

Monitoring Belgian COVID-19 infections in work sectors in 2021

Geert Molenberghs^{1,2}, Johan Verbeeck¹, Godelieve Vandersmissen³, and Lode Godderis^{3,4}

¹Data Science Institute, I-BioStat, Universiteit Hasselt, Hasselt. Belgium

²I-BioStat, KU Leuven, Leuven, Belgium

³IDEWE, External Service for Prevention and Protection at Work, Heverlee, Belgium

⁴Centre for Environment and Health, Department of Public Health and Primary Care, KU Leuven, Leuven, Belgium

Version 16 – 21 October 2021

1 Introduction

The workplace is among the main activities for a large proportion of the population, and consequently a source of potential infection. Hence, it is often (up to 25%) reported in the contact centre database as one of the collectivities visited by the index case. It is important to monitor the incidence of COVID-19 by sector as it can help us to better understand causes of increased infection rates and it can offer us ways to reduce infections without jeopardising the continuity of these sectors/companies for the benefit of all, first and foremost the companies and their workers. Two sources of information on infection in work sectors will be used in this report: the RSZ/ONSS data and the contact tracing data.

1.1 RSZ/ONSS data

The RSZ/ONSS data analyses of COVID-19 infections in the working population were set up in the first place to allow for signal detection. The alerts consist of 2 or more cases in the same company as well as the identification of employment of an index case in a risk sector as defined by the regional contact tracing agencies (daily alerts are sent by the RSZ/ONSS to the regions). Aggregated data show the evolution over time of the incidence in the sectors. It helps to better understand the spread of the virus in the active population. The latter is of interest here.

Data description: RSZ-ONSS has been receiving information regarding positive COVID-19 cases from Sciensano since 8 September 2020. RSZ-ONSS links this information to workplace-related databases, at the level of the national number (NISS). The linkage is allowed during a period of 14 days, after which the information on positive cases is destroyed, while the aggregated output tables are stored. Linkage is done of positive cases with the NSSO Dimona database of active workers since 8 September 2020. This covers most of the workers, such as private and public sectors, interim employment and job students. Since 12 January 2021, additional linkage of positive cases with the ARZA-RGTI (Algemeen Repertorium van de Zelfstandige Arbeiders - Répertoire Général des Travailleurs Indépendants) database was allowed, which covers self-employed workers.

Each company is classified by sector of its main activity (as attributed by the RSZ-ONSS), which are identified by the NACE code. This standard code classifies workplaces into 21 main sectors and then in subcategories for which the specificity depends on the chosen granularity (which can have up to 943 subcategories). However, although some companies or self-employed workers may be active in more than one sector, only one NACE number associated with the main activity is used in the analysis. This limitation is particularly important to consider for employees within national education. Because a vast majority of schools provide both primary and secondary education, the employees will be registered as working in “Secondary education” even when in reality they are primary school teachers.

Further, since the link of the cases is only identified at the level of the company, no information is available on the type of the job of the index case (e.g., administrative work in metal industry will be registered under metal industry). Further, information on the exact employment location is not always available and/or accurate (e.g., information on telework or temporary unemployment is not available).

Finally, the actual source of infection (in particular: at the workplace or elsewhere) cannot be traced back from this database. Thus, the size and extent of the database allows us to obtain a clear and precise picture of the level of infection within a given sector, without link to the source and circumstances of infection.

1.2 Contact tracing

For companies affiliated with IDEWE, COVID-19 positive tested employees are reported to IDEWE starting from 22 July 2020. Of these index cases, contact tracing is performed of high and low-risk contact within the company. Subsequently, appropriate measures are taken within the company and by high-risk contacts to limit spread of the infection. Since 11 March 2021, index cases are asked about the work relatedness of their infection. At the start of the contact tracing, data were registered in a shared Excel file. From 29 October 2020 onwards, a ‘tracing application’ was used to register all notifications of index cases in companies under medical surveillance of IDEWE. Note that high and low-risk contacts are registered only for contacts in the company, contacts at home or in leisure time are not registered.

An index case can be any person present in the company. It can be an employee, but also an interim worker, an intern, etc. Importantly, for schools, the index case can also be a student. Of the index cases the employer information is retrieved via the INSZ number by IDEWE. Information of the employer is subsequently grouped by region and by customer segments. Although some customer segments are similar to the NACE code sectors, this is not true in general. IDEWE considers 10 customer segments based on the NACE codes of the companies, but these segments resemble only partially level 1 and 2. The segment classification is based on similarities in the needs of IDEWE’s customers and in the services IDEWE provides for them.

