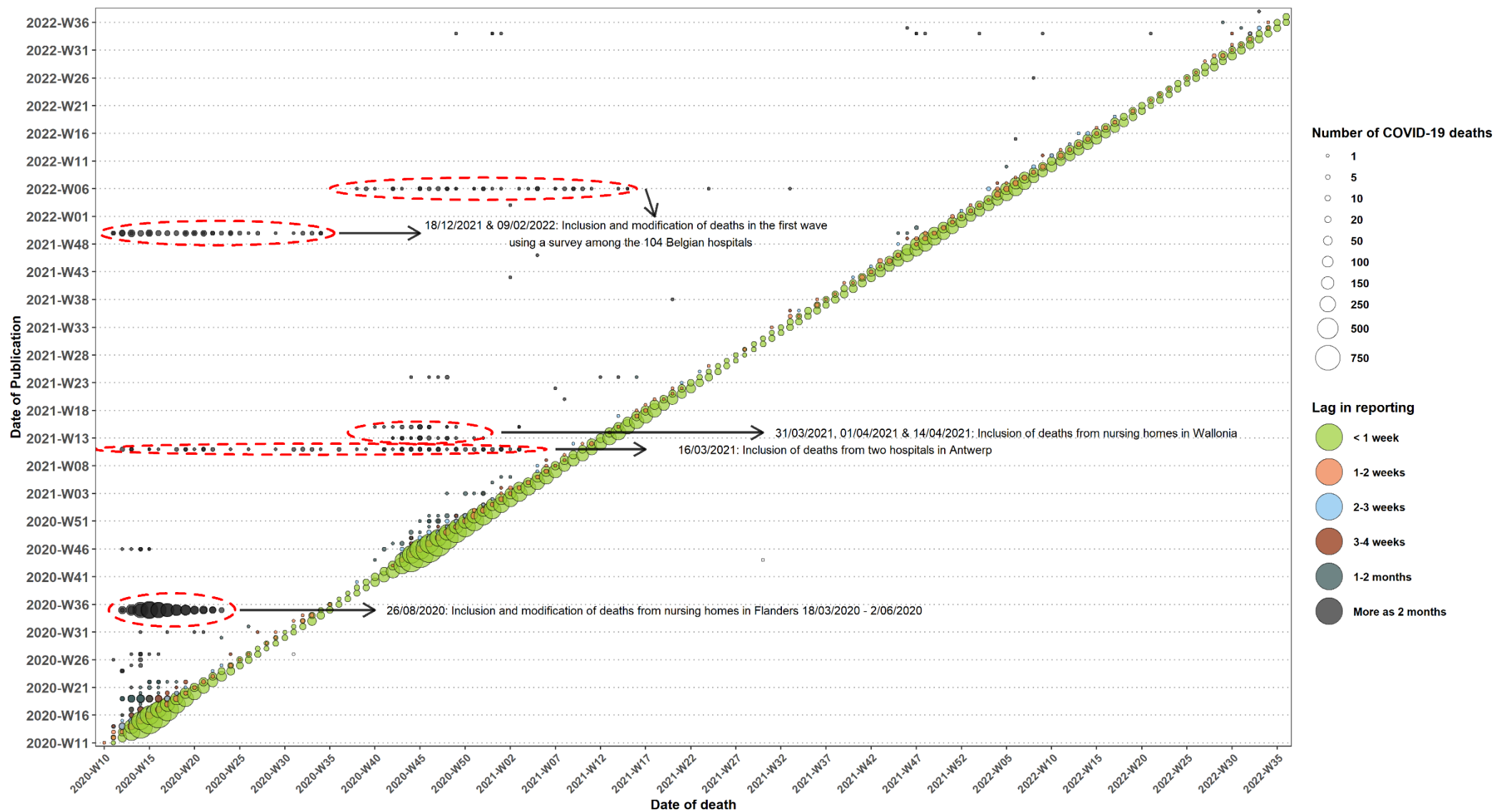
For this report, daily COVID-19 mortality was extracted on 4 November 2022 from the Sciensano database, and all-cause mortality data were extracted on 10 November 2022 from the National register. Data and graphs were created using R, version 4.1.2 (6).

¹ Available since 21 June 2020 from hospitals: to live or not in a NH, a residential community for the elderly, a psychiatric institute, an institute for people with disabilities or another kind of community.

² Available since 24 April 2020 from hospitals.

³ Vaccination status was requested from hospitals from 8 December 2021 to 6 March 2023 and from 10 January 2022 in NH in all regions. The 14-day cumulative COVID-19 in-hospital mortality rate per 100,000 people by vaccination status and age group was published in the [COVID-19 weekly epidemiological bulletin](#) from 21 January 2022 to 8 September 2022 inclusive ("previous bulletins" section).

Figure 1. Number of COVID-19 deaths in Belgium by date of death and date of publication, March 2020 – 11 September 2022



3. EPIDEMIOLOGY OF COVID-19 MORTALITY

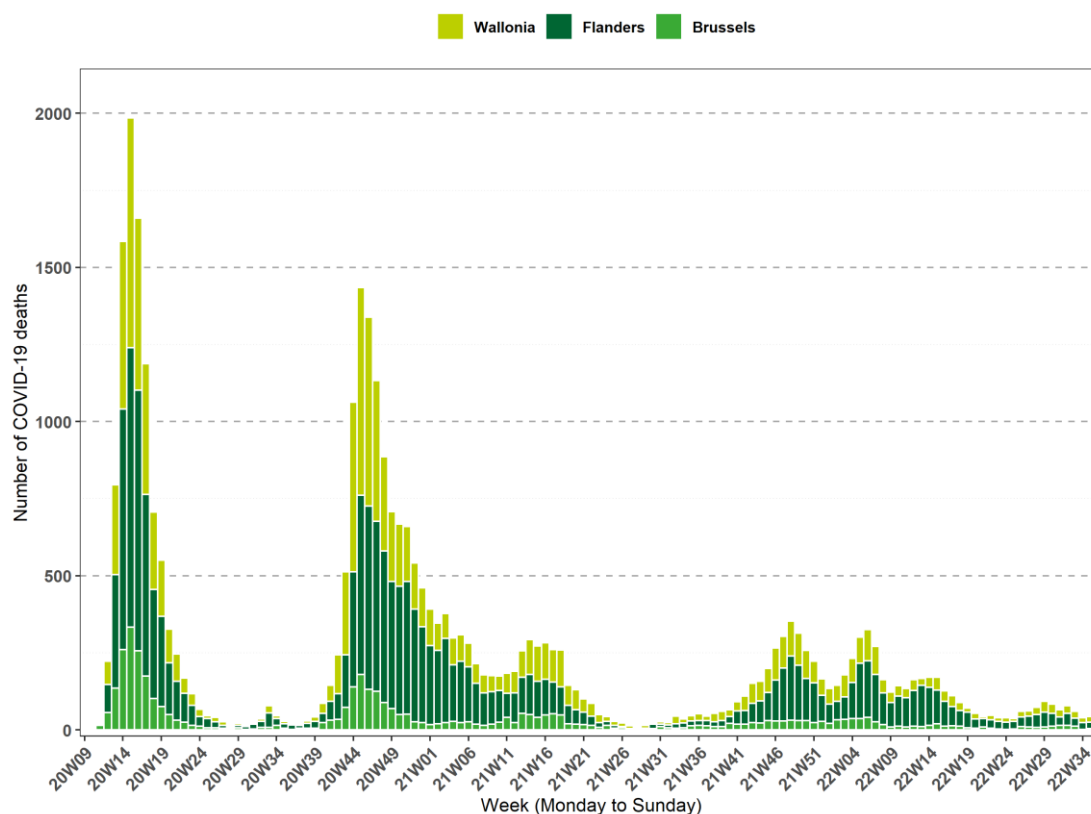
3.1. HOW MANY COVID-19 DEATHS HAVE OCCURRED?

Table 2 Number of COVID-19 deaths in Belgium per region of residence and wave, March 2020 – 11 September 2022

	Flanders			BXL			Wallonia			Belgium		
	n	%	%	n	%	%	n	%	%	n	%	%
Wave 1	4,836	49.9	28.7	1,390	14.4	38.3	3,456	35.7	28.5	9,682	100	29.7
Interwave 1-2	176	54.0	1.0	53	16.3	1.5	97	29.8	0.8	326	100	1.0
Wave 2	6,230	52.0	36.9	1,048	8.7	28.9	4,710	39.3	38.9	11,988	100	36.8
Wave 3	1,561	47.0	9.3	416	12.5	11.5	1,344	40.5	11.1	3,321	100	10.2
Interwave 3-4	171	36.8	1.0	92	19.8	2.5	202	43.4	1.7	465	100	1.4
Wave 4	1,298	52.1	7.7	260	10.4	7.2	932	37.4	7.7	2,490	100	7.6
Wave 5	1,039	54.3	6.2	201	10.5	5.5	672	35.1	5.5	1,912	100	5.9
Wave 6	1,082	69.2	6.4	89	5.7	2.5	392	25.1	3.2	1,563	100	4.8
Wave 7	474	55.2	2.8	79	9.2	2.2	306	35.6	2.5	859	100	2.6
Total	16,867		100.0	3,628		100.0	12,111		100.0	32,606		100.0

The first percentage is the one in row and the second one in column.

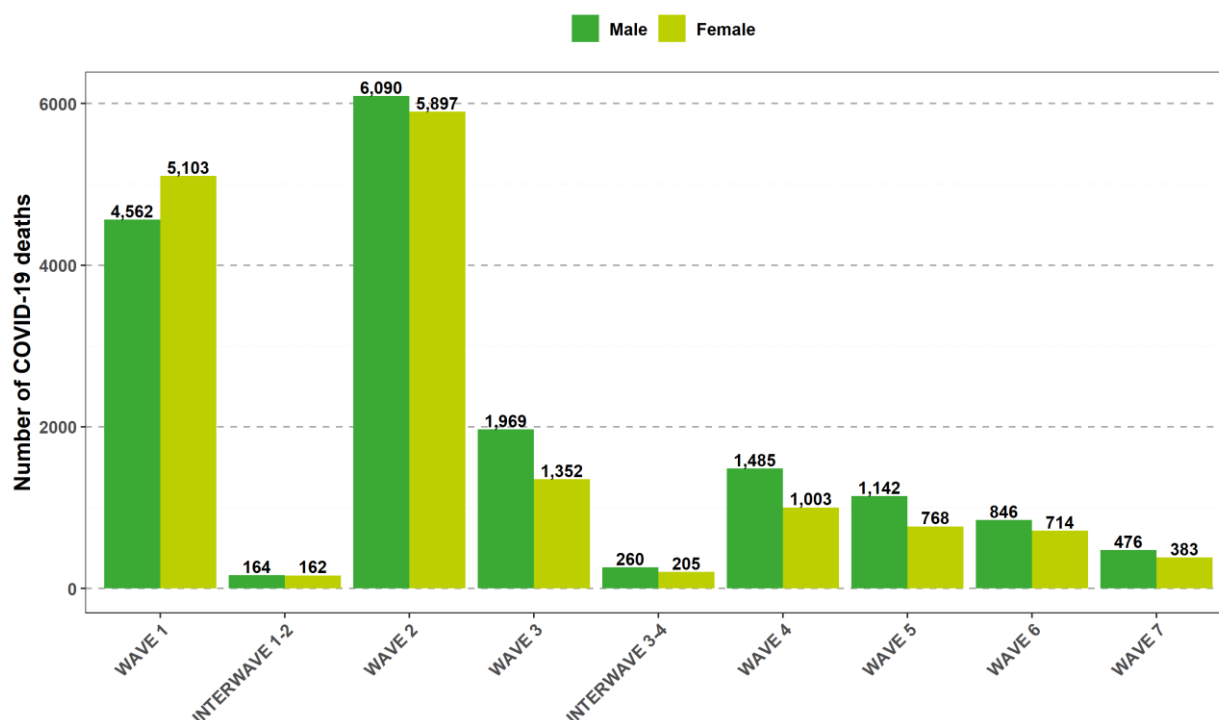
Figure 2. Number of COVID-19 deaths in Belgium per week and region of residence, March 2020 – 11 September 2022



3.2. WHAT WAS THE DISTRIBUTION OF THE COVID-19 DEATHS BY SEX AND AGE?

Between 7 March 2020 and 11 September 2022, **16,994** (52.1%) and **15,587** (47.8%) **COVID-19 deaths** occurred in male and female patients respectively. For 25 of the deceased (between 19 March 2020 and 21 April 2022) the sex was unknown. The number of COVID-19 deaths was always higher among men except for wave 1 (Figure 3). For more information on lethality see chapter 3.9.

Figure 3. COVID-19 deaths in Belgium by sex and wave of the epidemic, March 2020 – 11 September 2022



Note: There are 25 records excluded with missing sex.

Between 7 March 2020 and 11 September 2022, **15,495 COVID-19 deaths** occurred in the age group over 84 years old (47.5%), **14,443** in the age group 65-84 years old (44.3%) and **2,635** in the age group under 65 years old (8.1%). For 33 reported deaths (between 28 March 2020 and 19 February 2021) the age was unknown. The 85-89 age group had the most COVID-19 deaths and 295 deaths (0.9%) occurred among people over 100 years of age (Figure 4) of which 65 were male and 230 were female (Figure 5). The median age was 84 years old and the average age was 81.6 years old.

During waves 3, 4, 5 and 7 there were more COVID-19 deaths in the 65-84 age group than in the over 84 age group (Figure 6). This effect stood out the most during wave 3 and could be attributed to the high vaccination coverage by the start of this wave in NH, where most deaths occurred in the 85+ age group. As a result, the proportion of NH resident deaths dropped significantly, depicted by Figure 20 (e.g., from 56.4% in the first two waves to 13.5% in wave 3).

Figure 4. Number of COVID-19 deaths in Belgium by age group, March 2020 – 11 September 2022

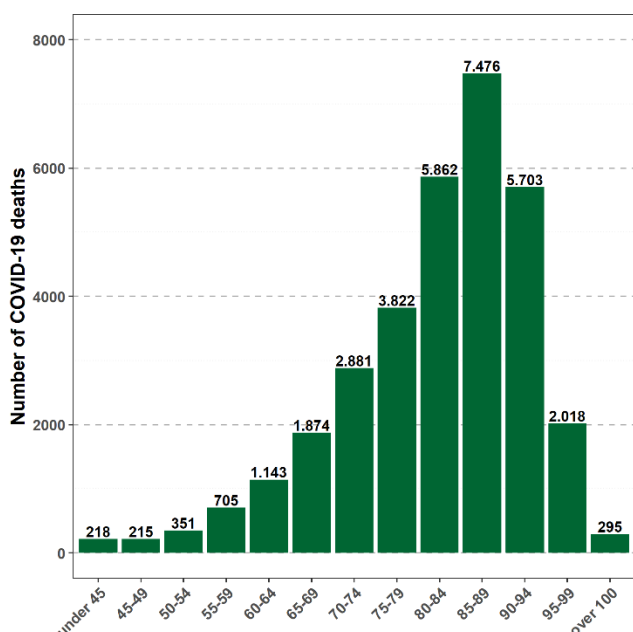
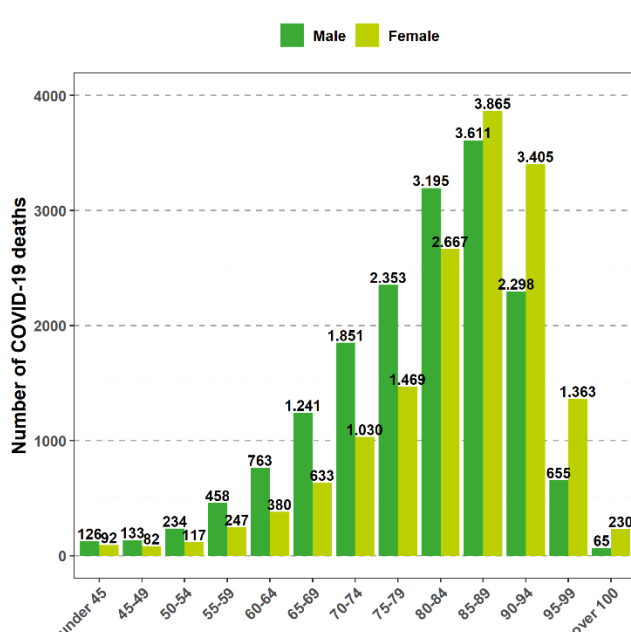


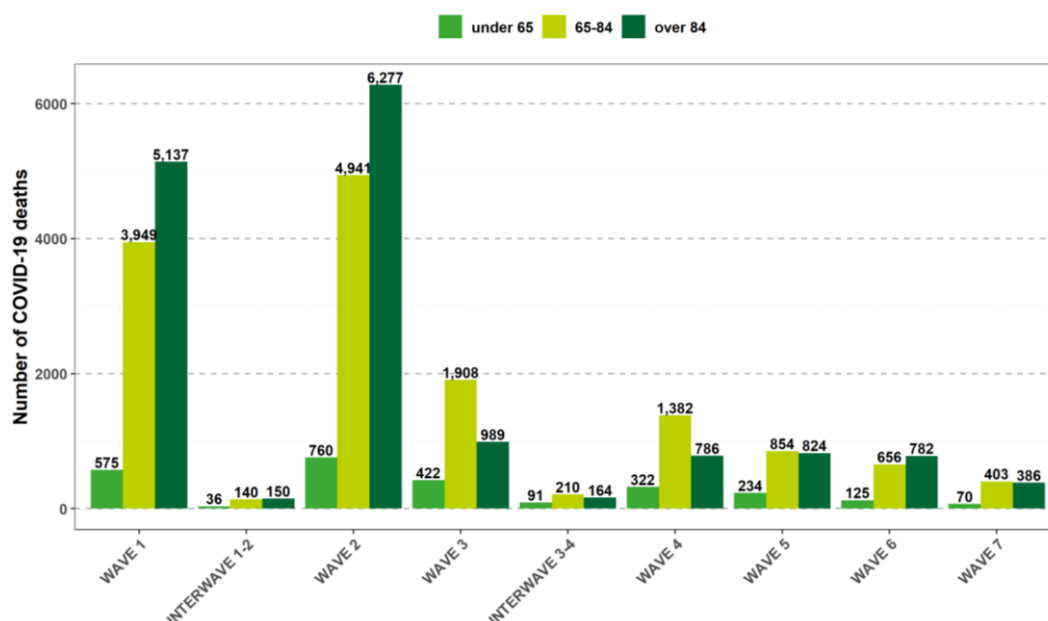
Figure 5. Number of COVID-19 deaths in Belgium by age group and sex, March 2020 – 11 September 2022



Note: There are 43 records excluded with missing age or sex.

From the start of the epidemic through the end of wave 7, in all age groups up to 80-84 years old, males represented the highest fraction of COVID-19 deaths. This pattern changed from the age group 85-89 onwards. In this age group, 7,476 people died of COVID-19, representing **22.9%** of all COVID-19 deaths. Of these, 3,611 (48.3%) were males and 3,865 (51.7%) were females (Figure 5). An analysis by year showed that for 2020 in all age groups up to and including 80-84 years old and for 2021 and 2022 in all age groups up to and including 85-89 years old, **males represented the highest fraction of COVID-19 deaths**, see appendix 9.1.

Figure 6. COVID-19 deaths in Belgium by age group and wave of the epidemic, March 2020 – 11 September 2022



Note: There are 33 records excluded with missing age.

The analysis of the age pyramid at the beginning of the year allows us to investigate the differences in sex per age group. For the year 2020, as of 1 January the 85-89 age group of the population was composed of more females (138,933 or 63.8%) than males (78,809 or 36.2%) (Figure 7), which means that the 2,268 COVID-19 deaths represented 2.9% of the total male population and the 2,666 COVID-19 deaths represented 1.9% of the total female population, aged 85-89 years old (Figure 8). In 2020, while more females in the 85-89 age group and above have died from COVID-19 than males in absolute numbers, it is clear that **the share of the male population in this age group that died from COVID-19 was greater than that of females in 2020.**

Naturally, for the year 2021 the 85-89 age group of the population was composed of more females (135,211 or 63.5%) than males (77,690 or 36.5%) (Figure 9). The 835 COVID-19 deaths represented 1.1% of the total male population and the 781 COVID-19 deaths represented 0.6% of the total female population, aged 85-89 years old (Figure 10). In 2022, the 85-89 age group of the population was composed of 134,671 females (63.2%) and 78,447 males (36.8%) (Figure 11). The 508 COVID-19 deaths represented 0.6% of the total male population and the 418 COVID-19 deaths represented 0.3% of the total female population, aged 85-89 years old (Figure 12). In summary, a similar conclusion as for 2020 can be drawn based on these data.

Figure 7. Age pyramid Belgian population (in %), 1 January 2020

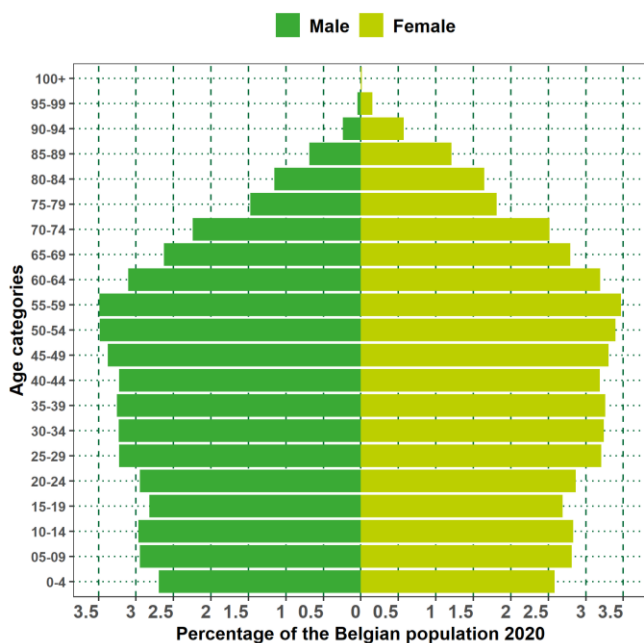


Figure 8. Belgian population who died from COVID-19 (in %) by age group and sex, March 2020 – 31 December 2020

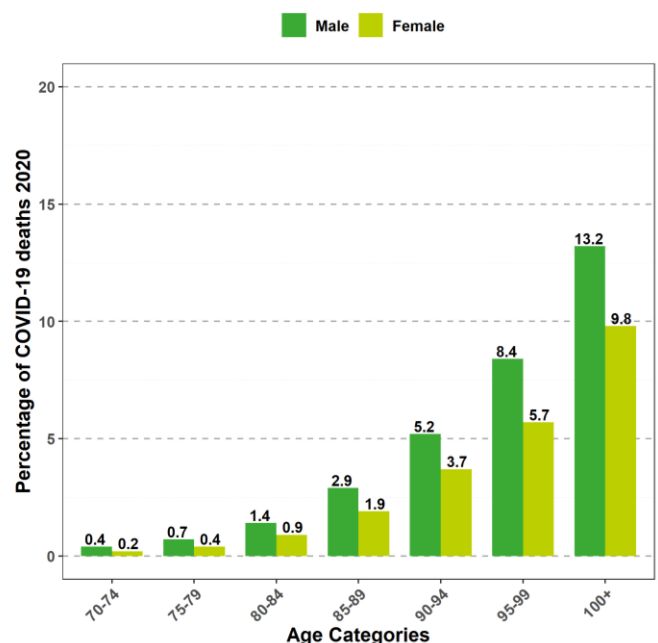


Figure 9. Age pyramid Belgian population (in %), 1 January 2021

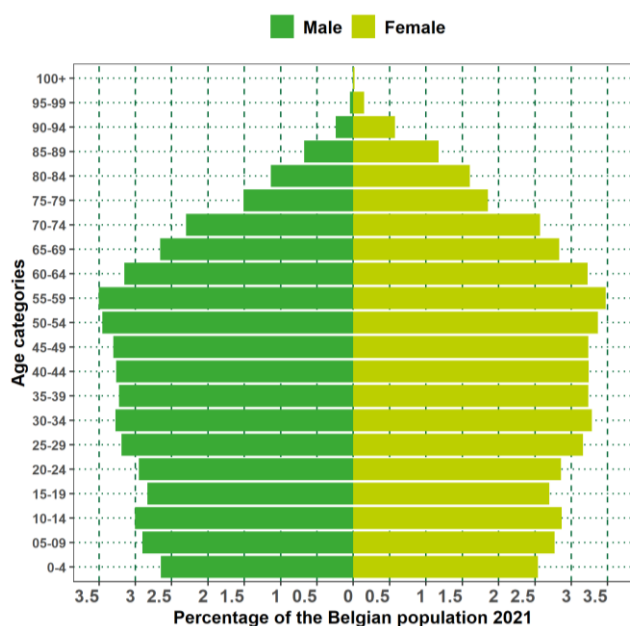


Figure 10. Belgian population who died from COVID-19 (in %) by age group and sex, January 2021 – 31 December 2021