The incidences in the RSZ/ONSS sectors may differ from those in the contact tracing customer segments due to two aspects:

1. The RSZ/ONSS data concerns all employees and self-employed workers, while the contact tracing data concerns only companies under surveillance.
2. Similar named sectors and customer segments may contain different companies.

For instance, the NACE sector ‘education’ contains only information on positive cases among employees, while the contact tracing data also contain pupils. In schools, a considerable amount of index cases were pupils, especially since the onset of increased testing of children in January 2021. Finally, the contact tracing for the education segment is performed by regionally organised Student Guidance Centres (SGC). The organisation of the contact tracing by the SGC can vary from centre to centre and often only index cases with high-risk contacts are reported to IDEWE.

IDEWE has 9 regional offices that cover the surrounding areas and that are called after the city where they are located. Most Belgian provinces have one regional office, except Antwerp that is served by the regions Antwerpen, Mechelen and Turnhout, and Namur that serves all of Wallonia. The sole exception is Public transport. Companies belonging to this segment are not regionally divided.

Note that some larger companies have organised contact tracing by their internal prevention service. Data of these companies are however not included in this analysis, causing an underestimation of index cases in general. For some segments this underestimation might be more important than for others.

2 Methodology

2.1 RSZ/ONSS data

The data provided by RSZ/ONSS will be shown per work sector. Work sectors are divided by NACE codes and grouped into 5 levels of detail, going from 21 sectors at level 1 to 943 sectors at level 5. The evolution of the 14-day incidence of positive COVID-19 cases among all employees registered in the same sector (number of cases per 100,000 employees) is presented for the 5 levels of work sectors. A 95% confidence interval (CI) for the incidence is calculated on a logit transformation of the incidence, after which it is backtransformed to the original scale.

At each of the 5 levels of detail of the work sectors, the highest incidences in the last 14-day period are selected (5 October–18 October 2021) and presented together with the COVID-19 14-day incidence over all work sectors (~ 4.5 million individuals) and the COVID-19 14-day incidence in the general population (~ 11.5 million individuals) for reference.

Because the number of employees in some occupational sectors is low compared to others, the precision of the 14-day incidence is low in such small sectors. Therefore, we select the highest incidences for level 1 sectors with a minimum of 10,000 employees and self-employed workers. For level 2 and 3 sectors with a minimum of 5,000 employees and self-employed workers are selected, while for level 4 and level 5, sectors with a minimum of 3,000 and 1,500 employees, respectively, are selected.

Note that for 25% of the self-employed a sector is missing in the ARZA-RGTI data. Positive cases of self-employed worker with missing sector information are left out of the analysis. Linkage to occupational data shows that missing sector information is dispersed over many sectors, so that the impact of missing data is not affecting a single sector excessively. There will be a slight underestimation of the true incidence, but the

ordering among sectors is likely not affected.

Finally, we cannot exclude varying testing preparedness and custom between sectors.

2.2 Contact tracing

In addition to the comparison of the 14-day incidence of index cases between customer segments under surveillance, also the 14-day incidence of index cases between regions are compared. The reported day is the last day of the 14-day period.

Since its initiation on 29 October 2020, the tracing application registers in a standardized manner, besides information on incidences, also information on high-risk and low-risk contacts of index cases. Per segment and per region, the mean number of high-risk contacts by the index case over the entire study period (29 October 2020–14 October 2021) and the four-weekly percentage of index cases with two or more high risk contacts are evaluated.

There might be an underreporting of high-risk contacts because the number of contacts for an index case is set equal to 0 by default by the application. For index cases, who for example could not be contacted or who refused to answer, the number of high and low-risk contacts is reported 0, which may not coincide with reality. The incidences reported by contact tracing depend on the testing willingness in sectors and accuracy in reporting high-risk contact.

3 Results

This report is accompanied with an Excel sheet, listing all sectors and all NACE-BEL sectors for further examination.

3.1 Level 1 work sector

Of the 21 sectors at level 1, the sectors with a 14-day incidence on 18 October 2021 significantly above the working population average are Education (sector P) and Human health and social work activities (sector Q) (Table 1 and Figure 1). The 14-day incidences in the working population is again significantly above the general population incidence, indicating a stronger increase in incidence among the working population than among the children. The increase in incidence in the last week is present in all sectors.

14-day incidence of employees and self-employed at level 1

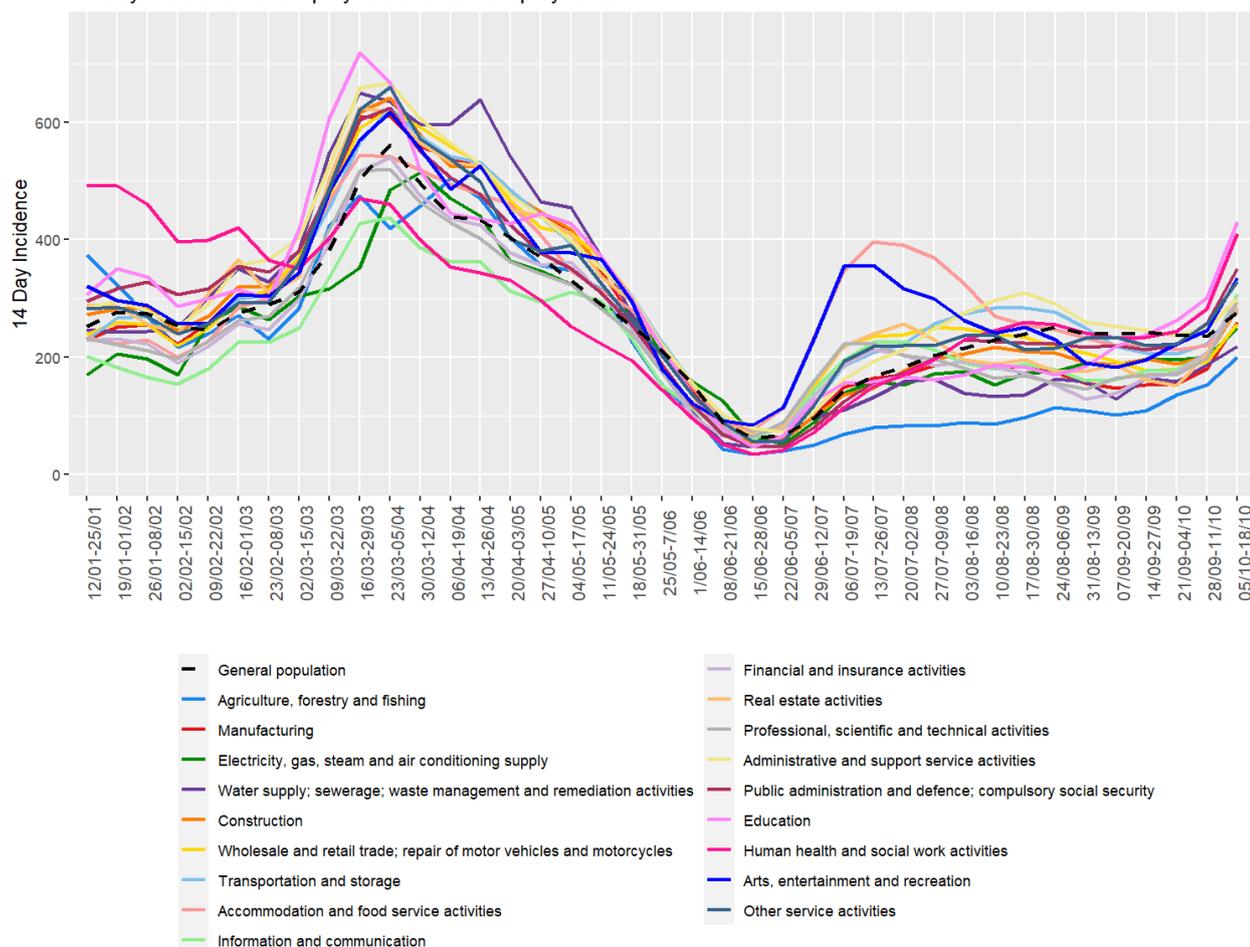


Figure 1: 14-Day incidence of COVID-19 infection of all 21 sectors at Level 1 in both employees and self-employed workers

Table 1: 14-Day incidence of COVID-19 infection of all 21 sectors at Level 1 on 18 October September 2021