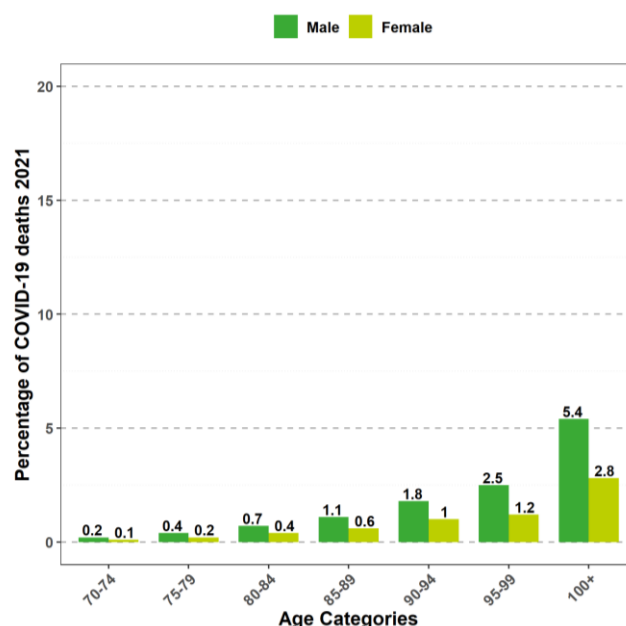


Figure 11. Age pyramid Belgian population (in %), 1 January 2022

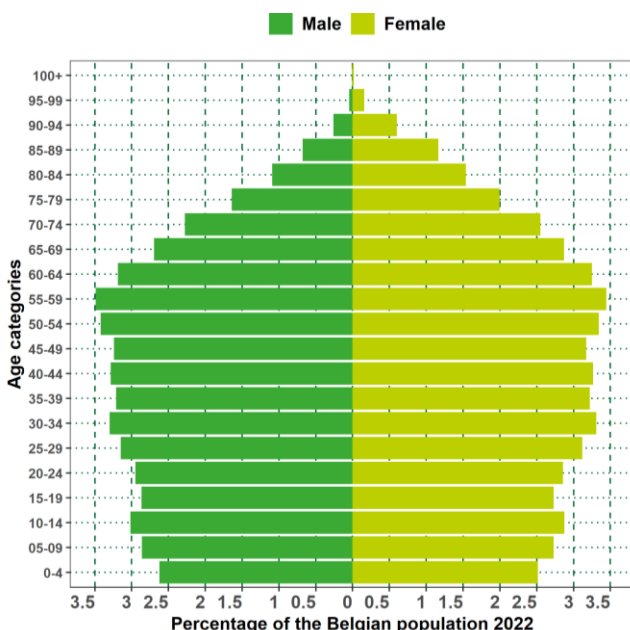
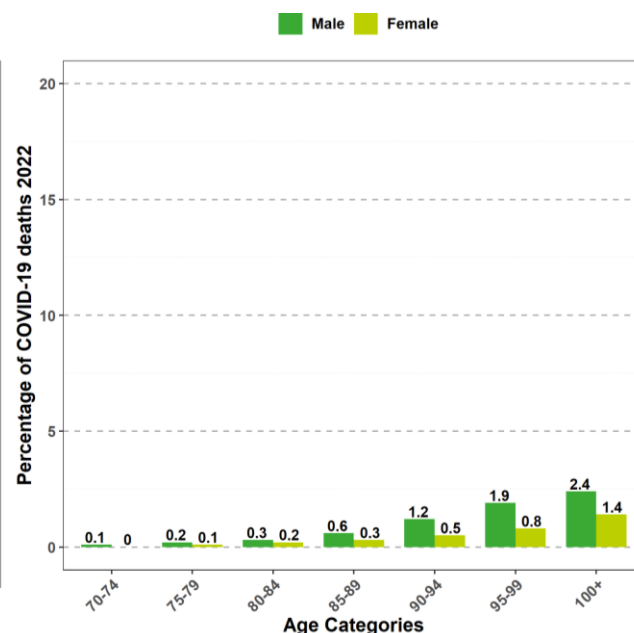


Figure 12. Belgian population who died from COVID-19 (in %) by age group and sex, January 2022 – 11 September 2022

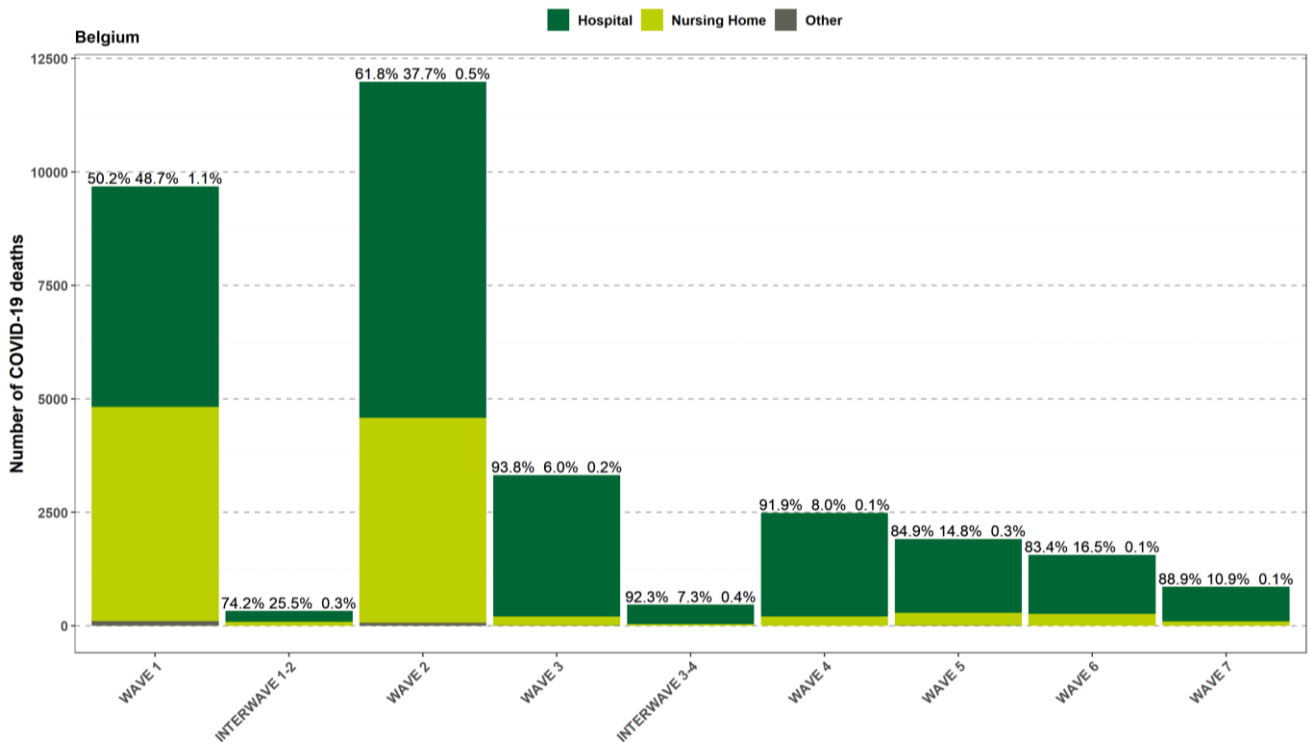


3.3. WHERE DID COVID-19 PATIENTS DIE?

Between 7 March 2020 and 11 September 2022, **22,029** (67.6%) of the COVID-19 deaths occurred in hospitals, **10,387** (31.9%) in NH and **190** (0.6%) in other locations (at home, other LTCFs, other places, unknown). During wave 1 of the epidemic, about half of the COVID-19 deaths occurred in hospitals (50.2%) and the other half in NH (48.7%) (Figure 13).

In 2020, 56.1% of the COVID-19 deaths occurred in hospitals and 43.1% in NH (Figure 14). By 2022, most deaths took place in hospitals (84.8%). Regional differences were observed from wave 2, where Flanders maintained higher number of COVID-19 deaths that took place in NH (46.0%) compared to Wallonia (29.9%) and Brussels-Capital Region (23.0%). Similar trends were visible for the other waves. Available in appendix 9.2.

Figure 13. COVID-19 deaths in Belgium by place of death and wave of the epidemic, March 2020 – 11 September 2022



Note: Percentages are deaths in hospital, in nursing home and deaths at other places respectively.

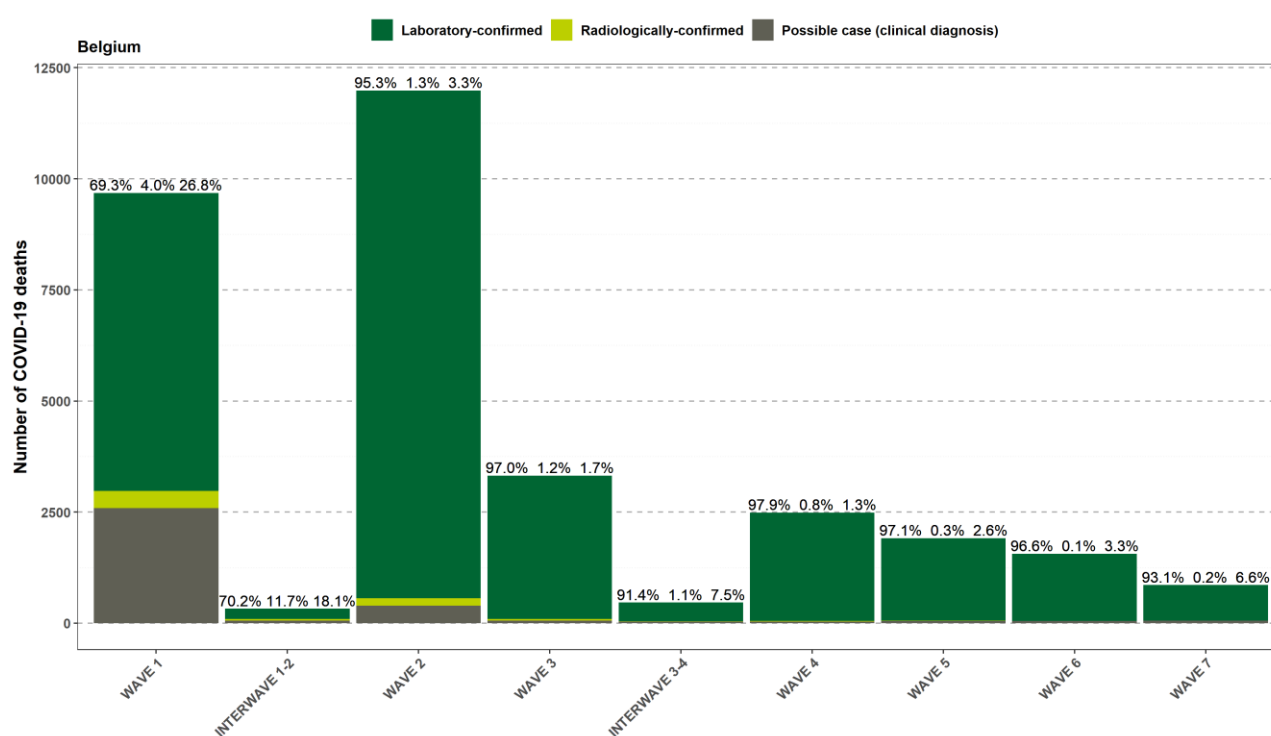
Figure 14. COVID-19 deaths in Belgium by place of death and per year, March 2020 – 11 September 2022



3.4. WHAT WAS THE DISTRIBUTION OF THE COVID-19 DEATHS BY CASE CLASSIFICATION?

Between 10 March 2020 and 11 September 2022, **28,617** (87.8%) of COVID-19 deaths were laboratory-confirmed cases, **658** (2.0%) were radiologically-confirmed cases and **3,331** (10.2%) were possible COVID-19 cases. During the COVID-19 epidemic, the proportion of laboratory-confirmed cases increased due to an increasing test capacity and the broadening of the test strategy, e.g. 69.3% in wave 1 (Figure 15) to 96.1% in 2022 (Figure 17 and Figure 16). Deaths of possible cases are mainly related to the first six weeks of the epidemic. Deaths from radiologically-confirmed cases have been notified from 11 April 2020 and concern mainly the first two waves. The latter criteria was applied retrospectively (5). Regional analyses are available in appendix 9.3.

Figure 15. COVID-19 deaths in Belgium by case classification and wave of the epidemic, March 2020 – 11 September 2022



Note: Percentages are laboratory-confirmed, radiologically-confirmed and possible cases.

Figure 16. Evolution of COVID-19 deaths in Belgium by case classification, March 2020 – 11 September 2022

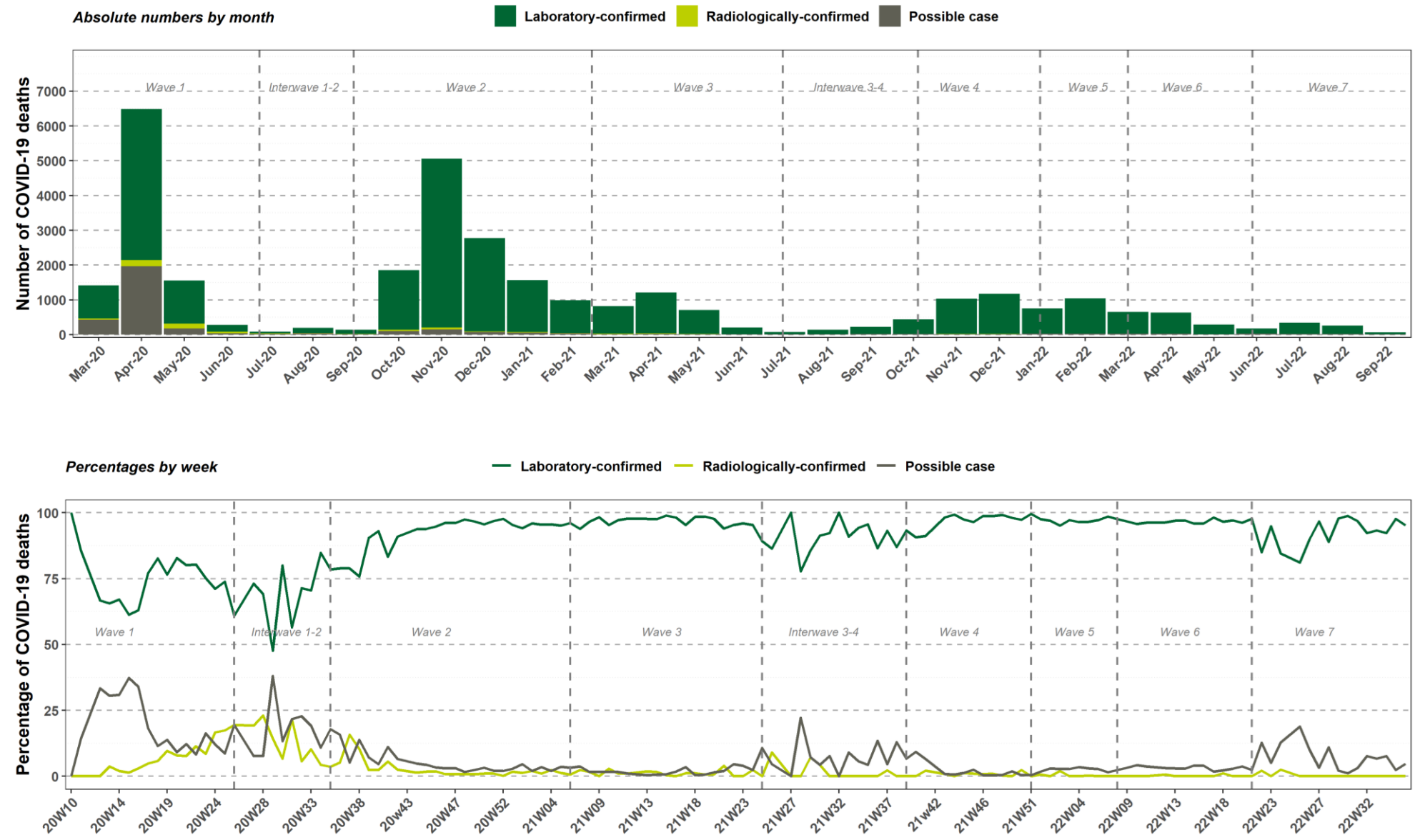
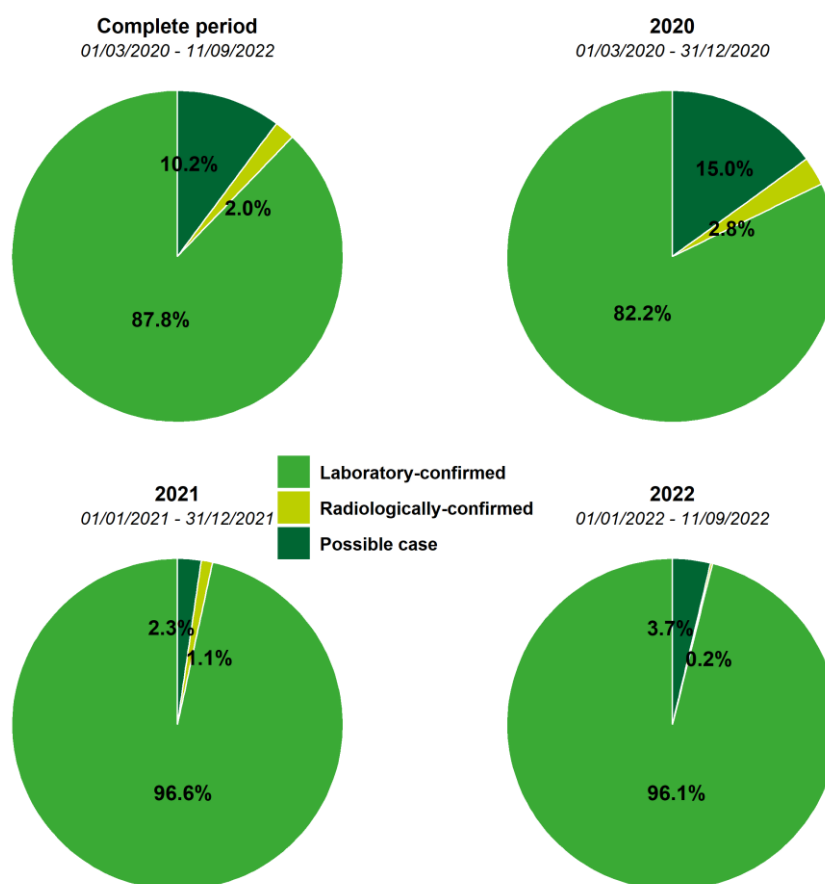


Figure 17. COVID-19 deaths in Belgium by case classification and per year, March 2020 – 11 September 2022

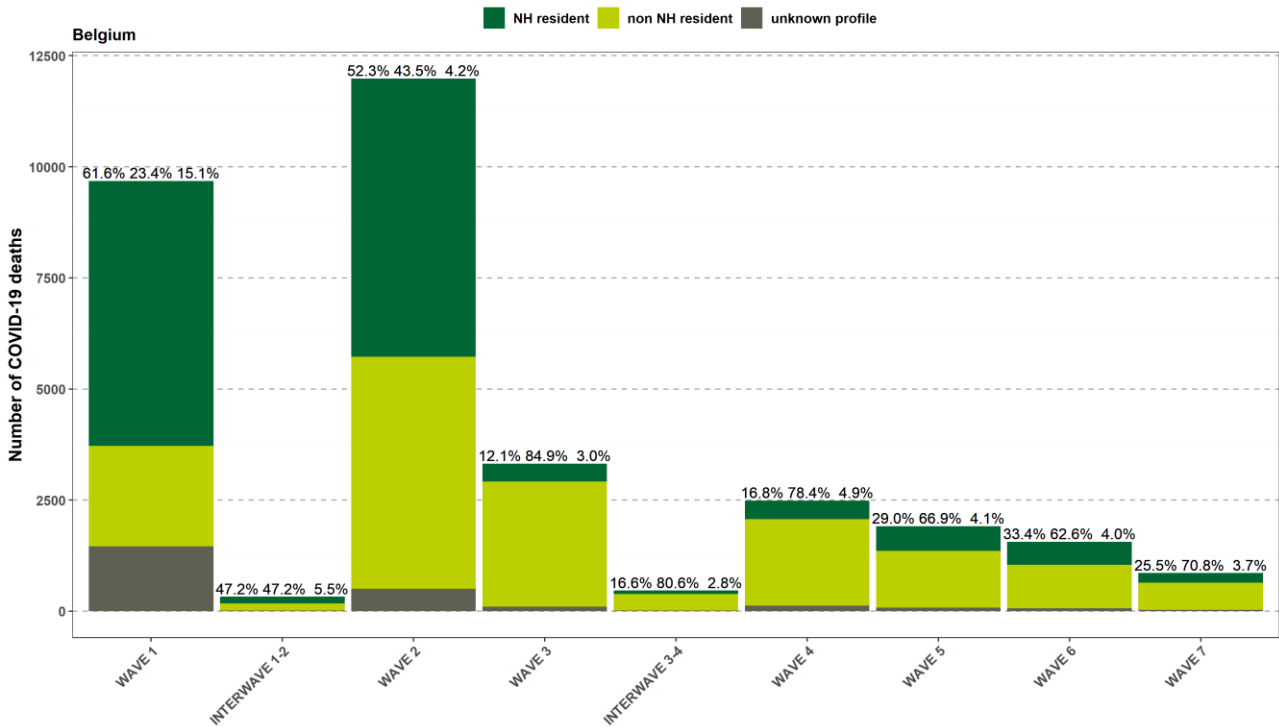


3.5. HOW MANY NH RESIDENTS DIED DUE TO COVID-19?

Between 10 March 2020 and 11 September 2022, **14,570 NH residents** died, which represents **44.7%** of all COVID-19 deaths. Additionally, 492 people residing in other collectivises died during this period. Fortunately, the percentage of COVID-19 deaths that are NH residents has dropped since 2020, as depicted by Figure 18, Figure 19 and Figure 20. Regional analyses are available in appendix 9.4.

In Belgium, based on the data of [IMA of 2018](#), 5.6% of the population above 65 years old, was living in a LTCF. Belgium also has an important peculiarity compared to other countries: it is the second European country with the highest number of nursing home beds per 100,000 inhabitants (after Sweden) according to WHO (7). For more information on NH surveillance: [COVID-19 NH surveillance](#). For more information on managing mortality data among NH residents: [FAQ COVID-19 surveillance section 6.4](#).

Figure 18. COVID-19 deaths in Belgium per profile by wave of the epidemic, March 2020 – 11 September 2022



Note: Percentages are deaths that are NH residents, non-NH residents and deaths with an unknown profile, respectively.