DESCRIPTION	NACE-code	Total number of workers	Incidence (95%CI) all workers	Incidence (95%CI) employees	Incidence (95%CI) self-employed	Percentage of self-employed workers
Education	P	572622	431(414;448)	431(414;449)	435(362;522)	4.71
Human health and social work activities	Q	653528	411(396;427)	403(387;419)	497(441;560)	8.48
Public administration and defence; compulsory social security	O	544444	351(336;367)	351(336;367)		0.19
Working population		4510651	338(333;343)	338(333;343)		
Arts, entertainment and recreation	R	110149	335(303;371)	315(276;359)	371(316;436)	37.46
Other service activities	S	160790	329(302;358)	345(307;387)	312(275;354)	49.66
Information and communication	J	184740	308(284;334)	300(272;331)	328(283;380)	30.15
Financial and insurance activities	K	160465	301(275;329)	299(270;331)	309(256;373)	22.17
Administrative and support service activities	N	444482	299(283;315)	297(280;315)	308(272;349)	18.35
Professional, scientific and technical activities	M	395222	293(277;310)	286(264;310)	300(276;326)	47.67
Real estate activities	L	58947	285(245;331)	290(231;365)	282(231;345)	58.29
Transportation and storage	H	312014	283(265;302)	279(260;299)	319(260;392)	9.31
Construction	F	383333	282(266;299)	272(252;294)	296(270;324)	40.95
Accommodation and food service activities	I	336071	280(263;298)	283(263;304)	269(233;310)	22.36
General population			276	276	276	
Manufacturing	C	624231	260(248;273)	255(242;269)	301(262;346)	10.45
Wholesale and retail trade; repair of motor vehicles and motorcycles	G	841406	256(245;267)	260(248;273)	244(223;267)	23.02
Electricity, gas, steam and air conditioning supply	D	21600	250(192;326)	256(195;336)		6.15
Water supply; sewerage; waste management and remediation activities	E	36239	218(175;272)	213(169;268)		6.59
Agriculture, forestry and fishing	A	97500	200(174;230)	195(158;241)	205(170;247)	56.22

3.2 Level 2 work sector

In the sectors at level 2 with a minimum of 5,000 workers, the sectors with a 14-day incidence on 18 October 2021 significantly higher than the working population average are: Manufacturing (sector 14, 21, 32), Human health and residential care activities (sector 86, 87), Education (sector 85), Motion picture, video and television programme production (sector 59), Activities of membership organisations (sector 94), Creative, arts and entertainment activities (sector 90), Social work without accommodation (sector 88), Public administration and defence (sector 84) and Libraries, archives, museums and cultural activities (sector 91)(Table 2 and Figure 2).