Figure 19. COVID-19 deaths in Belgium per profile per year, March 2020 – 11 September 2022

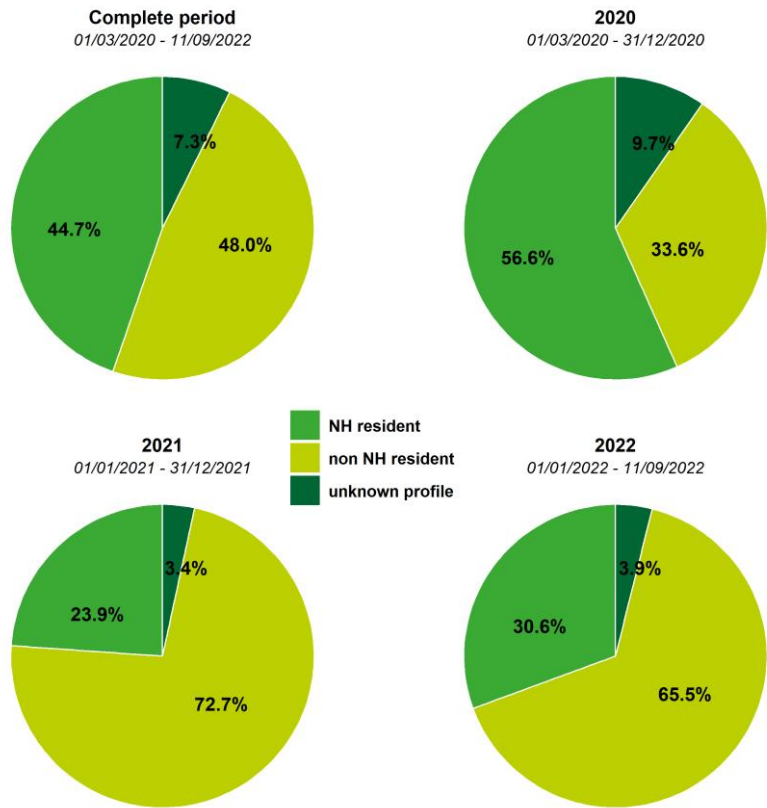
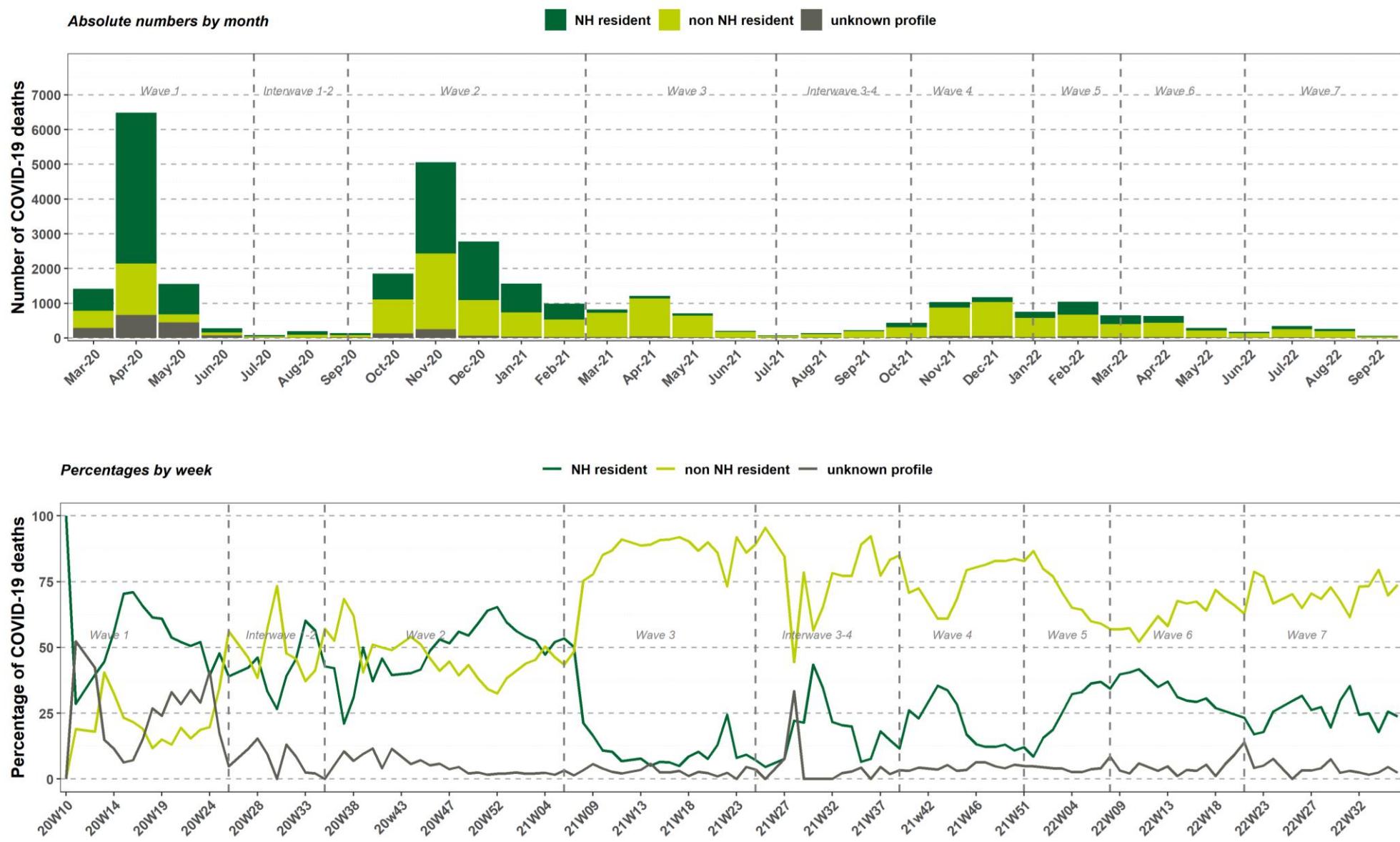


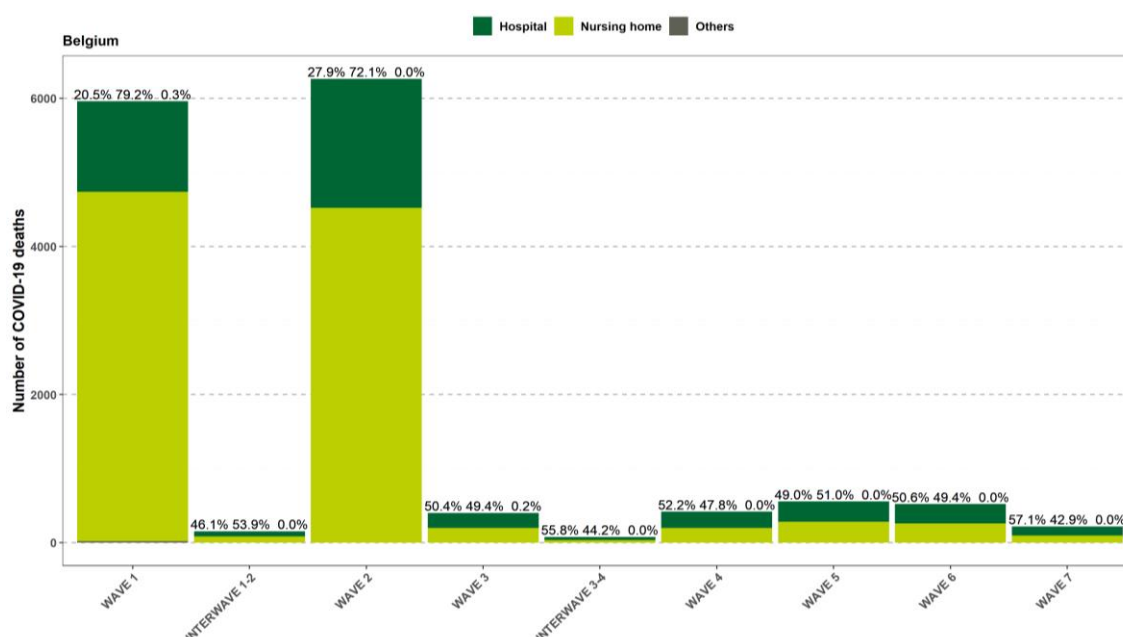
Figure 20. Evolution of COVID-19 deaths in Belgium per profile, March 2020 – 11 September 2022



3.6. WHERE DID THE COVID-19 DEATHS AMONG NH RESIDENTS TAKE PLACE?

Of the 14,570 NH residents who died from COVID-19 between 10 March 2020 and 11 September 2022, **10,387 COVID-19 deaths** (71.3%) occurred in the NH. The fraction of NH residents that died in hospitals has increased from a quarter (23.7%) in 2020 to half (51.0%) in 2022, indicated by Figure 21, Figure 22 and Figure 23. Regional analyses are available in appendix 9.5. For more info on European comparison between COVID-19 mortality in NH residents: [https://covid19-country-overviews.ecdc.europa.eu/#7 Belgium](https://covid19-country-overviews.ecdc.europa.eu/#7_Belgium).

Figure 21. COVID-19 deaths among NH residents by place of death and wave of the epidemic, March 2020 – 11 September 2022



Note: Percentages are deaths in hospital, in nursing home and deaths at other places respectively.

Figure 22. COVID-19 deaths among NH residents in Belgium by place of death and per year, March 2020 – 11 September 2022

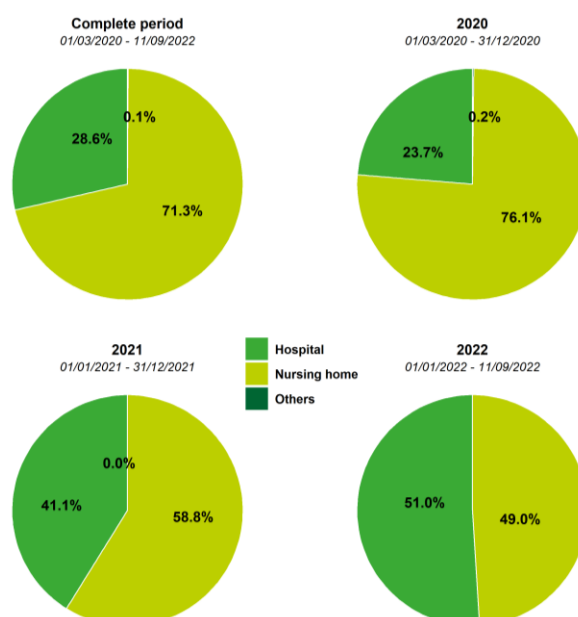
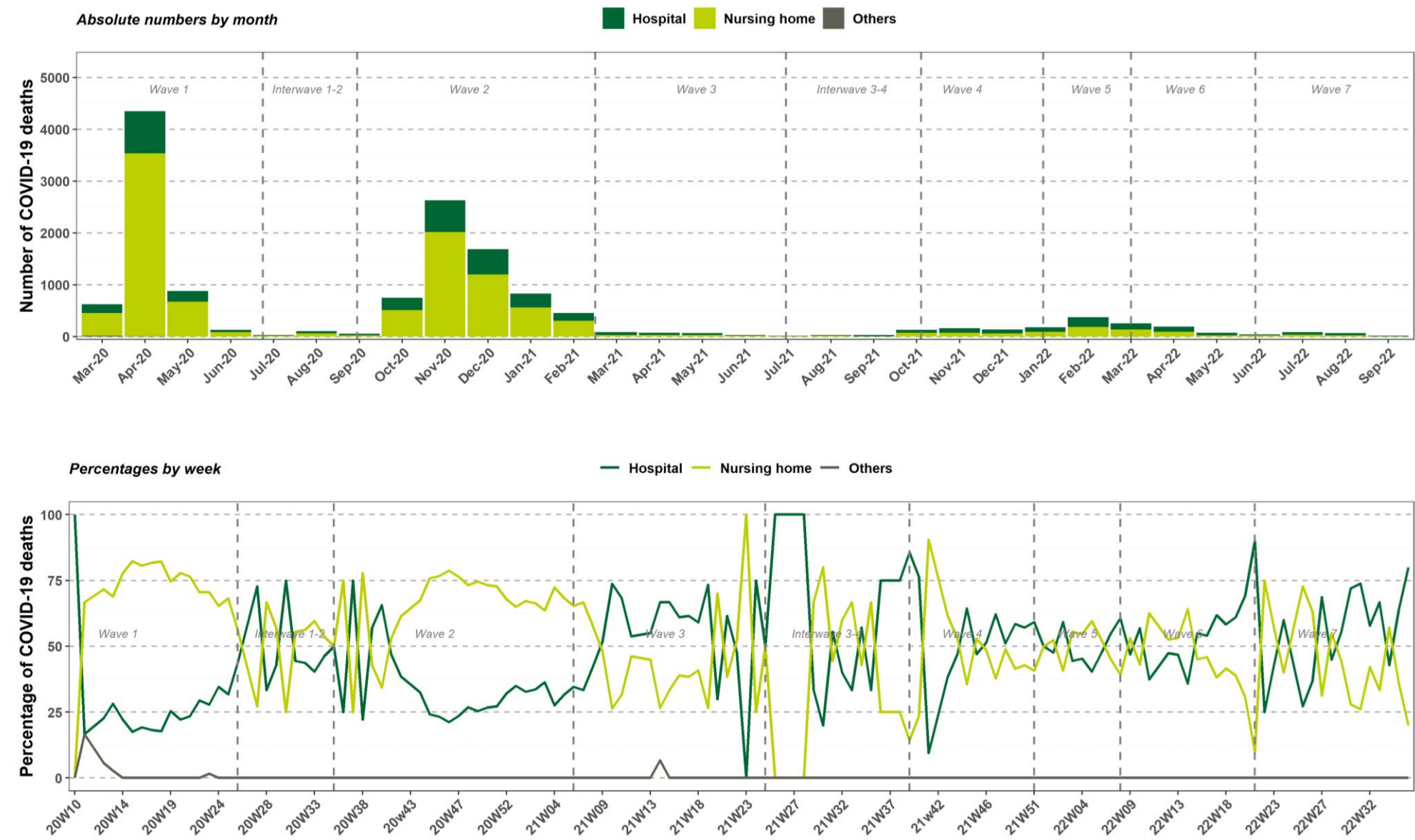


Figure 23. Evolution of COVID-19 deaths in Belgium among NH residents, by place of death, March 2020 – 11 September 2022



3.7. HOW WAS COVID-19 MORTALITY DISTRIBUTED GEOGRAPHICALLY IN BELGIUM?

This section describes the COVID-19 mortality rates for Belgium, by geographical entity (region and province of residence), by profile (being a NH resident or not) for the seven waves separately, by year and for the global period. The Belgian population is used as reference.

First, the **crude COVID-19 mortality rate** (CMR) is presented, which is the number of COVID-19 deaths per 100,000 inhabitants in Belgium.

Second, to remove the effect of possible differences in the age structure of the populations of the different geographical entities, the **COVID-19 mortality rates after direct age-standardization** (direct standardized mortality rate - dSMR) are calculated, using the Belgian population as a reference. Those dSMRs are fictitious, influenced by the selected reference population, but they allow to compare mortality rates between different geographic entities in a certain period.

Another method to account for possible variations in the age distribution of the different populations of the geographical entities is by calculating **indirect age-standardized COVID-19 mortality ratios** (indirect standardized mortality ratio - iSMR). These ratios compare the number of deaths that occurred in an entity with the number that would have been expected if this entity had had the age-specific mortality rates of the entire Belgian population. The iSMRs of the different entities are not compared with each other but with the entire Belgian population. Indirect standardization is preferred to direct standardization when small number of deaths are involved.

Mortality rates are presented by **place of residence**, with place of death used as a proxy when place of residence was unknown. After retrospective analyses, only 204 (0.6%) records have missing place of residence. It has to be noted that as the different waves have **different durations** their mortality rates cannot be directly compared with each other.

3.7.1. COVID-19 mortality indicators by region of residence

COVID-19 mortality rates by region of residence are presented in Table 3 and Table 4. The overall CMR due to COVID-19 in Belgium, all waves combined, reached 281 per 100,000 inhabitants. It was higher in Wallonia (331 per 100,000 inhabitants), followed by Brussels-Capital Region (297 per 100,000 inhabitants) and finally Flanders (252 per 100,000 inhabitants).

There was a difference in the ranking of the different regions when the age structure of the population is taken into account (dSMR and iSMR). For instance, for the total period, Brussels-Capital Region had the highest overall COVID-19 dSMR in Belgium (419 per 100,000 inhabitants), followed by Wallonia (350 per 100,000 inhabitants) and finally Flanders where the COVID-19 dSMR (231 per 100,000 inhabitants) was far lower than that of Brussels-Capital Region.

Taking all waves together, we observed that there was a 49% excess of COVID-19 deaths (iSMR = 149/100) in the Brussels population compared to the Belgian population. Moreover, the Brussels population recorded the highest percentage of excess COVID-19 deaths during wave 1 (86% or iSMR = 186/100) compared to the Belgian population.

A comparison of the level of COVID-19 mortality per year, showed that the year 2020 of the epidemic was the deadliest in Belgium with a COVID-19 CMR reaching 173 per 100,000 inhabitants (compared to 74 per 100,000 inhabitants for 2021).

Table 3 COVID-19 mortality indicators in Belgium by region and wave of the epidemic, March 2020 – 11 September 2022

<u>Total period</u> (01/03/2020 to 11/09/2022, week 9 2020 to week 36 2022)				<u>Wave 1</u> (01/03/2020 to 21/06/2020, week 9 to week 25 2020)				<u>Interwave 1-2</u> (22/06/2020 to 30/08/2020, week 26 2020 to week 35 2020)			
Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)	Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)	Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)
BXL	297	419	149	BXL	114	157	186	BXL	4	6	204
FLA	252	231	83	FLA	73	67	80	FLA	3	2	87
WAL	331	350	125	WAL	95	100	119	WAL	3	3	99
BEL	281	-	-	BEL	84	-	-	BEL	3	-	-

<u>Wave 2</u> (31/08/2020 to 14/02/2021, week 36 2020 to week 6 2021)				<u>Wave 3</u> (15/02/2021 to 27/06/2021, week 7 to week 25 2021)				<u>Interwave 3-4</u> (28/06/2021 to 03/10/2021, week 26 2020 to week 39 2020)			
Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)	Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)	Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)
BXL	86	120	116	BXL	34	48	166	BXL	8	10	254
FLA	94	86	83	FLA	23	22	76	FLA	3	2	59
WAL	129	137	132	WAL	37	38	134	WAL	6	6	143
BEL	104	-	-	BEL	29	-	-	BEL	4	-	-

Wave 4 (04/10/2021 to 26/12/2021, week 40 2021 to week 51 2021)			
Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)
BXL	21	29	137
FLA	20	18	84
WAL	26	27	124
BEL	22	-	-

Wave 5 (27/12/2021 to 27/02/2022, week 52 2021 to week 8 2022)			
Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)
BXL	16	23	139
FLA	16	14	87
WAL	18	19	117
BEL	17	-	-

Wave 6 (28/02/2022 to 29/05/2022, week 9 2022 to week 21 2022)			
Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)
BXL	7	10	76
FLA	16	15	110
WAL	11	11	84
BEL	13	-	-

Wave 7 (30/05/2022 to 11/09/2022, week 22 2022 to week 36 2022)			
Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)
BXL	6	9	122
FLA	7	7	88
WAL	8	9	119
BEL	7	-	-

CMR: COVID-19 crude mortality rate, dSMR: COVID-19 direct standardized mortality rate, iSMR: COVID-19 indirect standardized mortality ratio, BEL: Belgium, BXL: Brussels-Capital Region, FLA: Flanders, WAL: Wallonia

Table 4 COVID-19 mortality indicators in Belgium by region and per year, March 2020 – 11 September 2022

Year 2020 (01/01/2020 to 31/12/2020)			
Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)
BXL	195	269	159
FLA	148	136	79
WAL	210	221	131
BEL	173	-	-

Year 2021 (01/01/2021 to 31/12/2021)			
Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)
BXL	74	103	139
FLA	68	63	85
WAL	85	90	121
BEL	74	-	-

Year 2022 (01/01/2022 to 31/12/2022)			
Region	CMR (/100,000)	dSMR (/100,000)	iSMR (/100)
BXL	33	47	109
FLA	44	41	95
WAL	44	46	108
BEL	43	-	-

CMR: COVID-19 crude mortality rate, dSMR: COVID-19 direct standardized mortality rate, iSMR: COVID-19 indirect standardized mortality ratio, BEL: Belgium, BXL: Brussels-Capital Region, FLA: Flanders, WAL: Wallonia

3.7.2. COVID-19 mortality indicators by province of residence (and Brussels-Capital Region)

COVID-19 mortality rates by province of residence are presented in Table 5 and Table 6. The province of **Hainaut**, all seven waves combined, presented the highest COVID-19 CMR (385 per 100,000 inhabitants) while the lowest COVID-19 CMR was recorded in the province of Walloon Brabant (213 per 100,000 inhabitants). When we take into account the age structure of the populations of the different provinces, we see that the highest level of COVID-19 dSMR was recorded in Brussels-Capital Region and the lowest level in the province of Flemish Brabant.

The analysis by year, separating wave and interwave showed that: during wave 1 and interwaves 1-2 and 3-4, it was in Brussels-Capital Region that the COVID-19 dSMR was the highest, while it was the lowest in Walloon Brabant and in province of Luxembourg. Compared to the Belgian population, 86% of excess of deaths ($iSMR = 186/100$) were registered among the Brussels population during wave 1.

Waves 2, 3, 5 and 7 were marked by the highest COVID-19 dSMR recorded in the province of Hainaut while the lowest level was recorded in the provinces of Flemish Brabant and Limburg. Regarding the iSMR, in the population of the province of Hainaut, an excess of COVID-19 deaths of 54%, 76%, 39% and 61% was observed in waves 2, 3, 5 and 7 respectively compared to the population of Belgium. During wave 4, the province of Liège had the highest percentage of excess deaths due to COVID-19 in relation to the Belgian population. It was lowest in the province of Flemish Brabant in relation to the Belgian population.

Brussels-Capital Region in 2020 and **Hainaut** in 2021 and in 2022 recorded the highest levels of COVID-19 dSMR. In the provinces of Flemish Brabant and province of Luxembourg, the levels of COVID-19 dSMR were relatively the lowest. In the populations of Brussels-Capital Region (2020) and Hainaut (2021 and 2022), excess of COVID-19 deaths of 59% (2020), 40% (2021) and 40% (2022) respectively were observed compared to the Belgian population.

Table 5 COVID-19 mortality indicators in Belgium by province and wave of the epidemic, March 2020 – 11 September 2022

Total period					
(01/03/2020 up to and including 11/09/2022, week 9 2020 to week 36 2022)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Hainaut	385	Brussels	419	BXL	149
Liège	348	Hainaut	409	Hainaut	146
Namur	298	Liège	366	Liège	131
BXL	297	Namur	319	Namur	114
West Flanders	278	Luxembourg	264	Luxembourg	93
East Flanders	271	East Flanders	254	East Flanders	91
Limburg	252	Limburg	237	Limburg	85
Antwerp	240	Antwerp	233	Antwerp	83
Luxembourg	232	West Flanders	219	West Flanders	78
Flemish Brabant	217	Walloon Brabant	214	Walloon Brabant	76
Walloon Brabant	213	Flemish Brabant	207	Flemish Brabant	74

Wave 1					
(01/03/2020 up to and including 21/06/2020, week 9 to week 25 2020)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
BXL	114	BXL	157	BXL	186
Limburg	113	Hainaut	113	Hainaut	135
Hainaut	107	Liège	112	Liège	132
Liège	106	Limburg	110	Limburg	131
Namur	82	Namur	90	Namur	106
Luxembourg	72	Luxembourg	81	Luxembourg	96
West Flanders	71	Flemish Brabant	67	Flemish Brabant	81
Flemish Brabant	71	Antwerp	65	Antwerp	78
Antwerp	67	East Flanders	57	East Flanders	68
East Flanders	61	West Flanders	56	West Flanders	67
Walloon Brabant	54	Walloon Brabant	55	Walloon Brabant	65

Interwave 1-2					
(22/06/2020 up to and including 30/08/2020, week 26 to week 35 2020)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Antwerp	6	BXL	6	BXL	204
Hainaut	4	Antwerp	5	Antwerp	192
BXL	4	Hainaut	4	Hainaut	149
Liège	3	Liège	3	Liège	109
West Flanders	2	Limburg	2	Limburg	70
Limburg	2	Walloon Brabant	2	Walloon Brabant	62
Walloon Brabant	2	West Flanders	1	West Flanders	52
East Flanders	1	East Flanders	1	East Flanders	42
Namur	1	Namur	1	Flemish Brabant	38
Flemish Brabant	1	Flemish Brabant	1	Namur	30
Luxembourg	0	Luxembourg	0	Luxembourg	0

Wave 2					
(31/08/2020 up to and including 14/02/2021, week 36 2020 to week 6 2021)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Hainaut	149	Hainaut	159	Hainaut	154
Liège	136	Liège	143	Liège	138
East Flanders	118	Namur	121	Namur	118
Namur	114	BXL	120	BXL	116
West Flanders	112	East Flanders	110	East Flanders	106
Antwerp	93	Luxembourg	104	Luxembourg	99
Luxembourg	91	Walloon Brabant	91	Antwerp	87
Walloon Brabant	89	Antwerp	90	Walloon Brabant	87
BXL	86	West Flanders	87	West Flanders	85
Flemish Brabant	73	Flemish Brabant	69	Flemish Brabant	67
Limburg	54	Limburg	52	Limburg	50

Wave 3					
(15/02/2021 up to and including 27/06/2021, week 7 to week 25 2021)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Hainaut	48	Hainaut	50	Hainaut	176
Namur	45	Namur	48	Namur	166
BXL	34	BXL	48	BXL	166
East Flanders	28	Luxembourg	29	Luxembourg	102
Liège	26	East Flanders	27	Liège	94
Luxembourg	26	Liège	27	East Flanders	92
West Flanders	25	Walloon Brabant	25	Walloon Brabant	87
Limburg	25	Limburg	24	Limburg	82
Walloon Brabant	25	Antwerp	21	Antwerp	74
Antwerp	22	West Flanders	20	West Flanders	71
Flemish Brabant	17	Flemish Brabant	16	Flemish Brabant	57
Interwave 3-4					
(28/06/2021 up to and including 03/10/2021, week 26 to week 39 2020)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
BXL	8	BXL	10	BXL	254
Liège	7	Liège	8	Liège	193
Hainaut	6	Hainaut	7	Hainaut	163
Flemish Brabant	4	Namur	4	Namur	89
West Flanders	3	Flemish Brabant	3	Flemish Brabant	84
Namur	3	Walloon Brabant	3	Walloon Brabant	73
Walloon Brabant	3	Antwerp	2	Limburg	56
Antwerp	2	West Flanders	2	Antwerp	54
East Flanders	2	East Flanders	2	West Flanders	54
Limburg	2	Limburg	2	East Flanders	54
Luxembourg	2	Luxembourg	2	Luxembourg	47

Wave 4					
(04/10/2021 up to and including 26/12/2021, week 40 to week 51 2021)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Liège	32	Liège	34	Liège	156
Hainaut	24	BXL	29	BXL	137
Luxembourg	24	Luxembourg	27	Luxembourg	124
Namur	24	Hainaut	25	Hainaut	115
West Flanders	22	Namur	25	Namur	115
Limburg	22	Limburg	21	Limburg	97
East Flanders	21	East Flanders	20	East Flanders	93
BXL	21	West Flanders	18	West Flanders	84
Antwerp	17	Antwerp	17	Walloon Brabant	79
Walloon Brabant	17	Walloon Brabant	17	Antwerp	78
Flemish Brabant	16	Flemish Brabant	15	Flemish Brabant	70
Wave 5					
(27/12/2021 up to and including 27/02/2022, week 52 2021 to week 8 2022)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Hainaut	22	Hainaut	23	Hainaut	139
Liège	19	BXL	23	BXL	139
West Flanders	18	Liège	20	Liège	121
East Flanders	18	Namur	18	Namur	108
Namur	17	East Flanders	17	East Flanders	104
BXL	16	Antwerp	14	West Flanders	88
Antwerp	14	West Flanders	14	Antwerp	83
Flemish Brabant	14	Flemish Brabant	13	Flemish Brabant	82
Walloon Brabant	13	Walloon Brabant	13	Walloon Brabant	77
Limburg	12	Limburg	12	Luxembourg	72
Luxembourg	11	Luxembourg	12	Limburg	71

Wave 6					
(28/02/2022 up to and including 29/05/2022, week 9 to week 21 2022)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
West Flanders	19	East Flanders	16	East Flanders	117
East Flanders	17	Hainaut	15	Hainaut	115
Limburg	16	West Flanders	15	Limburg	113
Flemish Brabant	16	Flemish Brabant	15	West Flanders	112
Antwerp	14	Limburg	15	Flemish Brabant	110
Hainaut	14	Antwerp	14	Antwerp	102
Liège	10	Liège	11	Liège	80
Luxembourg	7	BXL	10	BXL	76
Namur	7	Namur	8	Namur	58
Walloon Brabant	7	Walloon Brabant	7	Luxembourg	55
BXL	7	Luxembourg	7	Walloon Brabant	51

Wave 7					
(30/05/2022 up to and including 11/09/2022, week 22 to week 36 2022)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Hainaut	11	Hainaut	12	Hainaut	161
Liège	8	Liège	9	BXL	122
Flemish Brabant	8	BXL	9	Liège	120
Antwerp	7	Flemish Brabant	8	Flemish Brabant	103
West Flanders	7	Antwerp	7	Namur	98
East Flanders	7	East Flanders	7	East Flanders	92
Namur	7	Namur	7	Antwerp	89
Limburg	6	West Flanders	6	Limburg	81
BXL	6	Limburg	6	West Flanders	76
Walloon Brabant	5	Walloon Brabant	5	Walloon Brabant	73
Luxembourg	2	Luxembourg	2	Luxembourg	26

Note: CMR: COVID-19 crude mortality rate, dSMR: COVID-19 direct standardized mortality rate, iSMR: COVID-19 indirect standardized mortality rate. Additionally note that deaths are underreported in Luxembourg during wave 7 due to reporting problems, underestimating the reported mortality rates.

Table 6 COVID-19 mortality indicators in Belgium by province and year, March 2020 – 11 September 2022

Year 2020 (01/01/2020 up to and including 31/12/2020)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Hainaut	242	BXL	269	BXL	159
Liège	232	Hainaut	255	Hainaut	151
BXL	195	Liège	241	Liège	143
Namur	183	Namur	196	Namur	115
West Flanders	157	Luxembourg	165	Luxembourg	96
Limburg	154	Limburg	150	Limburg	86
East Flanders	153	Antwerp	144	Antwerp	83
Antwerp	147	East Flanders	143	East Flanders	83
Luxembourg	146	Walloon Brabant	128	Walloon Brabant	74
Flemish Brabant	127	West Flanders	124	West Flanders	72
Walloon Brabant	126	Flemish Brabant	121	Flemish Brabant	70
Year 2022 (01/01/2022 up to and including 31/12/2022)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Hainaut	56	Hainaut	60	Hainaut	140
West Flanders	50	BXL	47	BXL	109
East Flanders	48	Liège	46	Liège	106
Flemish Brabant	43	East Flanders	45	East Flanders	104
Liège	43	Flemish Brabant	41	Flemish Brabant	97
Limburg	41	West Flanders	40	West Flanders	92
Antwerp	40	Antwerp	39	Antwerp	90
Namur	34	Limburg	39	Limburg	90
BXL	33	Namur	36	Namur	85
Walloon Brabant	30	Walloon Brabant	31	Walloon Brabant	71
Luxembourg	23	Luxembourg	26	Luxembourg	61

Year 2021 (01/01/2021 up to and including 31/12/2021)					
Province	CMR (/100,000)	Province	dSMR (/100,000)	Province	iSMR (/100)
Hainaut	98	Hainaut	103	Hainaut	140
Namur	88	BXL	103	BXL	139
Liège	81	Namur	93	Namur	126
West Flanders	80	Liège	84	Liège	114
East Flanders	80	Luxembourg	78	Luxembourg	105
BXL	74	East Flanders	76	East Flanders	102
Luxembourg	70	Walloon Brabant	65	Walloon Brabant	88
Limburg	65	West Flanders	63	West Flanders	86
Walloon Brabant	65	Limburg	62	Limburg	83
Antwerp	61	Antwerp	59	Antwerp	79
Flemish Brabant	55	Flemish Brabant	53	Flemish Brabant	72

Note: CMR: COVID-19 crude mortality rate, dSMR: COVID-19 direct standardized mortality rate, iSMR: COVID-19 indirect standardized mortality ratio. Additionally note that deaths are underreported in Luxembourg during wave 7 due to reporting problems, underestimating the reported mortality rates.

3.8. COVID-19 MORTALITY RATES IN NH AND NON-NH RESIDENTS

In this section only COVID-19 CMR for the seven waves separately, by year and for the global period, are described for all **NH residents (all ages) and non-NH residents aged 65 years and over**, as the limitation of age-specific data in the NH population **did not allow to perform an age standardization** (no dSMR and iSMR in this section). In the denominator, the average NH population from the NH surveillance was used for the NH residents, and the general population aged 65 years and over for the non-NH residents. The results are presented in Table 7 and Table 8.

In Belgium, the overall COVID-19 CMR, all waves combined, among NH residents reached 7,500 per 100,000 inhabitants and 923 per 100,000 inhabitants among non-NH residents. By region, the overall COVID-19 CMR, all waves combined, **among NH residents was the highest for Flanders** (7,979 per 100,000 inhabitants) and the highest for Brussels-Capital Region among non-NH residents (1,552 per 100,000 inhabitants). However, the age distribution of NH residents is very different from that of non-NH residents: the highest age groups are much more represented among NH residents than in the general population of people from over 65 living at home (8). Therefore, the comparison of crude rates should be interpreted with caution. Age-adjusted mortality rates would be more appropriate, but could not be calculated due to above mentioned limitations.

At the regional level, throughout wave 1, the COVID-19 CMR was highest in Brussels-Capital Region for both NH residents and non-NH residents. During waves 2 and 3, the rate was highest among NH residents in Flanders, and in Brussels-Capital Region for non-NH residents. For wave 4, this rate was highest in Wallonia and in Brussels-Capital Region for NH residents and non-NH residents respectively. During waves 5 and 7, the COVID-19 CMR was highest among NH residents in Flanders, and in Brussels-Capital Region for non-NH residents. For wave 6, the rate was highest in Flanders for both NH residents and non-NH residents. As the age structure, but also the degree of dependency of elderly (8), of the populations from these different geographical entities is not the same, it is difficult to conclude that NH residents in Flanders compared to other regions, have been hit harder by the COVID-19 epidemic using solely the CMR.

At the provincial level considering the total period, the provinces of **East Flanders** and **Brussels-Capital Region** had the highest COVID-19 CMR for NH residents and for non-NH residents respectively. Throughout wave 1, the COVID-19 CMR was highest in Limburg for NH residents and in Brussels-Capital Region for non-NH residents. During waves 2 and 6, it was highest in East Flanders for NH residents and in Hainaut for non-NH residents. This rate was highest in Walloon Brabant, province of Luxembourg and East Flanders during waves 3, 4 and 5 respectively for NH residents, while it was lowest in Brussels-Capital Region for non-NH residents during these periods. Flemish Brabant had the highest COVID-19 CMR for NH residents in wave 7, while it was highest in Brussels-Capital Region for non-NH residents.

During the years 2020, 2021 and 2022, at regional level, the COVID-19 CMR was highest in **Brussels-Capital Region** (2020) and in **Flanders** (2021 and 2022) for NH residents and in Brussels-Capital Region for non-NH residents. At the provincial level, it was highest in Liège and East Flanders for NH residents, and in Brussels-Capital Region and Hainaut for non-NH residents during these years.

Table 7 COVID-19 crude mortality rate per 100,000 inhabitants for NH residents (all ages) and non-NH residents (aged 65 years and over) in Belgium, by region and province, by wave of the epidemic, March 2020 – 11 September 2022

<u>Total period</u> (01/03/2020 up to and including 11/09/2022, week 9 2020 to week 36 2022)				<u>Wave 1</u> (01/03/2020 up to and including 21/06/2020, week 9 to week 25 2020)				<u>Interwave 1-2</u> (22/06/2020 up to and including 30/08/2020, week 26 to week 35 2020)			
NH residents		Non-NH residents 65 years and over		NH residents		Non-NH residents 65 years and over		NH residents		Non-NH residents 65 years and over	
Region	CMR (/100,000)	Region	CMR (/100,000)	Region	CMR (/100,000)	Region	CMR (/100,000)	Region	CMR (/100,000)	Region	CMR (/100,000)
Flanders	7,979	BXL	1,552	BXL	4,996	BXL	446	Flanders	72	BXL	24
Belgium	7,500	Wallonia	1,183	Belgium	3,350	Wallonia	259	Belgium	61	Wallonia	10
BXL	7,223	Belgium	923	Flanders	3,192	Belgium	215	BXL	49	Belgium	10
Wallonia	6,768	Flanders	724	Wallonia	3,176	Flanders	166	Wallonia	45	Flanders	8
Province	CMR (/100,000)	Province	CMR (/100,000)	Province	CMR (/100,000)	Province	CMR (/100,000)	Province	CMR (/100,000)	Province	CMR (/100,000)
East Flanders	8,485	BXL	1,552	Limburg	5,454	BXL	446	Antwerp	198	BXL	24
Antwerp	8,463	Hainaut	1,461	BXL	4,996	Hainaut	330	Walloon Brabant	91	Hainaut	17
Liège	8,380	Liège	1,158	Liège	4,088	Limburg	269	Liège	56	Antwerp	15
Flemish Brabant	7,885	Namur	1,056	Flemish Brabant	3,643	Liège	248	BXL	49	Liège	11
Limburg	7,563	Luxembourg	884	Namur	3,559	Luxembourg	245	Hainaut	48	Limburg	9
BXL	7,223	East Flanders	795	Antwerp	3,071	Namur	205	East Flanders	32	West Flanders	6
West Flanders	7,108	Limburg	770	Hainaut	2,686	Antwerp	160	Flemish Brabant	32	East Flanders	5
Namur	6,956	West Flanders	727	West Flanders	2,644	East Flanders	147	Limburg	23	Namur	5
Luxembourg	6,254	Walloon Brabant	718	Luxembourg	2,556	Flemish Brabant	147	West Flanders	18	Walloon Brabant	4
Hainaut	5,907	Antwerp	702	East Flanders	2,442	West Flanders	143	Luxembourg	0	Flemish Brabant	3
Walloon Brabant	5,431	Flemish Brabant	622	Walloon Brabant	2,268	Walloon Brabant	133	Namur	0	Luxembourg	0

<u>Wave 2</u> (31/08/2020 up to and including 14/02/2021, week 36 2020 to week 6 2021)			
NH residents		Non-NH residents 65 years and over	
Region	CMR (/100,000)	Region	CMR (/100,000)
Flanders	3,726	BXL	470
Belgium	3,334	Wallonia	456
Wallonia	3,062	Belgium	322
BXL	1,925	Flanders	238
Province	CMR (/100,000)	Province	CMR (/100,000)
East Flanders	4,901	Hainaut	552
Antwerp	4,188	BXL	470
Liège	3,663	Liège	454
West Flanders	3,593	Namur	395
Flemish Brabant	3,133	Luxembourg	329
Luxembourg	3,058	Walloon Brabant	311
Hainaut	2,823	East Flanders	289
Namur	2,804	West Flanders	259
Walloon Brabant	2,489	Antwerp	236
BXL	1,925	Flemish Brabant	191
Limburg	1,292	Limburg	187

<u>Wave 3</u> (15/02/2021 up to and including 27/06/2021, week 7 to week 25 2021)			
NH residents		Non-NH residents 65 years and over	
Region	CMR (/100,000)	Region	CMR (/100,000)
Flanders	174	BXL	229
Belgium	147	Wallonia	171
Wallonia	133	Belgium	129
BXL	33	Flanders	97
Province	CMR (/100,000)	Province	CMR (/100,000)
Walloon Brabant	367	BXL	229
Antwerp	204	Hainaut	225
East Flanders	201	Namur	215
Flemish Brabant	182	Luxembourg	134
Luxembourg	153	Liège	123
Namur	142	East Flanders	119
West Flanders	128	Limburg	107
Limburg	123	Walloon Brabant	99
Hainaut	118	West Flanders	95
Liège	71	Antwerp	92
BXL	33	Flemish Brabant	68

<u>Interwave 3-4</u> (28/06/2021 up to and including 03/10/2021, week 26 to week 39 2021)			
NH residents		Non-NH residents 65 years and over	
Region	CMR (/100,000)	Region	CMR (/100,000)
Flanders	29	BXL	44
Belgium	25	Wallonia	25
Wallonia	22	Belgium	16
BXL	17	Flanders	9
Province	CMR (/100,000)	Province	CMR (/100,000)
Flemish Brabant	79	BXL	44
West Flanders	48	Liège	31
Liège	35	Hainaut	30
Namur	35	Walloon Brabant	15
Limburg	24	Namur	13
BXL	17	Flemish Brabant	12
Hainaut	16	Luxembourg	11
Antwerp	5	Limburg	10
East Flanders	5	Antwerp	9
Luxembourg	0	East Flanders	8
Walloon Brabant	0	West Flanders	7

Wave 4 (04/10/2021 up to and including 26/12/2021, week 40 to week 51 2021)			
NH residents		Non-NH residents 65 years and over	
Region	CMR (/100,000)	Region	CMR (/100,000)
Wallonia	173	BXL	138
Flanders	154	Wallonia	110
Belgium	154	Belgium	94
BXL	91	Flanders	81
Province	CMR (/100,000)	Province	CMR (/100,000)
Luxembourg	296	BXL	138
Liège	271	Liège	137
Flemish Brabant	233	Luxembourg	110
Namur	192	Hainaut	103
West Flanders	160	Namur	101
East Flanders	138	East Flanders	91
Antwerp	137	Limburg	89
Limburg	101	West Flanders	82
Hainaut	98	Antwerp	77
BXL	91	Walloon Brabant	72
Walloon Brabant	54	Flemish Brabant	65

Wave 5 (27/12/2021 up to and including 27/02/2022, week 52 2021 to week 8 2022)			
NH residents		Non-NH residents 65 years and over	
Region	CMR (/100,000)	Region	CMR (/100,000)
Flanders	297	BXL	107
Belgium	219	Wallonia	80
Wallonia	110	Belgium	65
BXL	59	Flanders	53
Province	CMR (/100,000)	Province	CMR (/100,000)
East Flanders	387	BXL	107
Antwerp	365	Hainaut	99
Luxembourg	341	Liège	83
Limburg	242	Namur	74
Flemish Brabant	225	West Flanders	62
West Flanders	201	East Flanders	61
Liège	143	Flemish Brabant	52
Walloon Brabant	120	Walloon Brabant	48
Namur	112	Antwerp	46
BXL	59	Limburg	42
Hainaut	50	Luxembourg	37

Wave 6 (28/02/2022 up to and including 29/05/2022, week 9 to week 21 2022)			
NH residents		Non-NH residents 65 years and over	
Region	CMR (/100,000)	Region	CMR (/100,000)
Flanders	304	Flanders	58
Belgium	195	Belgium	55
BXL	41	Wallonia	51
Wallonia	36	BXL	50
Province	CMR (/100,000)	Province	CMR (/100,000)
East Flanders	362	Hainaut	71
Limburg	323	Flemish Brabant	62
West Flanders	295	East Flanders	60
Flemish Brabant	277	West Flanders	59
Antwerp	269	Limburg	57
Liège	67	Antwerp	54
Namur	52	BXL	50
BXL	41	Liège	47
Luxembourg	35	Namur	34
Walloon Brabant	25	Luxembourg	29
Hainaut	11	Walloon Brabant	28

<u>Wave 7</u> (30/05/2022 up to and including 11/09/2022, week 22 to week 36 2022)			
NH residents		Non-NH residents 65 years and over	
Region	CMR (/100,000)	Region	CMR (/100,000)
Flanders	114	BXL	48
Belgium	77	Wallonia	40
Wallonia	30	Belgium	32
BXL	13	Flanders	27
Province	CMR (/100,000)	Province	CMR (/100,000)
Flemish Brabant	137	Hainaut	54
Antwerp	135	BXL	48
Limburg	117	Liège	39
East Flanders	114	Namur	35
West Flanders	74	Flemish Brabant	33
Liège	55	East Flanders	28
Hainaut	28	Antwerp	26
Walloon Brabant	23	West Flanders	25
BXL	13	Walloon Brabant	25
Luxembourg	0	Limburg	23
Namur	0	Luxembourg	8

Note: CMR: crude mortality rate, NH: Nursing home

Table 8 COVID-19 crude mortality rate per 100,000 inhabitants for NH residents (all ages) and non-NH residents (aged 65 years and over) in Belgium, by region and province, by year, March 2020 – 11 September 2022

Year 2020 (01/01/2020 up to and including 31/12/2020)				Year 2021 (01/01/2021 up to and including 31/12/2021)				Year 2022 (01/01/2022 up to and including 31/12/2022)			
NH residents		Non-NH residents 65 years and over		NH residents		Non-NH residents 65 years and over		NH residents		Non-NH residents 65 years and over	
Region	CMR (/100,000)	Region	CMR (/100,000)	Region	CMR (/100,000)	Region	CMR (/100,000)	Region	CMR (/100,000)	Region	CMR (/100,000)
BXL	7,007	BXL	873	Flanders	1,175	BXL	485	Flanders	766	BXL	233
Belgium	6,183	Wallonia	664	Belgium	886	Wallonia	376	Belgium	508	Wallonia	204
Flanders	6,142	Belgium	489	Wallonia	585	Belgium	305	Wallonia	163	Belgium	179
Wallonia	6,034	Flanders	358	BXL	193	Flanders	249	BXL	126	Flanders	160
Province	CMR (/100,000)	Province	CMR (/100,000)	Province	CMR (/100,000)	Province	CMR (/100,000)	Province	CMR (/100,000)	Province	CMR (/100,000)
Liège	7,628	BXL	873	East Flanders	1,467	BXL	485	East Flanders	960	Hainaut	269
BXL	7,007	Hainaut	821	Flemish Brabant	1,351	Hainaut	446	Antwerp	816	BXL	233
Antwerp	6,668	Liège	664	Luxembourg	1,248	Namur	399	Limburg	686	Liège	199
Limburg	6,517	Namur	547	West Flanders	1,189	Liège	349	Flemish Brabant	686	Flemish Brabant	171
Namur	6,235	Luxembourg	536	Antwerp	1,095	Luxembourg	299	West Flanders	593	East Flanders	168
East Flanders	6,219	Limburg	411	Walloon Brabant	1,075	East Flanders	290	Luxembourg	287	West Flanders	167
Flemish Brabant	5,929	Walloon Brabant	388	Liège	555	Limburg	266	Liège	231	Namur	161
Hainaut	5,406	East Flanders	378	Namur	549	West Flanders	258	Walloon Brabant	156	Limburg	149
West Flanders	5,374	Antwerp	362	Limburg	509	Walloon Brabant	252	Namur	137	Antwerp	147
Luxembourg	4,746	West Flanders	342	Hainaut	388	Antwerp	232	BXL	126	Walloon Brabant	130
Walloon Brabant	4,228	Flemish Brabant	299	BXL	193	Flemish Brabant	192	Hainaut	100	Luxembourg	104

Note: CMR: crude mortality rate, NH: Nursing home

3.9. WHAT WAS THE LIKELIHOOD OF DYING FROM COVID-19?

The **case-fatality ratio (CFR)** can be defined as a measure of a disease's lethality. It represents the proportion of deaths related to a particular disease, relative to the total number of cases affected by that disease. Thus, in the most basic manner, it is the proportion of infected people that ended up dying from said disease for a particular period (9). However, a delay between infection and death is often observed and should be accounted for. In the framework of COVID-19, case-fatality ratio is "**an estimate of deaths among identified confirmed COVID-19 cases**" (9). For the following COVID-19 CFR estimation, the delay between being a case and death is implemented, by including a delay for the deaths where the inclusion period for the deaths is extended with **two weeks** and thus the numerator is modified.

There are other lethality indicators such as the **infection fatality ratio (IFR)**, which relates the number of deaths to the total number of people who were infected (and not just the cases diagnosed by a laboratory test). As it is impossible to know the exact total number of people who have been infected with SARS-CoV-2, the IFR's denominator is calculated based on statistical modelling. As the surveillance of COVID-19 confirmed deaths is generally more exhaustive than the surveillance of confirmed cases, the CFR is sometimes presented as an upper bound for the IFR. For instance, the IFR for the general population in Belgium, 9 March to 28 June 2020, was estimated to be 1.47% (10). The CFR for wave 1 was estimated to be 11.3% (Figure 26).

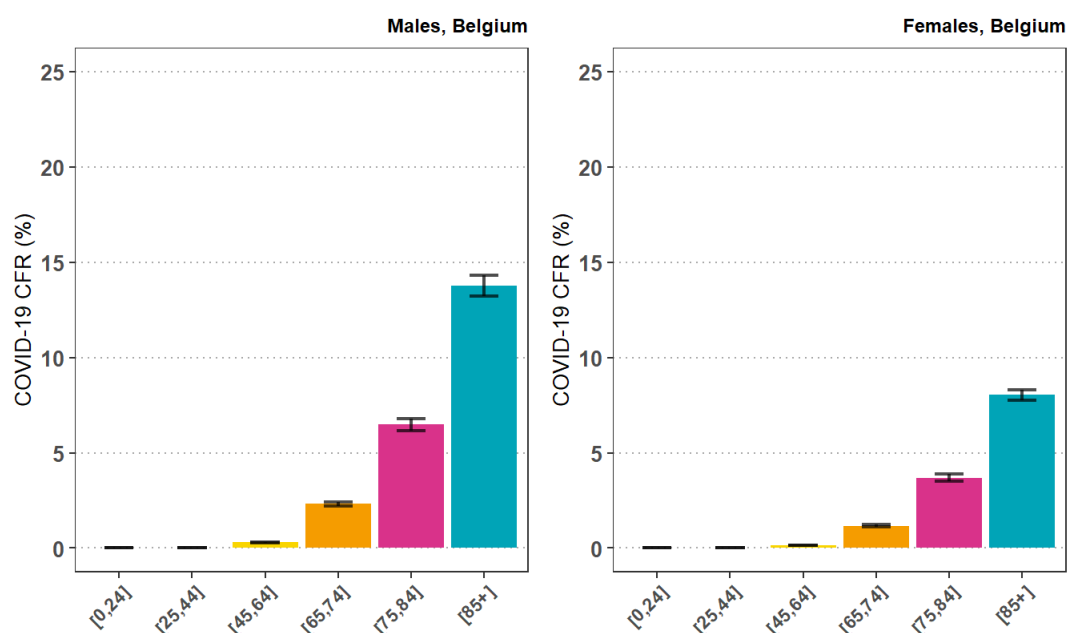
An important note, laboratory-confirmed COVID-19 cases are reported in the test database, possible and radiologically-confirmed cases are not notified. For the deaths on the other hand, deaths coming from laboratory-confirmed, possible and radiologically-confirmed cases are notified. Therefore, in order to ensure that deaths in the numerator and cases in the denominator have the same inclusion criteria, **only deaths of laboratory-confirmed cases are included in the calculation of the CFR**, removing deaths from radiologically-confirmed and possible cases to avoid biased results (note that the number of COVID-19 deaths is underestimated this way by 12.2%, i.e., 3,344 deaths from possible and 662 deaths from radiologically-confirmed cases are removed). This has a bigger impact for wave 1 and interwave 1-2 during which the Belgian testing capacity was lowest and overflowed (Figure 16).

For the calculation of the CFR a total of 4,423,426 COVID-19 cases and 28,637 COVID-19 deaths both confirmed by a laboratory test were included⁴. **Throughout the whole considered period the CFR in Belgium was estimated to be 0.65%.** More precise, 0.76% for males and 0.56% for females.

3.9.1. Sex- and age-specific differences

Already early in the COVID-19 epidemic it was observed that males seemed to have a higher CFR than females and even after two years, this trend is still apparent. This observation is examined by estimating the **age-specific COVID-19 CFR** and afterwards calculating the **age specific male to female COVID-19 CFR ratio (M:F CFR)**. Six age groups were defined [0 - 24] - [25 - 44] - [45 - 64] - [65 - 74] - [75 - 84] - [85 +]. **The COVID-19 CFRs were highest in males in all age groups** (Figure 24 and Table 9), **except the [0 - 24] age group**. Note that for the first age group, there were very few deaths (15 deaths) so these results are not reliable. CFRs increase exponentially with increasing age, for both sexes (Figure 24 and Table 9). Combining both sexes, the CFRs were observed to be 0.0012%, 0.012%, 0.21%, 1.72%, 4.92% and 9.87% for age groups [0 - 24] - [25 - 44] - [45 - 64] - [65 - 74] - [75 - 84] - [85 +] respectively.

Figure 24. COVID-19 case fatality ratio (%) and 95% confidence intervals, cases and deaths both laboratory-confirmed, by age group for males (left) and females (right), Belgium, March 2020 – 11 September 2022



⁴ For the laboratory-confirmed COVID-19 cases, ones with unknown sex/age/province of residence are removed. Regarding deaths from laboratory-confirmed cases, a delay of two weeks was used which results in 28,671 deaths confirmed by a laboratory test, but also 34 records with unknown sex/age/province were removed.

Table 9 COVID-19 case fatality ratio (%), cases and deaths both laboratory-confirmed, by age group and sex, Belgium, March 2020 – 11 September 2022

Age group	Sex	Total cases	Total deaths	COVID-19 CFR (%)
[0,24]	Male	627,191	7	0.0011
[0,24]	Female	649,208	8	0.0012
[25,44]	Male	656,454	106	0.0161
[25,44]	Female	835,821	74	0.0089
[45,64]	Male	509,011	1,477	0.2902
[45,64]	Female	576,414	750	0.1301
[65,74]	Male	124,880	2,864	2.2934
[65,74]	Female	132,386	1,519	1.1474
[75,84]	Male	78,528	5,046	6.4258
[75,84]	Female	98,637	3,606	3.6559
[85+]	Male	42,960	5,848	13.6127
[85+]	Female	91,936	7,332	7.9751

The M:F CFR ratios were all above one except for the 0-24 age group and greater than two for the 45-64 and 65-74 age groups (Table 10). **A large and consistent excess CFR in males for COVID-19, for all age groups was observed.** Similar findings are reported by Green *et al.* 2020 (11). They performed a meta-analysis, pooling data from seven different countries and the first year of the epidemic. The M:F CFR ratios were also computed by wave and the results show a similar trend as our results (Table 10). Furthermore, even after seven waves of COVID-19 and after vaccination campaigns, sex-specific factors clearly influence the severity of COVID-19. In order to comprehend these sex-specific differences, it is important to explore both biological and behavioural aspects. For instance, differential testing rates are observed as women undergo testing more frequently than men, consequently leading to a higher number of laboratory-confirmed cases among women compared to men.

Table 10 Age specific male to female COVID-19 case fatality ratios, cases and deaths both laboratory-confirmed, Belgium, March 2020 – 11 September 2022

	Wave 1	Inter-wave 1-2	Wave 2	Wave 3	Inter-wave 3-4	Wave 4	Wave 5	Wave 6	Wave 7	Total
[0-24]	0.00	0.00	0.36	3.85	NA	NA	0.00	NA	NA	0.91
[25-44]	2.34	4.24	1.99	0.95	2.81	2.33	3.62	1.06	1.22	1.82
[45-64]	3.35	1.51	2.24	2.11	1.60	2.09	1.56	2.39	1.26	2.23
[65-74]	1.53	2.66	1.88	2.09	1.54	1.76	2.57	1.95	1.79	2.00
[75-84]	1.69	1.40	1.81	1.95	1.50	2.09	1.97	2.18	2.00	1.76
[85+]	1.87	1.74	1.96	1.88	1.80	1.66	2.71	1.62	1.70	1.71

Note: In bold is the highest value for that wave of the epidemic. A M:F CFR ratio greater than 1 indicates that the CFR for males is higher than for females, meaning that males have a higher risk of dying from COVID-19 than females. A ratio of less than 1 indicates the opposite.

3.9.2. COVID-19 Case-fatality ratios over time

While there was substantial heterogeneity in COVID-19 CFR by age (Figure 24), age-specific differences were present in every period of the epidemic (Figure 25). **CFR decreased with time** depicted by Figure 25 and Figure 26. Regional analyses are available in appendix 9.6.

Figure 25. COVID-19 case fatality ratio (%) and 95% confidence intervals, cases and deaths both laboratory-confirmed, by age group, by wave of the epidemic for males (left) and females (right), Belgium, March 2020 – 11 September 2022

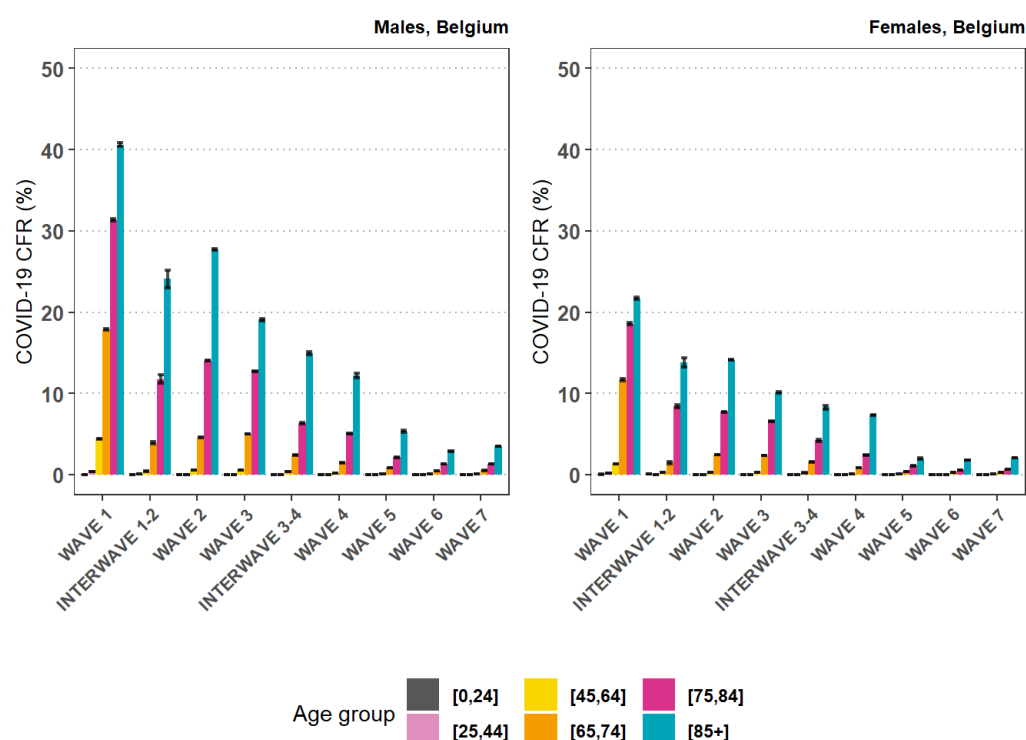
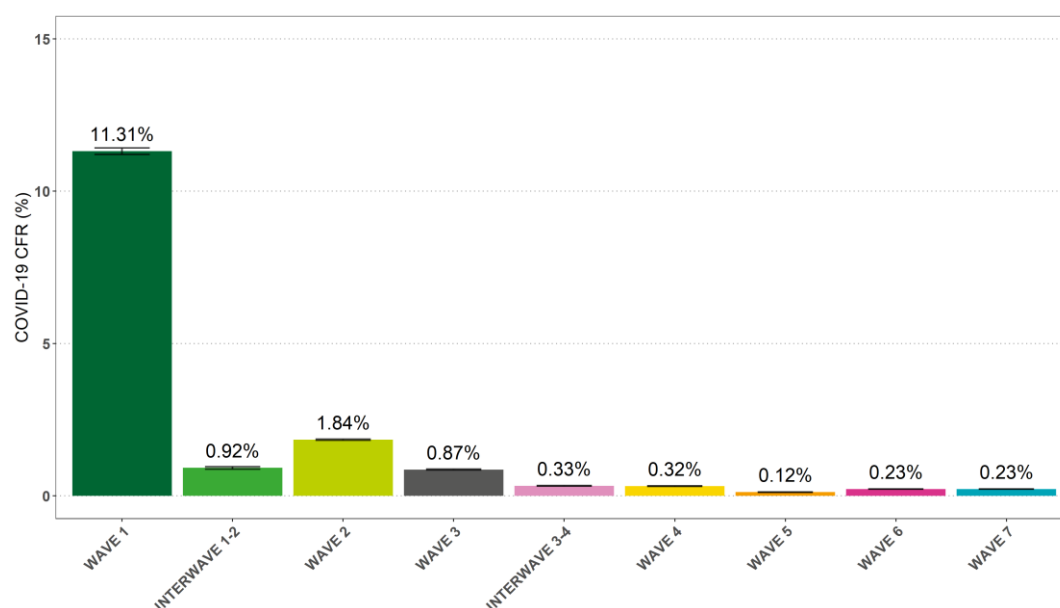


Figure 26. COVID-19 case fatality ratio (%) and 95% confidence intervals, cases and deaths both laboratory-confirmed, by wave, Belgium, March 2020 – 11 September 2022



This wave difference and especially the decrease in the CFR over the past two years, could be explained by **vaccination and infection induced immunity, increased testing, other variants**, etc. For instance, the CFR in wave 1 is high because a lot of cases were not detected as there was limited test capacity. As a result, only hospitalized and severe cases were tested, inflating the CFR. Also, the rise of different variants influences the CFR. For instance, the ratio has dropped substantially when comparing the Delta and Omicron variant, i.e. wave 4 and 5 respectively, which is also shown by Liu *et al.* 2022 (12). Lastly, it should be taken into account that the testing strategy changes over time and that during waves 6 and 7 less people were tested, possibly inflating the CFR.

3.9.3. Regional differences

Regional specific effects seem also present, but not as apparent as the age and time specific effects. Regional and provincial differences are shown by Table 11 and Table 12 respectively. The latest estimates were the highest in Hainaut and Liège; and the lowest in Walloon Brabant, Flemish Brabant and province of Luxembourg. Regional variation was observed, but was relatively low. Regional analyses are available in appendix 9.6.

Table 11 COVID-19 case fatality ratio (%), cases and deaths both laboratory-confirmed, by region of residence, Belgium, March 2020 – 11 September 2022

Region	Total cases	Total deaths	COVID-19 CFR (%)
Wallonia	1,367,573	10,308	0.7537
Brussels-Capital Region	479,898	3,020	0.6293
Flanders	2,575,955	15,309	0.5943

Table 12 COVID-19 CFR (%), cases and deaths both laboratory-confirmed, by province of residence, Belgium, March 2020 – 11 September 2022

Province	Total cases	Total deaths	COVID-19 CFR (%)
Hainaut	493,007	4,504	0.9136
Liege	401,170	3,195	0.7964
West Flanders	475,056	3,167	0.6667
Namur	192,333	1,265	0.6577
East Flanders	608,623	3,871	0.6360
Limburg	331,113	2,006	0.6058
Antwerp	722,762	4,015	0.5555
Flemish Brabant	438,401	2,250	0.5132
Luxembourg	116,255	568	0.4886
Walloon Brabant	164,808	776	0.4709

4. COMPARISON OF MORTALITY INDICATORS

Mortality indicators for COVID-19 (absolute numbers, rates, case fatality ratios) and all-cause mortality indicators (rates, excess mortality) for Belgium are summarised and compared per wave (Table 13 to Table 19), not including the interwaves. Note that, as the number of all-cause deaths in excess is calculated separately by region, it is normal to see a small difference between the total figures and the sum of these figures by region.

4.1. MORTALITY INDICATORS FOR COVID-19

4.1.1. Number of COVID-19 deaths

The highest peak of weekly COVID-19 deaths (i.e., 1,985 deaths during week 15, 2020) was observed during wave 1 (Figure 2). The following waves had decreasing intensities. Wave 2 accumulated the most COVID-19 deaths due to its length, despite the lower peak (1,461 deaths during week 45, 2020). At regional level, roughly 50% of COVID-19 deaths occurred in Flanders, 40% in Wallonia and 10% in Brussels-Capital Region in each wave, except for wave 6. During wave 6, the share of COVID-19 deaths in Flanders increased substantially (69.2%) compared to previous waves and decreased in Wallonia (25.1%) and in Brussels-Capital Region (5.7%).

4.1.2. COVID-19 crude mortality rates

In Belgium, the COVID-19 crude mortality rate (CMR) was the highest for wave 2 (104 per 100,000 inhabitants) due to its length, followed by wave 1 (84 per 100,000 inhabitants). For each succeeding wave, the rate decreased and reached its minimum in wave 7 (7 per 100,000 inhabitants). The difference in CMR between waves 2 and 3 (29 per 100,000 inhabitants) was substantial. Regional assessments showed that the CMR was highest in Brussels-Capital Region (114 per 100,000 population) for wave 1, in Wallonia for waves 2, 3, 4, 5, and 7, and in Flanders for wave 6 (16 per 100,000 inhabitants). Regional differences during waves 5 and 7 were small.

4.1.3. COVID-19 direct standardized mortality rates

The COVID-19 direct standardized mortality rate (dSMR) was, for each wave except waves 2 and 6, the highest in Brussels-Capital Region, which makes the regional ranking different from the CMR. It should be kept in mind that the population in Brussels-Capital Region is younger than the other two regions (13). The dSMR in Brussels-Capital Region decreased substantially over the waves, with dSMR of 157 to 9 per 100,000 inhabitants from wave 1 to wave 7. For wave 2 the rate was the highest in Wallonia and for wave 6 the rate was the highest in Flanders. For Wallonia and Flanders, the dSMR also decreased over time, but a rebound was observed in wave 2 with higher dSMR (137 per 100,000 inhabitants and 86 per 100,000 inhabitants, respectively). The difference in dSMR between waves 2 and 3 was substantial.

4.1.4. COVID-19 indirect standardized mortality ratios

The analysis of the COVID-19 indirect standardized mortality ratios (iSMR) of wave 1 showed that compared to the Belgian population, there was an 86% excess of COVID-19 deaths in the Brussels population, a 19% excess in the Walloon population, but a deficit of 20% in the Flemish population. Flanders had always an iSMR below 100%, except for wave 6 with a 10% excess of COVID-19 deaths compared to the Belgian population. Wave 6 was the only wave where the values for Brussels-Capital Region (24% less deaths than expected) and Wallonia (16% less deaths than expected) were lower as 100%. Wave 3 had the highest values for Wallonia, with a 34% excess of COVID-19 deaths. The regional ranking is the same as the dSMR.

4.1.5. COVID-19 case fatality ratios

For all regions, COVID-19 case fatality ratio (CFR) was highest during wave 1 (11.31% - Figure 26) and highest in Brussels-Capital Region (14.2%), then it decreased significantly over time (Figure 26). Regional analysis showed that the CFR during wave 2 was higher in Flanders (2.2%), then highest in Wallonia for waves 3 through 7. A slight increase in CFR was observed in all regions from wave 6, probably due to changes in the testing strategy. Differences can partially be explained by vaccination/infection induced immunity, changes in the testing capacity/strategy, different variants, etc. More details in section 3.9.

4.2. ALL-CAUSE MORTALITY INDICATORS

4.2.1. All-cause crude mortality rates

The all-cause CMR for Belgium varied by wave and was the highest for wave 2 (522 per 100,000 inhabitants), probably due to the length and the intensity of this wave. At regional level, the rate was always the highest in Wallonia and the lowest in Brussels-Capital Region. However, the crude all-cause mortality rate in Brussels-Capital Region always has been the lowest since 2010 as the population in this region is becoming younger (13). The all-cause dSMR, not shown in the tables below, exhibited similar results, with Wallonia having the highest rates, except during wave 1 where Brussels-Capital Region recorded the highest rate. The all-cause dSMR in Flanders has consistently been the lowest, except during wave 6 where the rates for Brussels-Capital Region and Flanders were equal.

4.2.2. Excess mortality

Excess mortality was highest during wave 1, with 8,410 deaths in excess (26.6% excess mortality), and especially in Brussels-Capital Region (1,379 deaths in excess, 57.2%) where percentage of excess mortality was more than twice as high compared to Flanders and Wallonia. The number of deaths in excess for wave 1 was roughly comparable to those caused by COVID-19 obtained via epidemiological surveillance.

The percentage of excess mortality was relatively high in all regions during the first two waves and then dropped drastically. There was an under mortality in Flanders in wave 3, suggesting a harvest effect. A rebound in excess mortality was observed in wave 4, coinciding with the winter months. During wave 6, the excess mortality (%) was relatively low, but it is noteworthy that in contrast to the other waves, Flanders had the highest excess mortality (6.8% - 1,111 excess deaths).

Some researchers showed that non-COVID-19 mortality deaths reduced drastically with the lockdown measures. For instance, due to social distancing and other strict restrictions, there was a decreased incidence of influenza, air pollution reduction (14), displaced mortality (especially in higher age groups), and others. Displaced mortality refers to people who died sooner from COVID-19 instead of another cause (15). However, note that this reduction in non-COVID-19 mortality is not a true reduction, as some diagnoses are delayed or missed due to the lockdown restrictions.

4.2.3. Deaths due to COVID-19

During wave 1, 24.2% of all deaths were caused by COVID-19, making it a major cause of death for this period. This proportion remained high during wave 2 (20.0%), dropped by more than half in wave 3 (8.4%) and declined to 2.8% in wave 7.

Table 13 Mortality indicators for COVID-19 and all-cause mortality in Belgium and by region of residence, during wave 1 (March 2020 to 21 June 2020)

Wave 1 (1/03/2020 up to and including 21/06/2020, weeks 10 2020 to 25 2021)									
Region	Number of COVID-19 deaths	COVID-19 CMR (/100,000)	COVID-19 dSMR (/100,000)	COVID-19 iSMR (%)	COVID-19 CFR (%)	All-cause CMR (/100,000)	Excess mortality (%)	Number of deaths in excess	Deaths related to COVID (%)
BXL	1,390	114	157	186	14.23	311	57.2	1,379	36.7
WAL	3,456	95	100	119	10.28	376	28.2	3,016	25.2
FLA	4,836	73	67	80	11.36	338	22.1	4,055	21.6
BEL	9,682	84	-	-	11.31	348	26.6	8,410	24.2

CMR: crude mortality rate. dSMR: direct standardized mortality rate. iSMR: indirect standardized mortality ratio. CFR: case-fatality ratio.

Table 14 Mortality indicators for COVID-19 and all-cause mortality in Belgium and by region of residence, during wave 2 (August 2020 to February 2021)

Wave 2 (31/08/2020 up to and including 14/02/2021, weeks 36 2020 to 6 2021)									
Region	Number of COVID-19 deaths	COVID-19 CMR (/100,000)	COVID-19 dSMR (/100,000)	COVID-19 iSMR (%)	COVID-19 CFR (%)	All-cause CMR (/100,000)	Excess mortality (%)	Number of deaths in excess	Deaths related to COVID (%)
BXL	1,048	86	120	116	1.25	388	22.5	870	22.2
WAL	4,710	129	137	132	1.66	601	27.1	4,673	21.5
FLA	6,230	94	86	83	2.19	501	13.4	3,928	18.7
BEL	11,988	104	-	-	1.84	522	18.3	9,306	20.0

CMR: crude mortality rate. dSMR: direct standardized mortality rate. iSMR: indirect standardized mortality ratio. CFR: case-fatality ratio.

Table 15 Mortality indicators for COVID-19 and all-cause mortality in Belgium and by region of residence, during wave 3 (February 2021 to June 2021)

Wave 3 (15/02/2021 up to and including 27/06/2021, weeks 7 to 25 2021)									
Region	Number of COVID-19	COVID-19 CMR (/100,000)	COVID-19 dSMR (/100,000)	COVID-19 iSMR (%)	COVID-19 CFR (%)	All-cause CMR (/100,000)	Excess mortality (%)	Number of deaths in excess	Deaths related to COVID (%)
BXL	416	34	48	166	0.95	258	6.1	180	13.2
WAL	1,344	37	38	134	1.03	379	5.0	657	9.7
FLA	1,561	23	22	76	0.74	338	-1.4	-326	6.9
BEL	3,321	29	-	-	0.87	343	0.8	300	8.4

CMR: crude mortality rate. dSMR: direct standardized mortality rate. iSMR: indirect standardized mortality ratio. CFR: case-fatality ratio.

Table 16 Mortality indicators for COVID-19 and all-cause mortality in Belgium and by region of residence, during wave 4 (October 2021 to December 2021)

Wave 4 (04/10/2021 up to and including 26/12/2021, weeks 40 to 51 2021)									
Region	Number of COVID-19	COVID-19 CMR (/100,000)	COVID-19 dSMR (/100,000)	COVID-19 iSMR (%)	COVID-19 CFR (%)	All-cause CMR (/100,000)	Excess mortality (%)	Number of deaths in excess	Deaths related to COVID (%)
BXL	260	21	29	137	0.36	179	16.1	304	11.9
WAL	932	26	27	124	0.42	272	17.0	1,450	9.4
FLA	1,298	20	18	84	0.27	245	13.5	1,955	7.9
BEL	2,490	22	-	-	0.32	247	14.0	3,513	8.7

CMR: crude mortality rate. dSMR: direct standardized mortality rate. iSMR: indirect standardized mortality ratio. CFR: case-fatality ratio.

Table 17 Mortality indicators for COVID-19 and all-cause mortality in Belgium and by region of residence, during wave 5 (December 2021 to February 2022)

Wave 5 (27/12/2021 up to and including 27/02/2022, weeks 52 2021 to 8 2022)									
Region	Number of COVID-19	COVID-19 CMR (/100,000)	COVID-19 dSMR (/100,000)	COVID-19 iSMR (%)	COVID-19 CFR (%)	All-cause CMR (/100,000)	Excess mortality (%)	Number of deaths in excess	Deaths related to COVID (%)
BXL	201	16	23	139	0.10	139	10.2	158	11.8
WAL	672	18	19	117	0.14	204	5.4	378	9.0
FLA	1,039	16	14	87	0.12	186	3.0	358	8.3
BEL	1,912	16	-	-	0.12	187	3.7	771	8.8

CMR: crude mortality rate. dSMR: direct standardized mortality rate. iSMR: indirect standardized mortality ratio. CFR: case-fatality ratio.

Table 18 Mortality indicators for COVID-19 and all-cause mortality in Belgium and by region of residence, during wave 6 (February 2022 to May 2022)

Wave 6 (28/02/2022 up to and including 29/05/2022, weeks 9 to 21 2022)									
Region	Number of COVID-19	COVID-19 CMR (/100,000)	COVID-19 dSMR (/100,000)	COVID-19 iSMR (%)	COVID-19 CFR (%)	All-cause CMR (/100,000)	Excess mortality (%)	Number of deaths in excess	Deaths related to COVID (%)
BXL	89	7	10	76	0.21	173	1.7	35	4.2
WAL	392	11	11	84	0.28	273	4.9	465	3.9
FLA	1,082	16	15	110	0.21	258	6.8	1,111	6.3
BEL	1,563	13	-	-	0.23	254	5.0	1,407	5.3

CMR: crude mortality rate. dSMR: direct standardized mortality rate. iSMR: indirect standardized mortality ratio. CFR: case-fatality ratio.

Table 19 Mortality indicators for COVID-19 and all-cause mortality in Belgium and by region of residence, during wave 7 (May 2022 to September 2022)

Wave 7 (30/05/2022 up to and including 11/09/2022, weeks 22 to 36 2022)									
Region	Number of COVID-19	COVID-19 CMR (/100,000)	COVID-19 dSMR (/100,000)	COVID-19 iSMR (%)	COVID-19 CFR (%)	All-cause CMR (/100,000)	Excess mortality (%)	Number of deaths in excess	Deaths related to COVID (%)
BXL	79	6	9	123	0.21	182	5.6	118	3.5
WAL	306	8	9	119	0.31	287	9.2	891	2.9
FLA	474	7	7	88	0.19	259	7.4	1,194	2.7
BEL	859	7	-	-	0.23	260	7.1	2,007	2.8

CMR: crude mortality rate. dSMR: direct standardized mortality rate. iSMR: indirect standardized mortality ratio. CFR: case-fatality ratio.

5. CONCLUSION

During the COVID-19 epidemic, the challenge for Belgium was to create an ad hoc epidemiological surveillance for COVID-19 mortality. Based on our three years' experience in this surveillance, we would like to emphasize the importance of rapidly setting up surveillance in the three main places of death (in hospitals, nursing homes and at home) and of including the different case definitions of the disease in the questionnaires. This enabled us to observe the significant effect of COVID-19 among nursing home residents and to obtain figures that accurately reflected the situation with regard to monitoring excess mortality from all causes. Two other key points were the flexibility of the questionnaires, which enabled us to adjust the variables in line with the characteristics of the epidemic (for example, adding radiologically confirmed cases or targeting nursing home residents in hospital), and the collection of individual data to provide a precise epidemiological profile and improve data quality (identification of duplicates and other coding errors).

The COVID-19 epidemic had a major effect on the mortality curve in Belgium, mainly for the year 2020, undeniably classifying the first two waves of the COVID-19 epidemic as major fatal events. In Belgium, excess mortality linked to COVID-19 waves was greatly reduced in 2021 compared with 2020, unlike other countries which showed higher excess mortality rates in 2021 than in 2020 (16).

Mortality indicators evolved differently in different regions, waves and all socio-demographic profile of the deceased. These provide paths for future research to understand the underlying causes.

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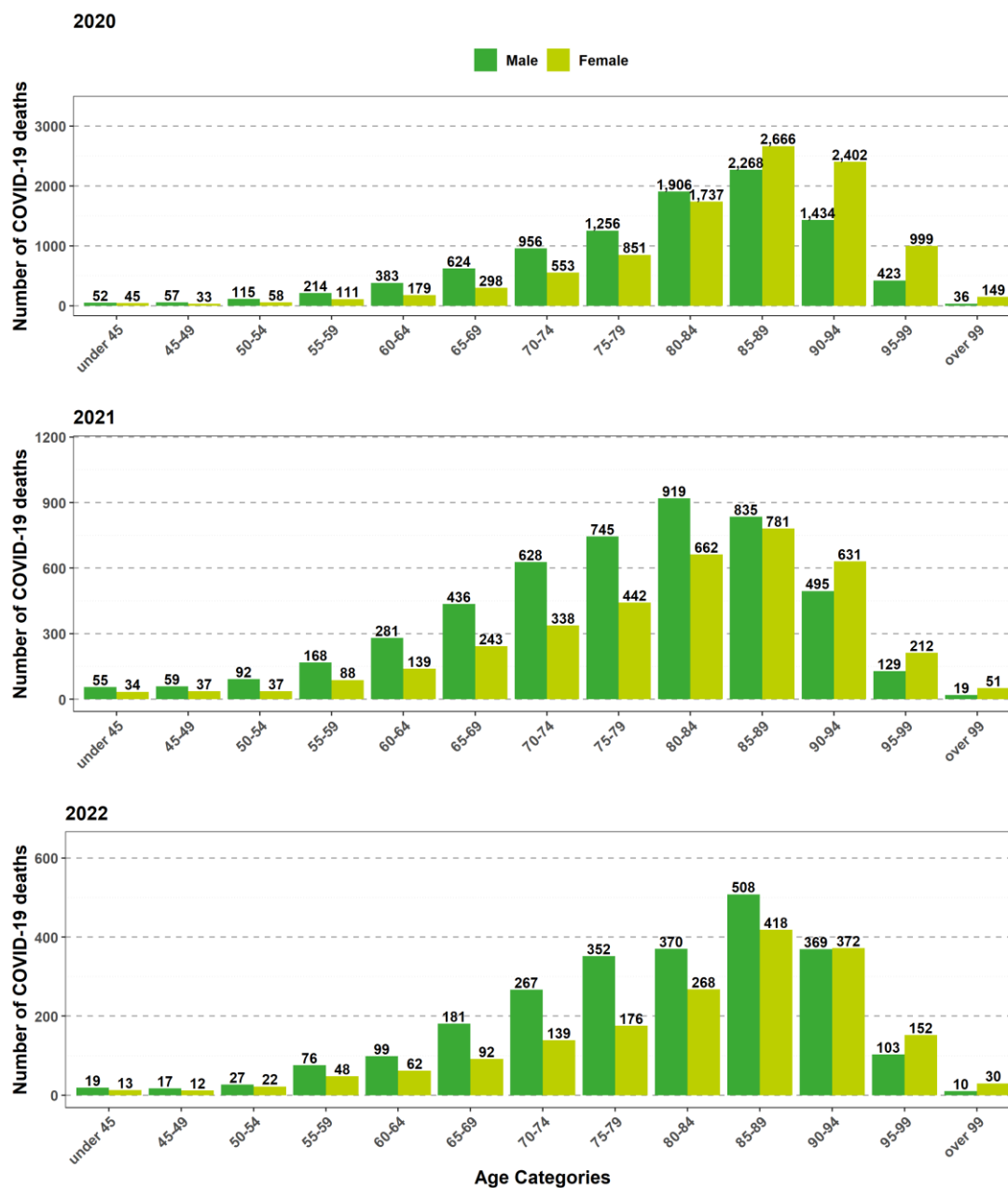
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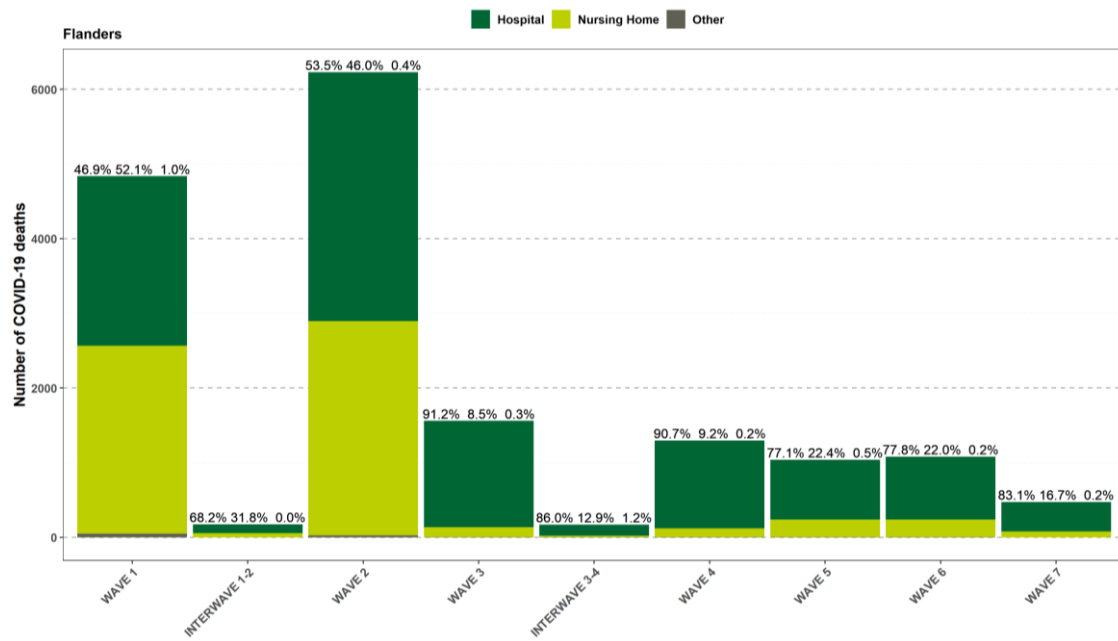
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Figure A1. COVID-19 deaths by age group and sex per year, Belgium, March 2020 – 11 September 2022



9.2. REGIONAL ANALYSIS BY PLACE OF DEATH

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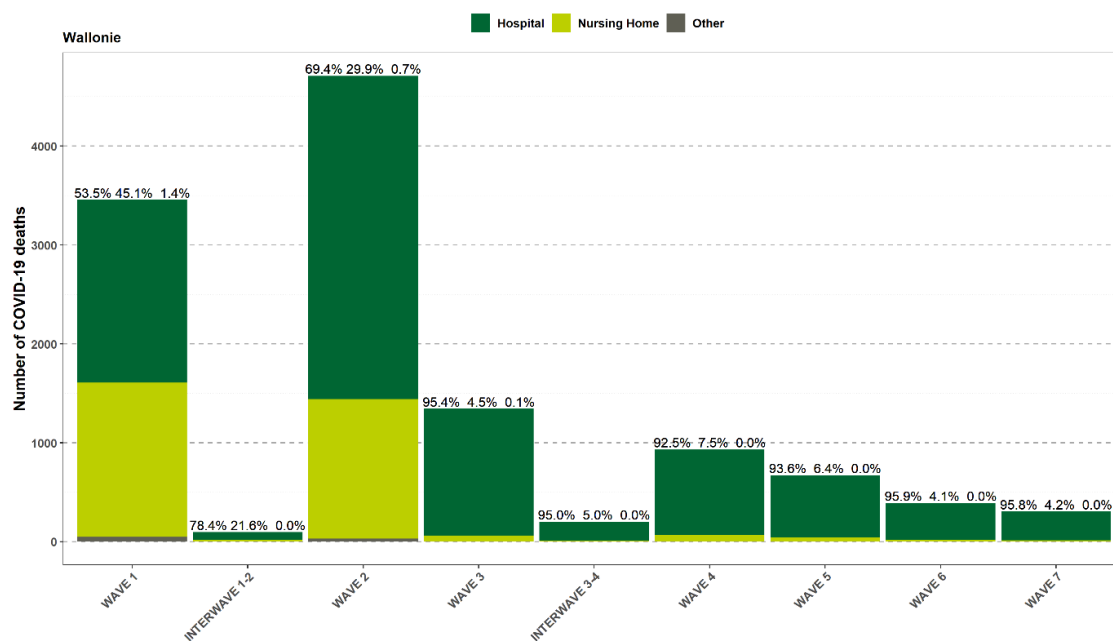


Note: Percentages are hospital, nursing home and other respectively.

Figure A3. COVID-19 deaths in Flanders by place of death and by year, March 2020 – 11 September 2022



Figure A4. COVID-19 deaths in Wallonia by place of death and wave of the epidemic, March 2020 – 11 September 2022



Note: Percentages are hospital, nursing home and other respectively.

Figure A5. COVID-19 deaths in Wallonia by place of death and by year, March 2020 – 11 September 2022

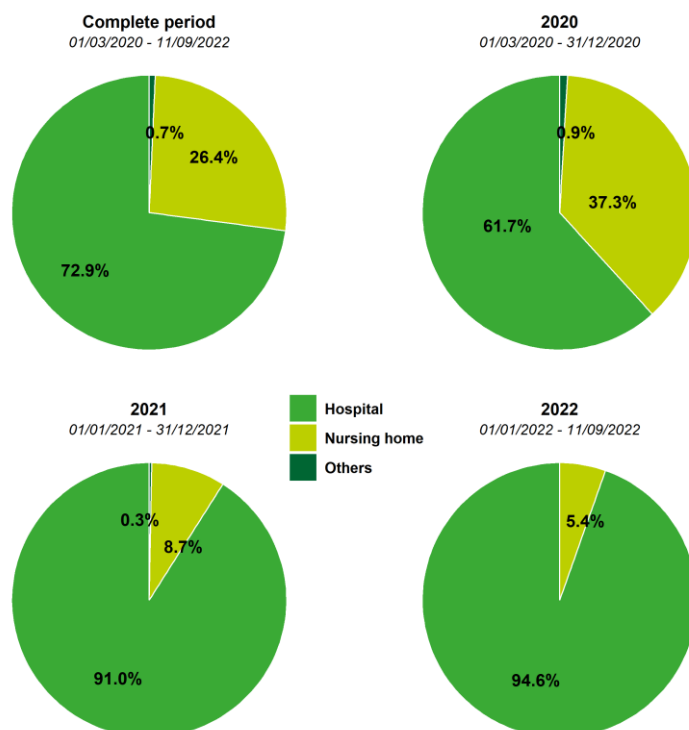
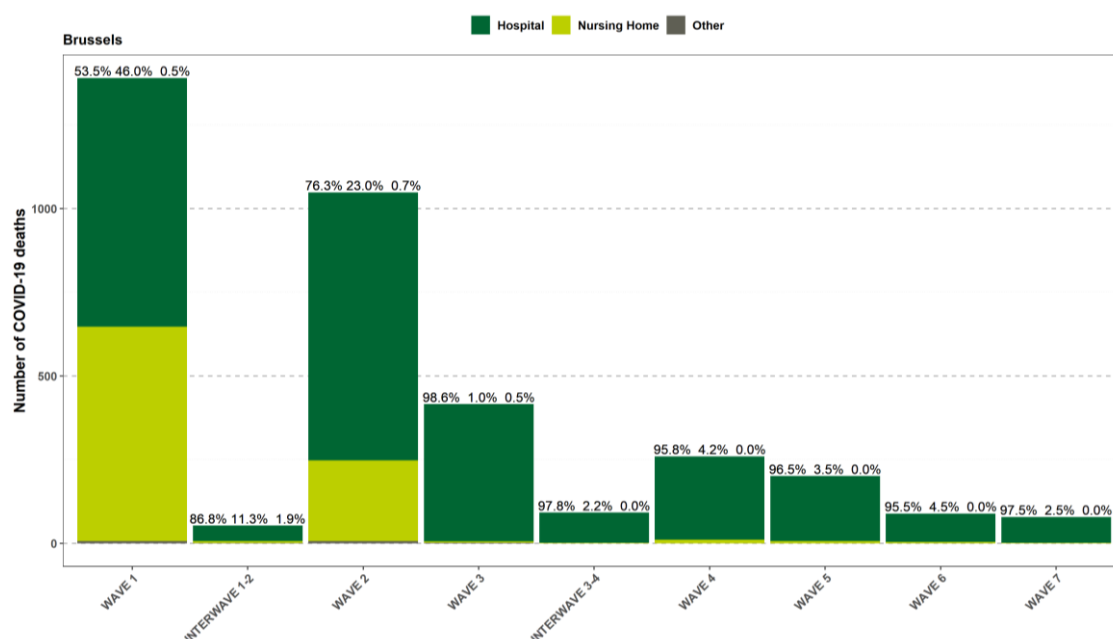
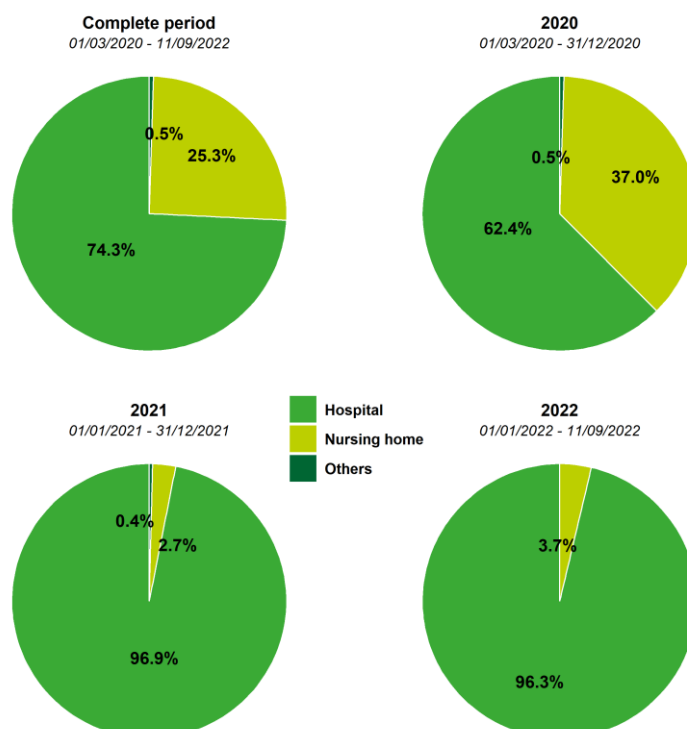


Figure A6. COVID-19 deaths in Brussels-Capital Region by place of death and wave of the epidemic, March 2020 – 11 September 2022



Note: Percentages are hospital, nursing home and other respectively.

Figure A7. COVID-19 deaths in Brussels-Capital Region by place of death and by year, March 2020 – 11 September 2022



9.3. REGIONAL ANALYSIS BY CASE CLASSIFICATION

Figure A8. COVID-19 deaths in Flanders by case classification and by year, March 2020 – 11 September 2022

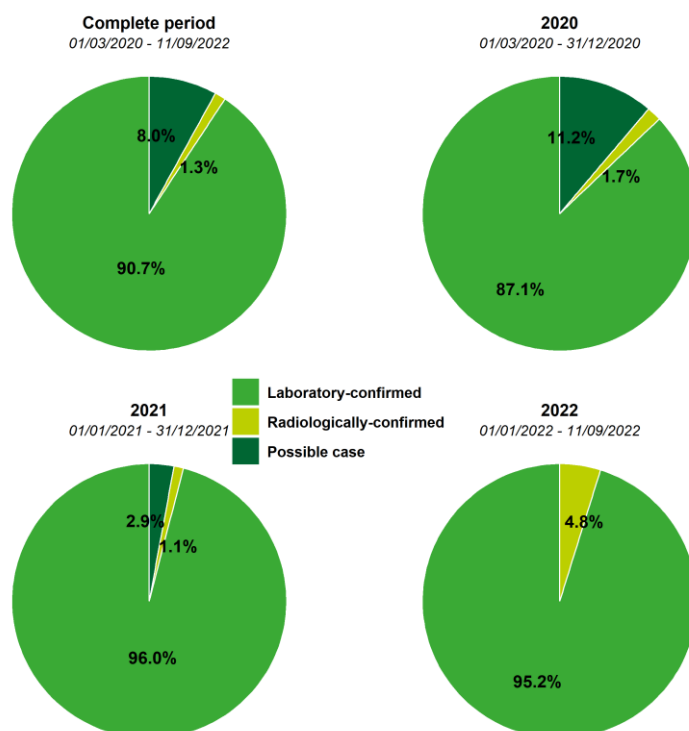


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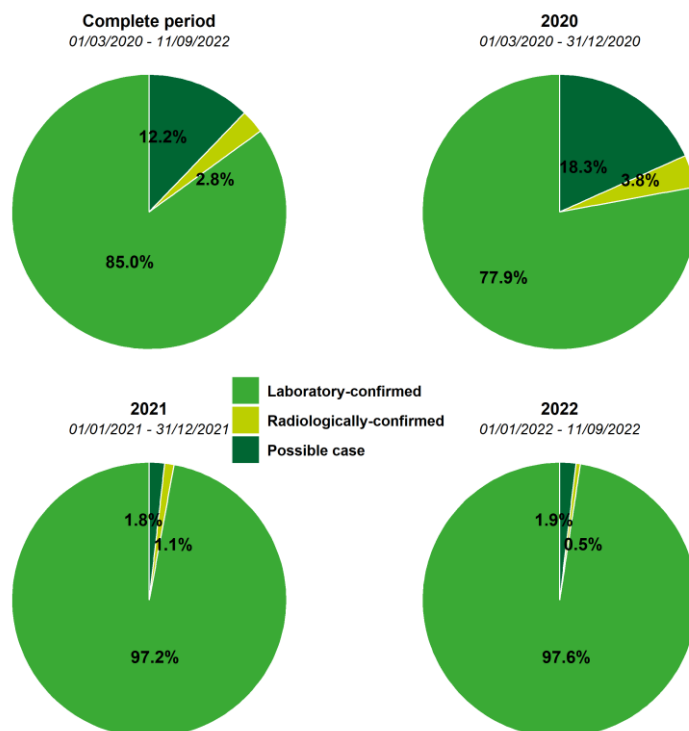


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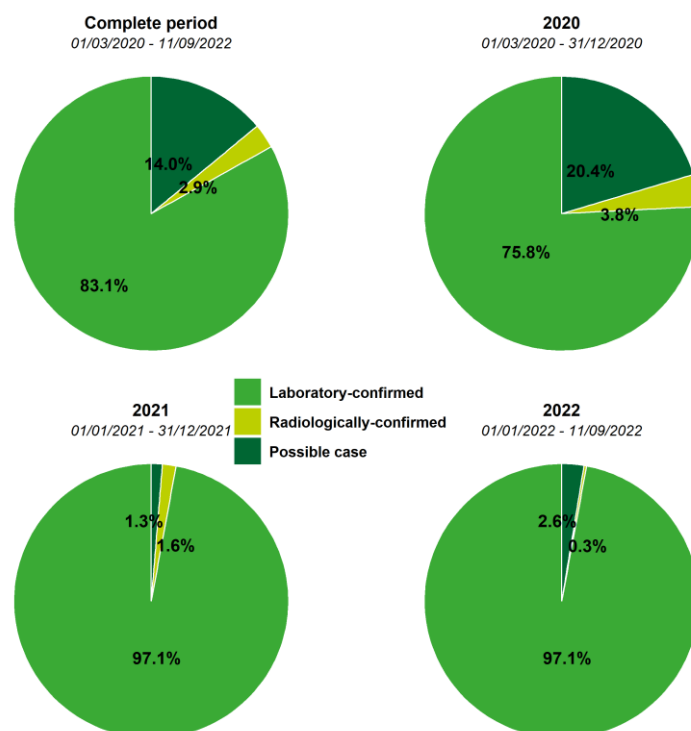


Figure A11. Evolution of COVID-19 deaths in Flanders by case classification, March 2020 – 11 September 2022

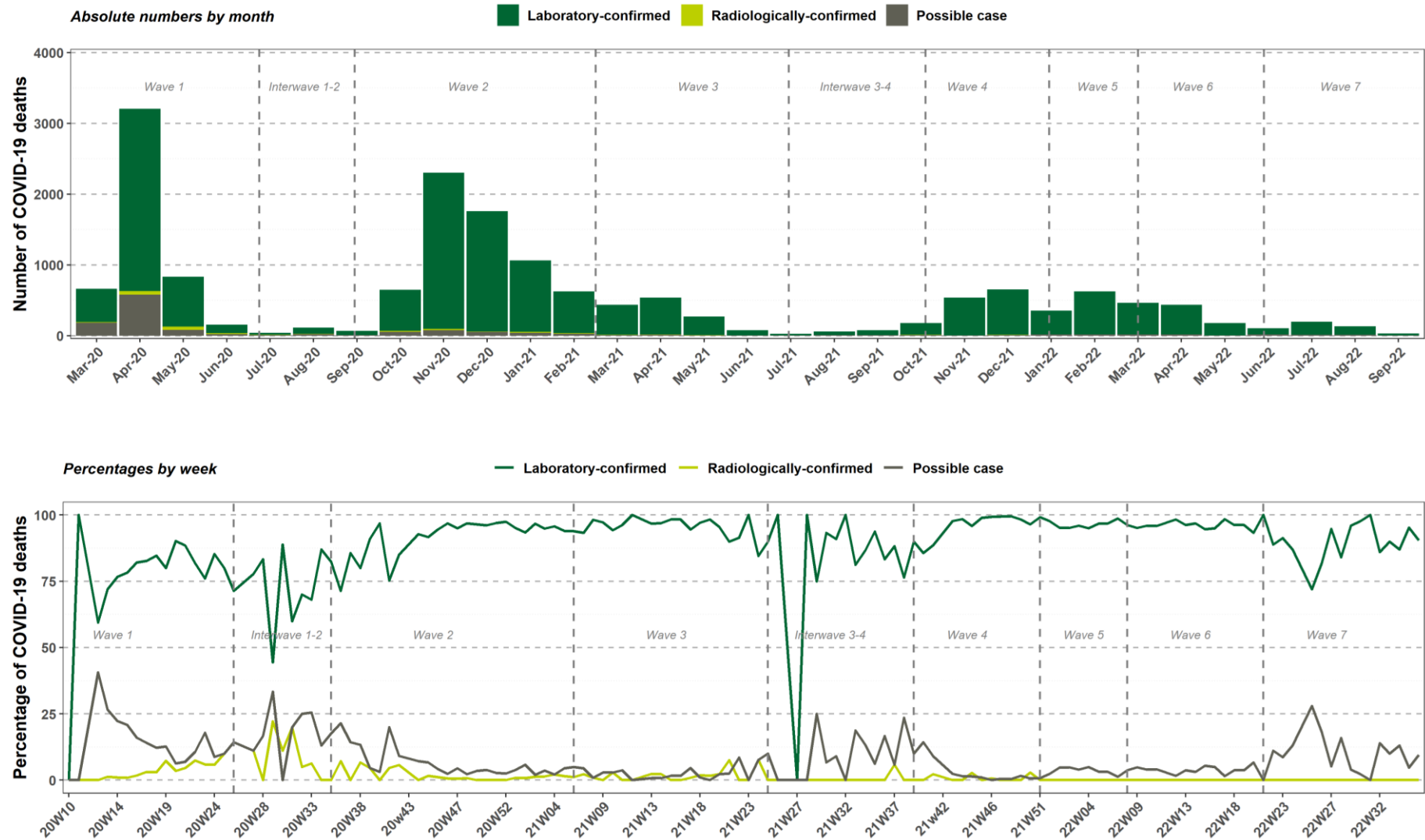


Figure A12. Evolution of COVID-19 deaths in Wallonia by case classification, March 2020 – 11 September 2022

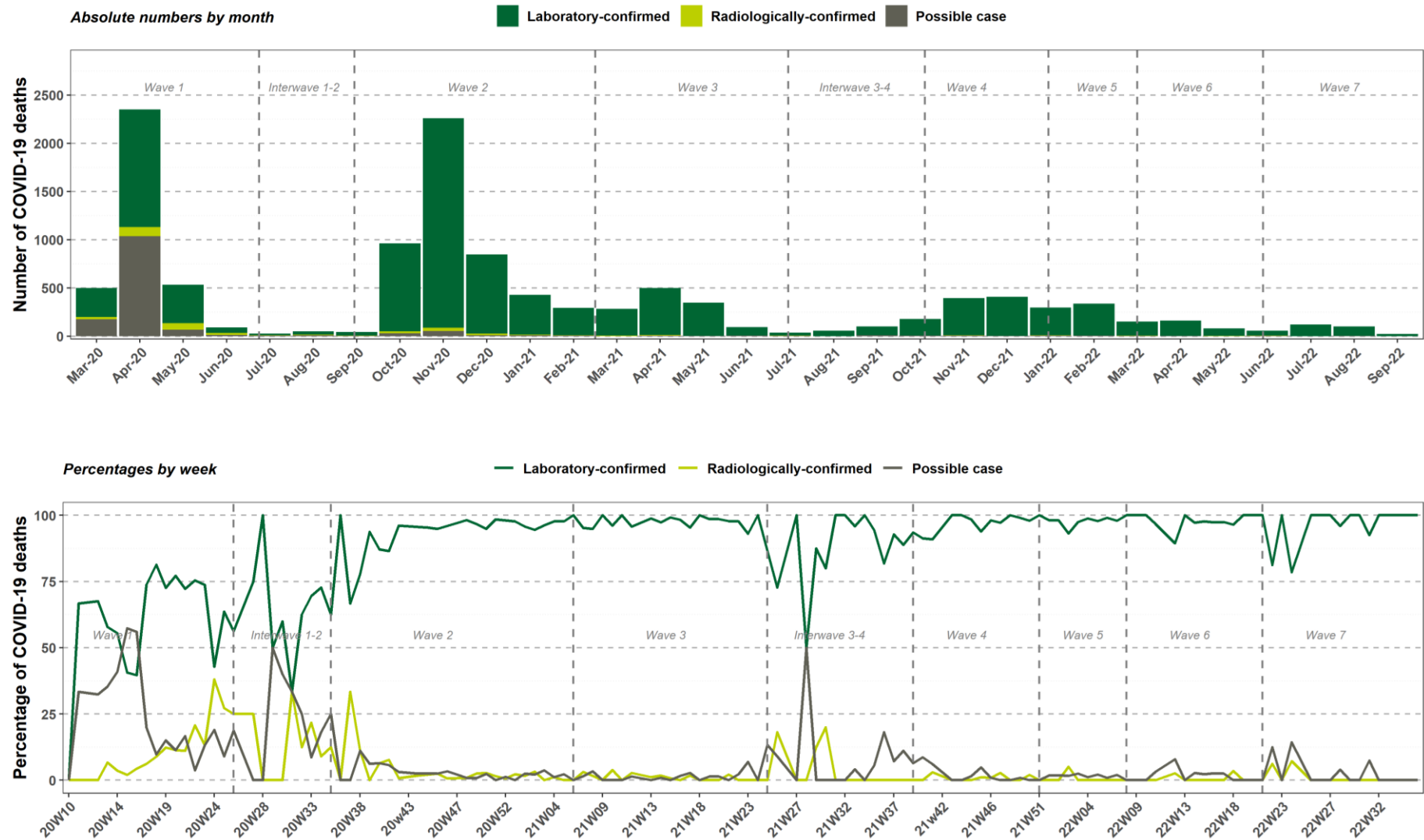
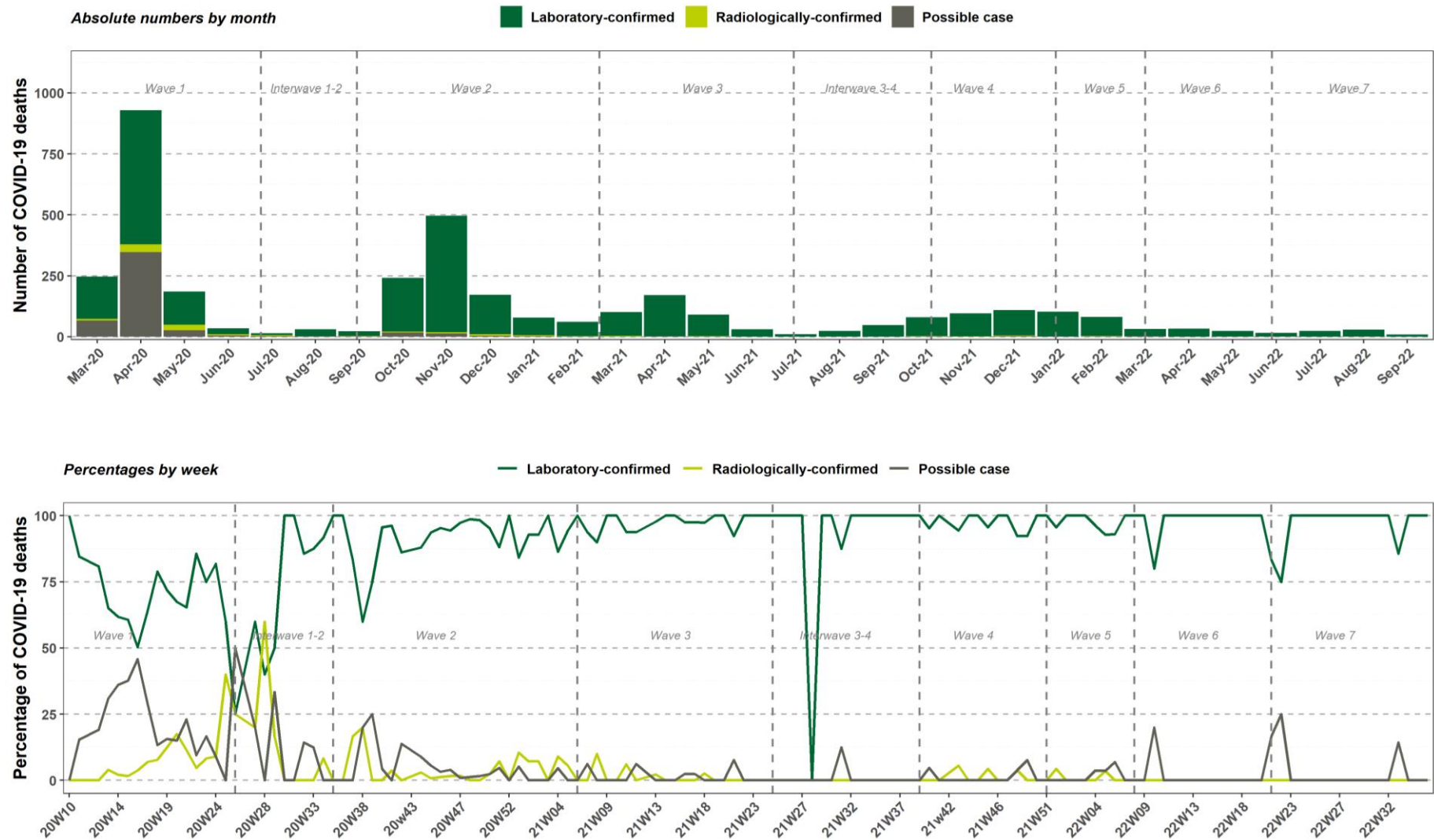


Figure A13. Evolution of COVID-19 deaths in Brussels-Capital Region by case classification, March 2020 – 11 September 2022



9.4. REGIONAL ANALYSIS PER PROFILE

Figure A14. COVID-19 deaths in Flanders per profile, by year, March 2020 – 11 September 2022

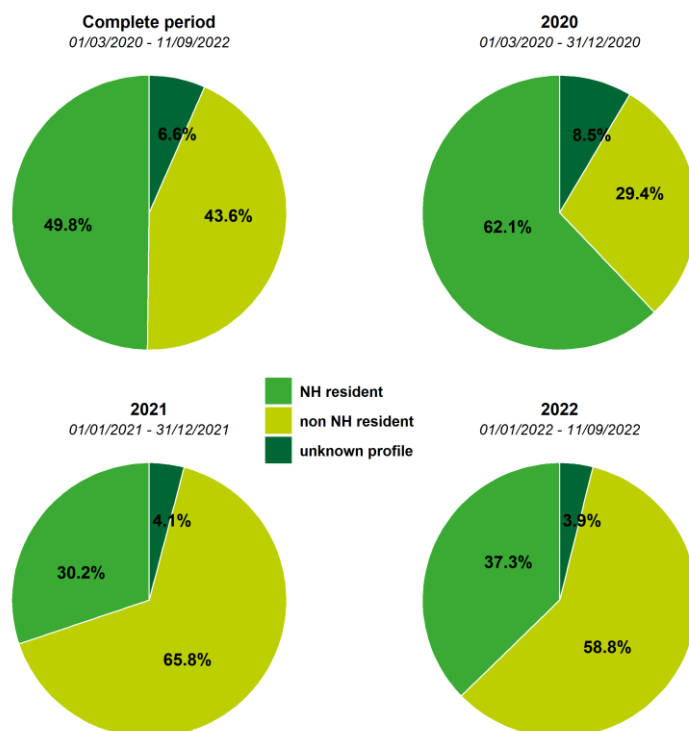


Figure A15. COVID-19 deaths in Wallonia per profile, by year, March 2020 – 11 September 2022

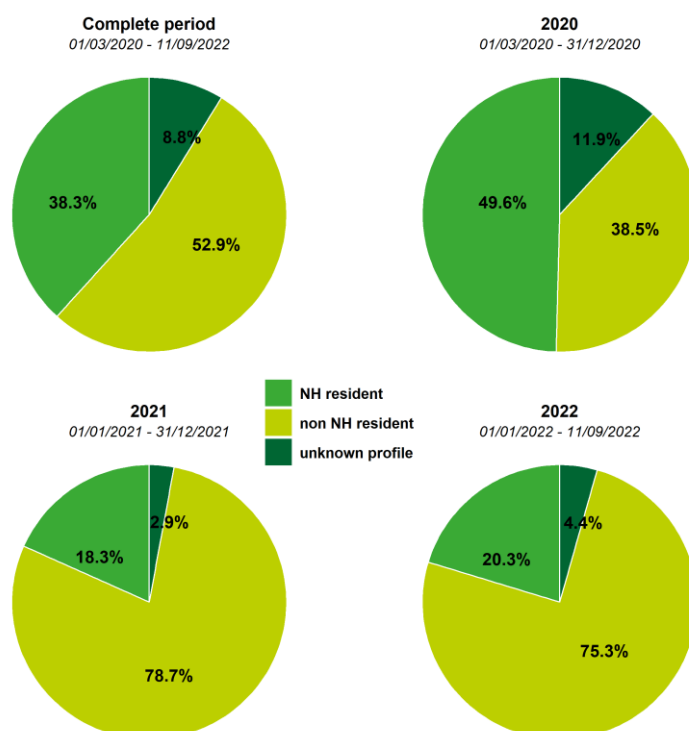


Figure A16. COVID-19 deaths in Brussels-Capital Region per profile, by year, March 2020 – 11 September 2022

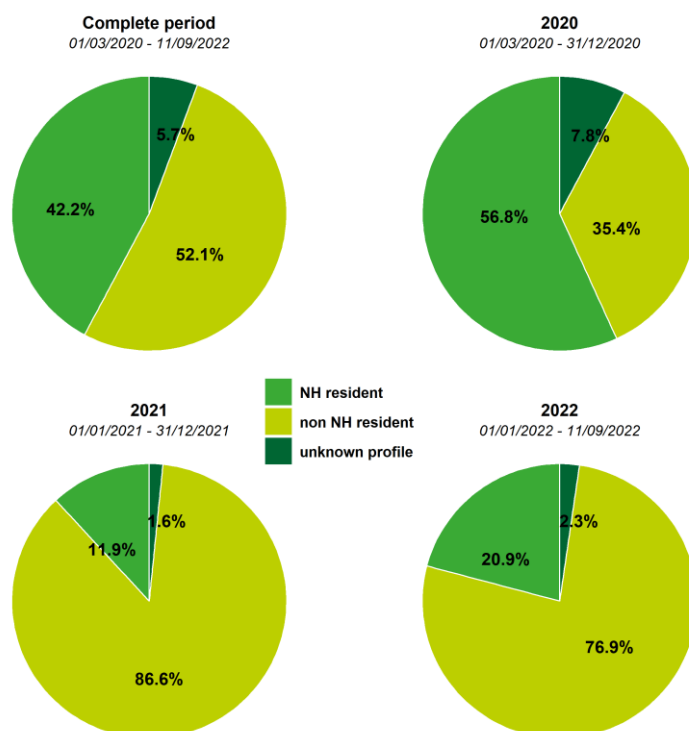


Figure A17. Evolution of COVID-19 deaths in Flanders per profile, March 2020 – 11 September 2022

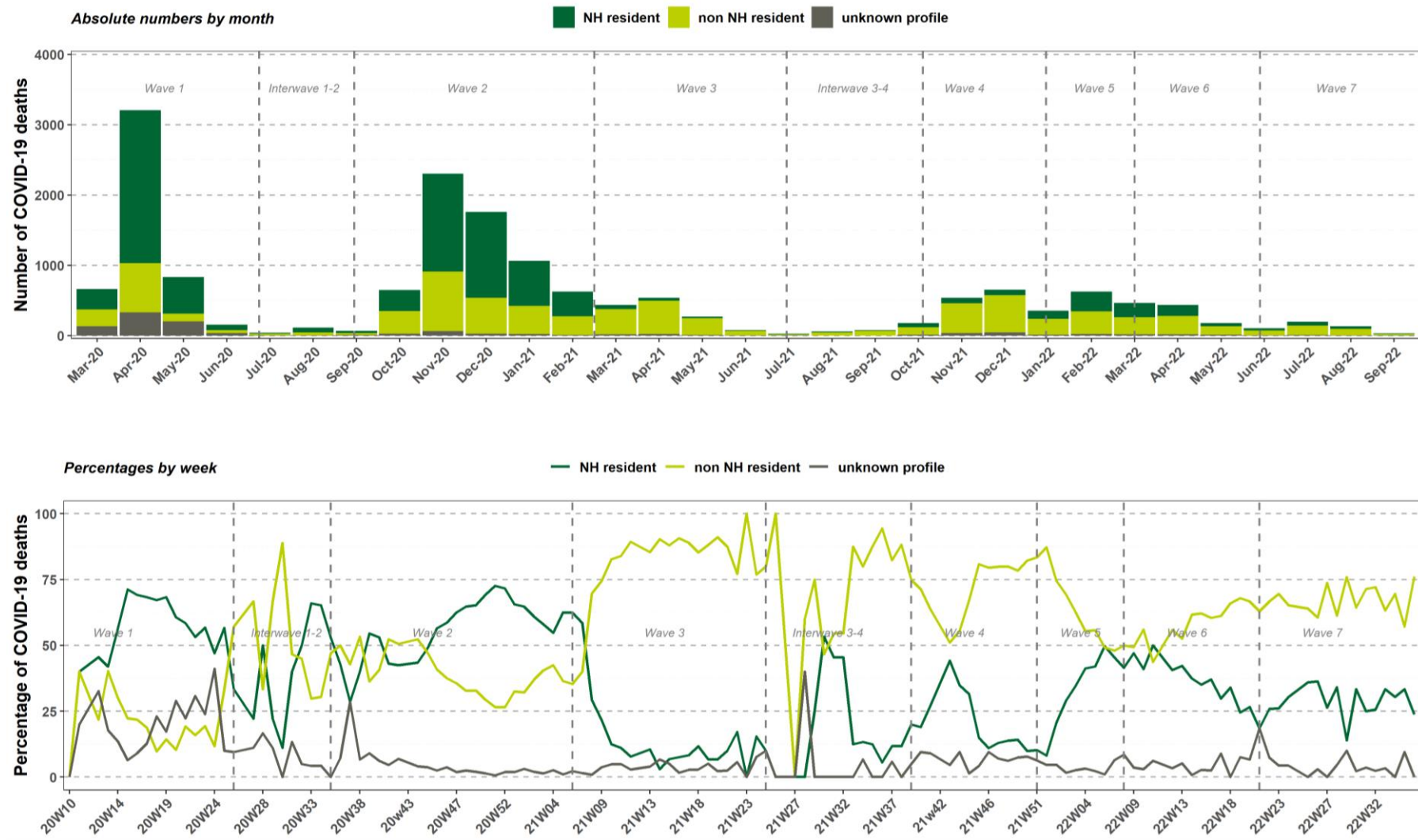


Figure A18. Evolution of COVID-19 deaths in Wallonia per profile, March 2020 – 11 September 2022

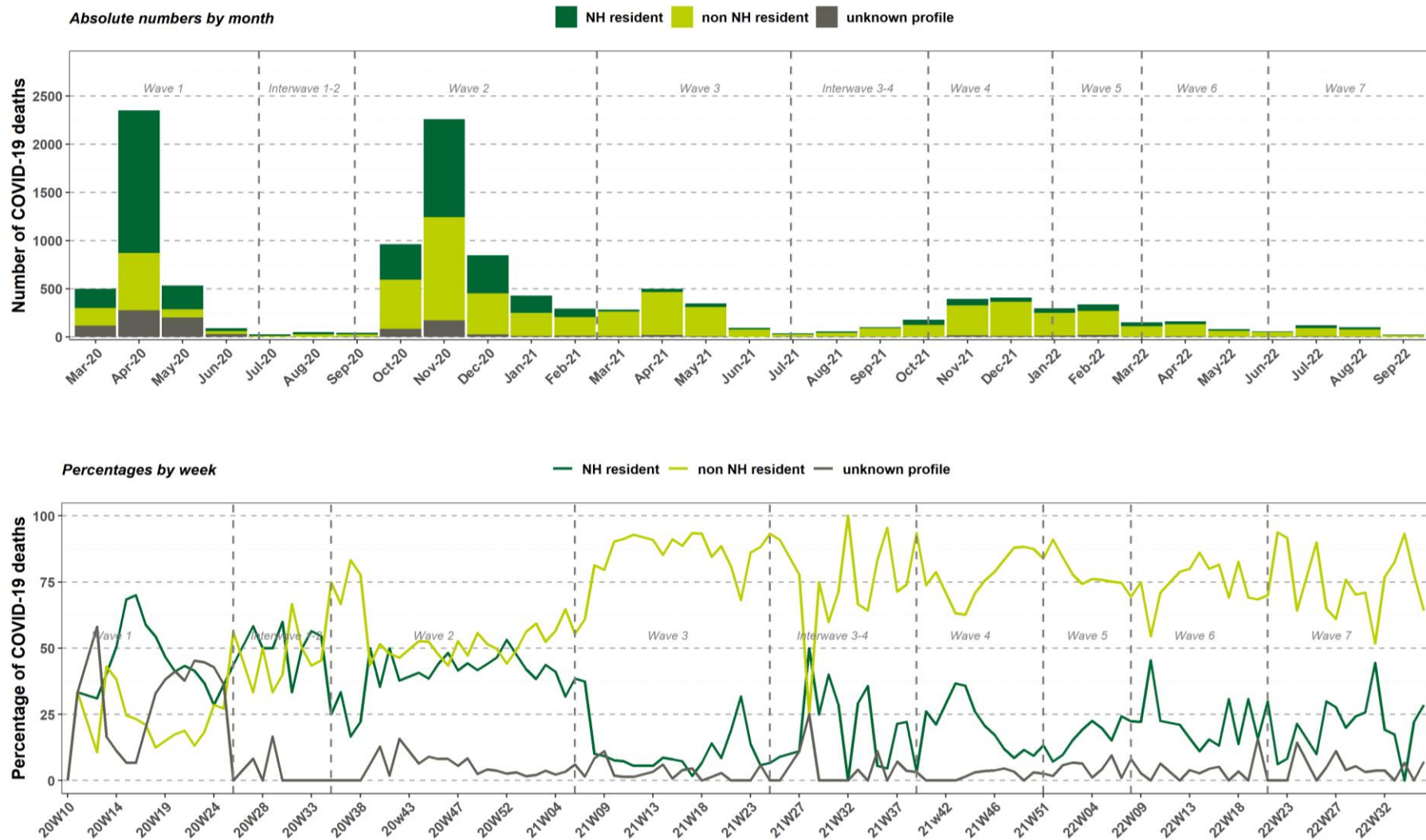
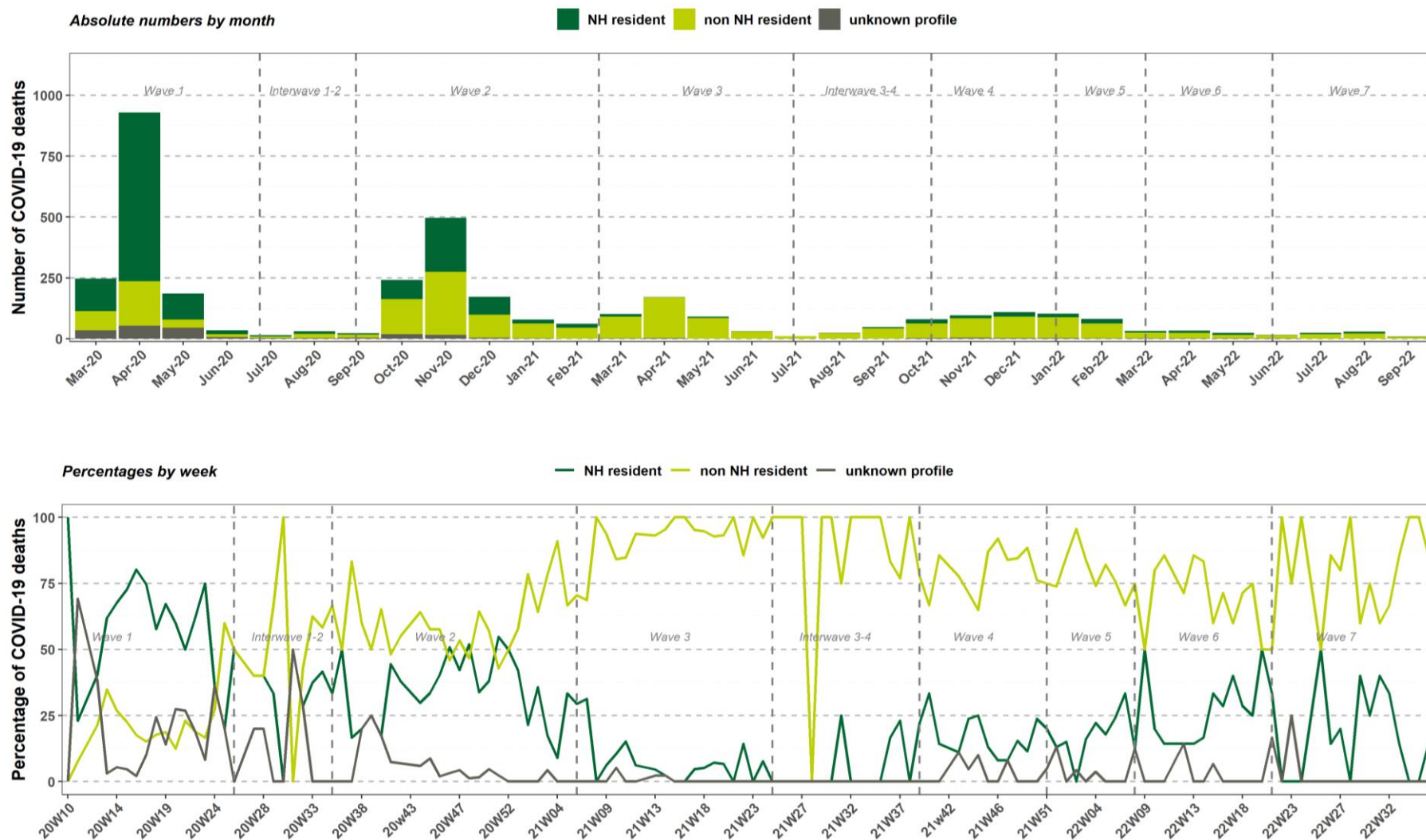


Figure A19. Evolution of COVID-19 deaths in Brussels-Capital Region among NH residents, March 2020 – 11 September 2022



9.5. REGIONAL ANALYSIS AMONG NH RESIDENTS BY PLACE OF DEATH

Figure A20. COVID-19 deaths among NH residents in Flanders by place of death and by year, March 2020 – 11 September 2022

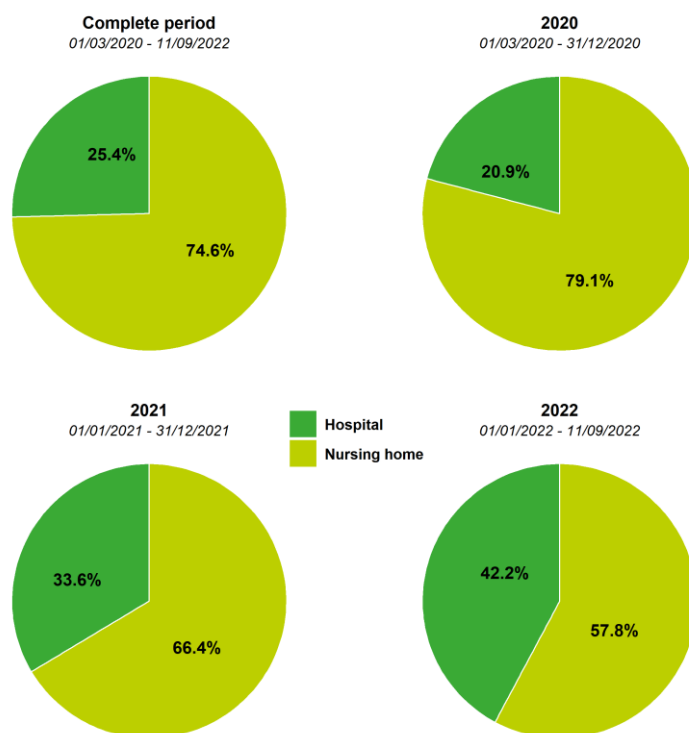


Figure A21. COVID-19 deaths among NH residents in Wallonia by place of death and by year, March 2020 – 11 September 2022

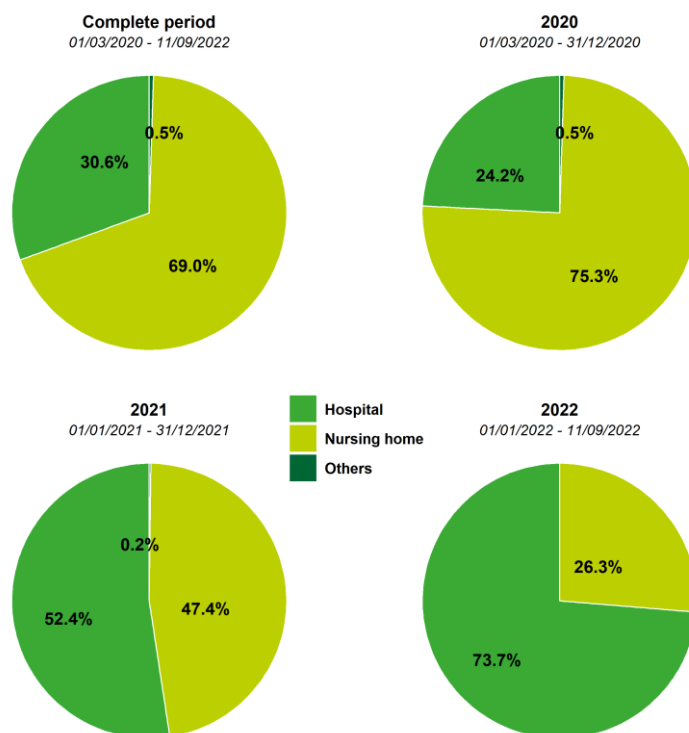


Figure A22. COVID-19 deaths among NH residents in Brussels-Capital Region by place of death and by year, March 2020 – 11 September 2022

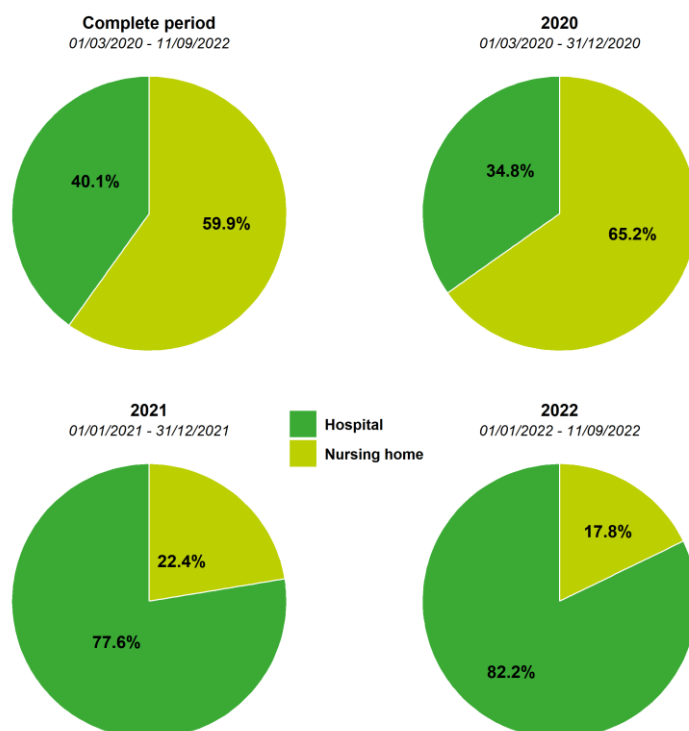


Figure A23. Evolution of COVID-19 deaths in Flanders among NH residents, by place of death, March 2020 – 11 September 2022

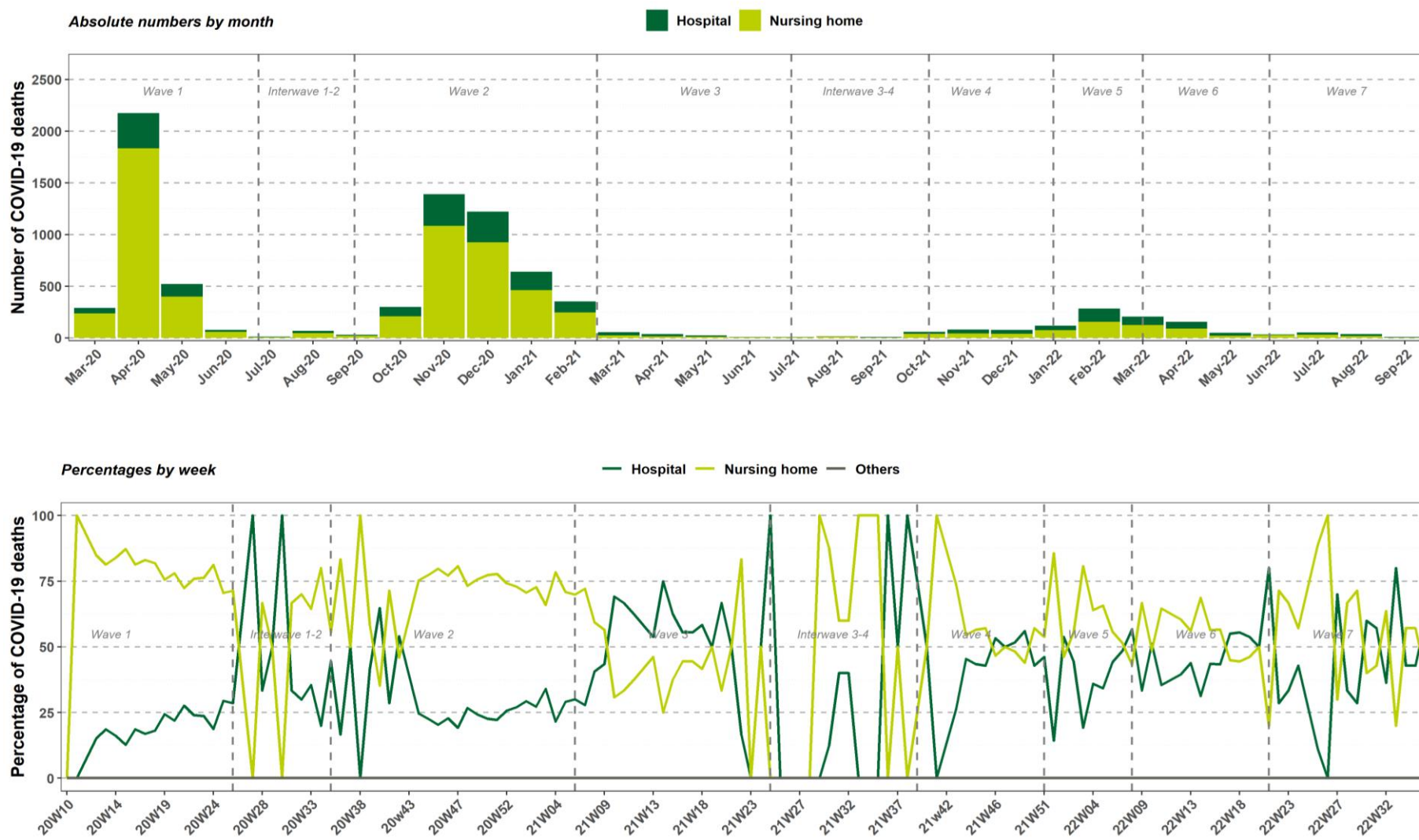


Figure A24. Evolution of COVID-19 deaths in Wallonia among NH residents, by place of death, March 2020 – 11 September 2022

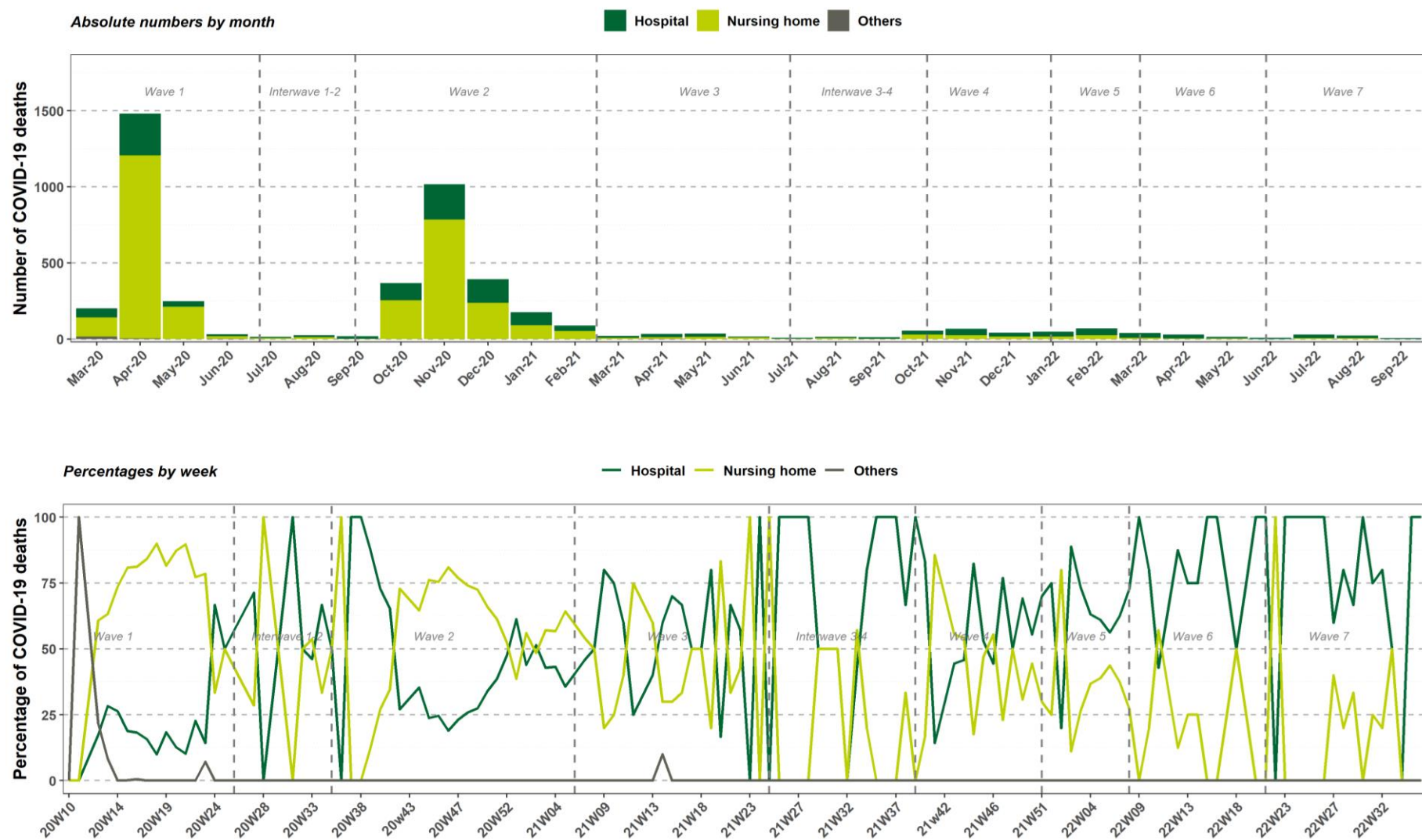
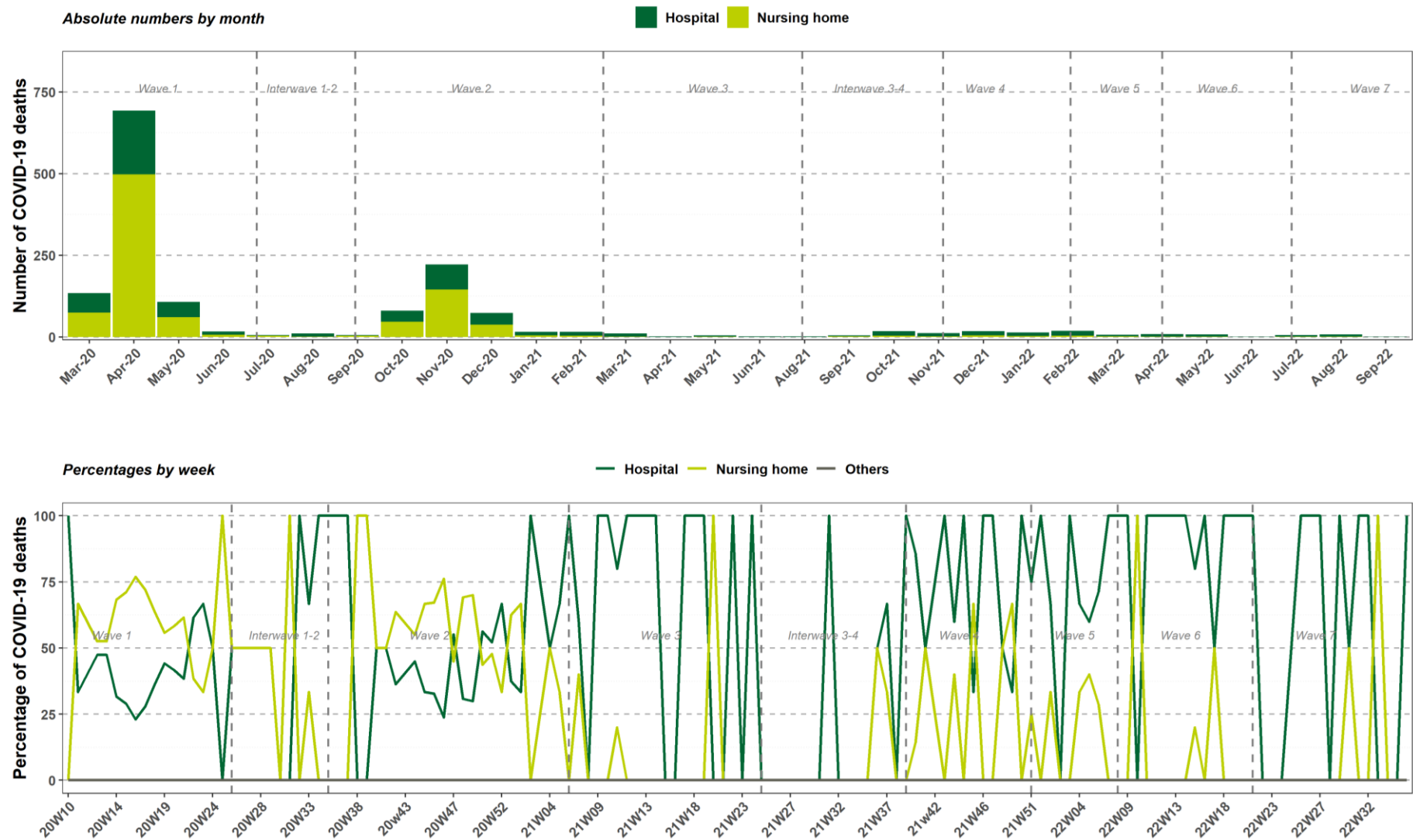


Figure A25. Evolution of COVID-19 deaths in Brussels-Capital Region among NH residents, by place of death, March 2020 – 11 September 2022



9.6. REGIONAL ANALYSIS FOR COVID-19 CASE FATALITY RATIOS

Figure A26. COVID-19 CFR (%) and 95% confidence intervals, cases and deaths both laboratory-confirmed, by region of residence and wave of the epidemic with and without wave 1, March 2020 – 11 September 2022

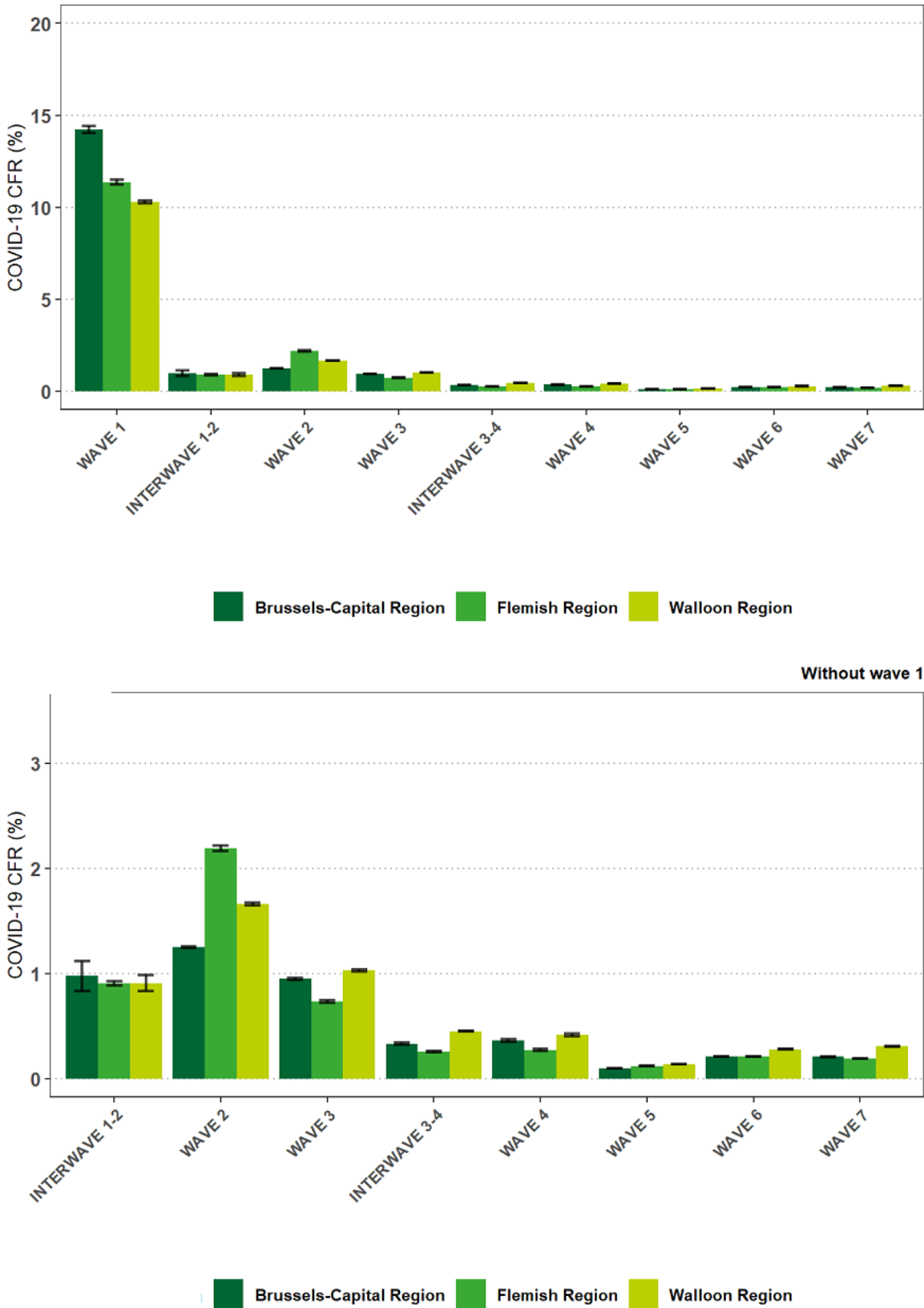
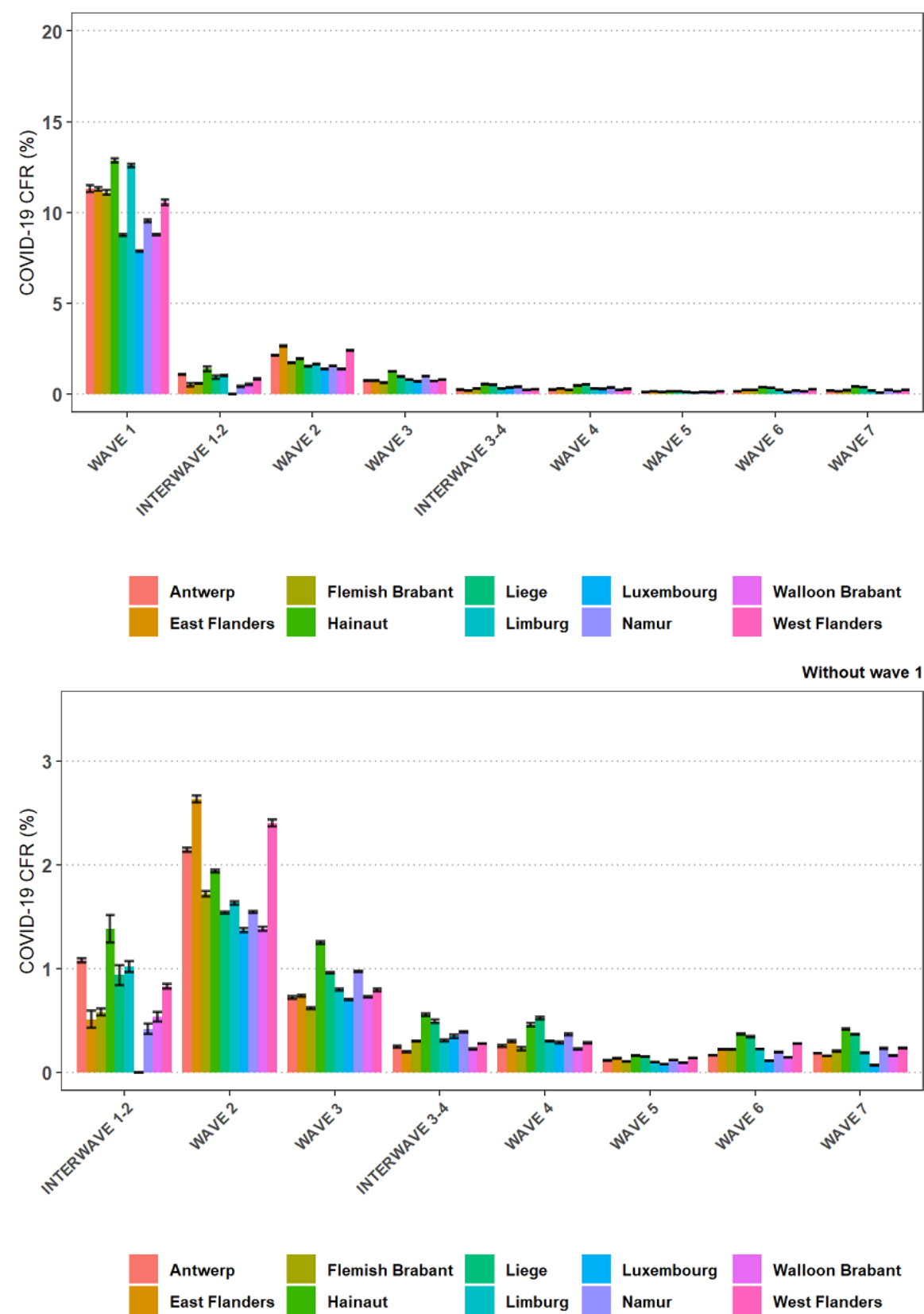


Figure A27. COVID-19 CFR (%) and 95% confidence intervals cases and deaths both laboratory-confirmed, by province of residence and wave of the epidemic with and without wave 1, March 2020 – 11 September 2022



10. ACKNOWLEDGMENTS

The authors would like to sincerely thank all the staff of the institutions (hospitals and LTCFs) and general practitioners that ensured the collection of the COVID-19 deaths data for public health purposes, and of course, all the people who contributed to the surveillance of COVID-19 mortality data within Sciensano, the regional institutions (AViQ, AZG, COCOM), the German-speaking Community, the federal institutions (FPS Public Health), the Belgian statistical office (Statbel) for the population data and the National Register for providing data for the Be-MOMO project. We hope that this report will add value to their work.

We would also like to reflect on the fact that behind these epidemiological figures there are human beings. All scientists of the COVID-19 surveillance express their deepest sympathy to all the families bereaved by the loss of a loved one due to this epidemic.

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