14-Days incidence at Level 2 Employees and Self-employed

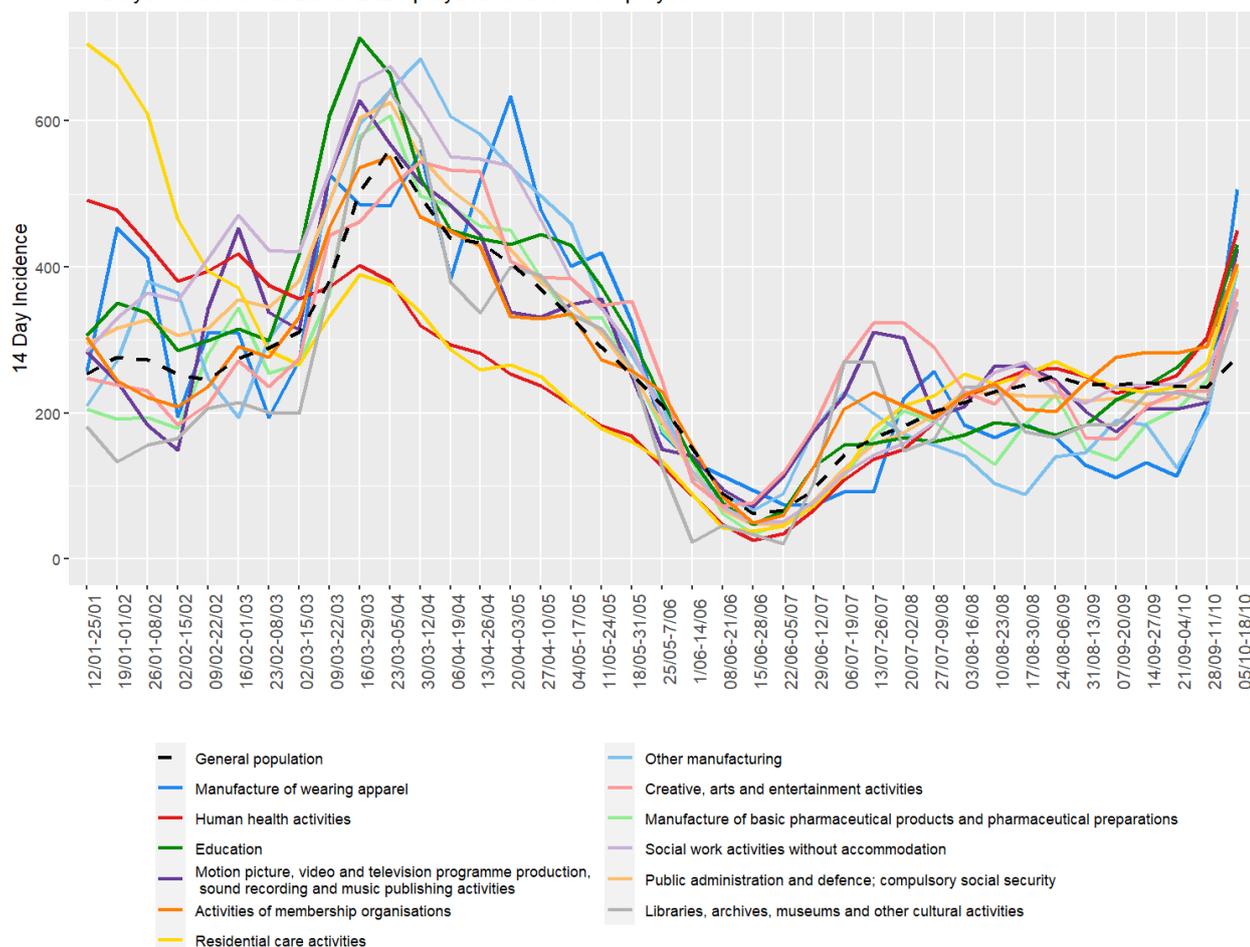


Figure 2: 14-Day incidence of COVID-19 infection in sectors with the highest incidence at Level 2 in both employees and self-employed workers

Table 2: 14-Day incidence of COVID-19 infection in sectors with the highest incidence at Level 2 on 18 October 2021

DESCRIPTION	NACE-code	Total number of workers	Incidence (95%CI) all workers	Incidence (95%CI) employees	Incidence (95%CI) self-employed	Percentage of self-employed workers
Manufacture of wearing apparel	14	5336	506(347;737)		585(347;985)	45.04
Human health activities	86	317111	450(427;474)	444(420;470)	485(426;552)	15.32
Education	85	572622	431(414;448)	431(414;449)	435(362;522)	4.71
Motion picture, video and television programme production, sound recording and music publishing activities	59	15294	425(333;542)	447(332;602)	387(255;587)	39.53
Activities of membership organisations	94	59158	404(356;458)	413(360;474)	361(259;502)	16.80
Residential care activities	87	168170	399(370;430)	393(364;424)	825(527;1290)	1.40
Other manufacturing	32	13568	398(305;519)	318(218;463)	532(365;775)	37.72
Creative, arts and entertainment activities	90	45405	370(318;430)	361(295;442)	382(305;479)	45.14
Manufacture of basic pharmaceutical products and pharmaceutical preparations	21	35150	367(309;436)	369(310;439)		1.32
Social work activities without accommodation	88	169972	353(326;382)	346(319;376)	571(402;811)	3.22
Public administration and defence; compulsory social security	84	544444	351(336;367)	351(336;367)		0.19
Libraries, archives, museums and other cultural activities	91	10496	343(248;475)	298(206;431)		10.56
Working population		4510651	338(333;343)	338(333;343)		
General population			276	276	276	

3.3 Level 3 work sector

In the sectors at level 3 with a minimum of 5,000 workers, the sectors with a 14-day incidence on 18 October 2021 significantly higher than the working population average are: Education (sector 852, 853), Processing and preserving of meat (sector 101), Residential care (sector 879, 873, 872), Health care (sector 862, 863, 869), Activities of other membership organisations (sector 949) and Social work activities without accommodation for the elderly and disabled (sector 881) (Table 3 and Figure 3).

Since the start of the primary and secondary schools on 1st September and the start of other and higher education later in September, employees in schools show an increase in 14-day incidences (Figure 4). The increase is very sharp in the last week. A comparison between primary and secondary schools is inaccurate based on the available data. Indeed, the NACE-BEL code for school employees is assigned to the main activity

of the school. Hence, for schools offering both primary and secondary education, all employees are counted as secondary education employees. Employees under the NACE-BEL code primary education are employees in schools that offer only primary education.

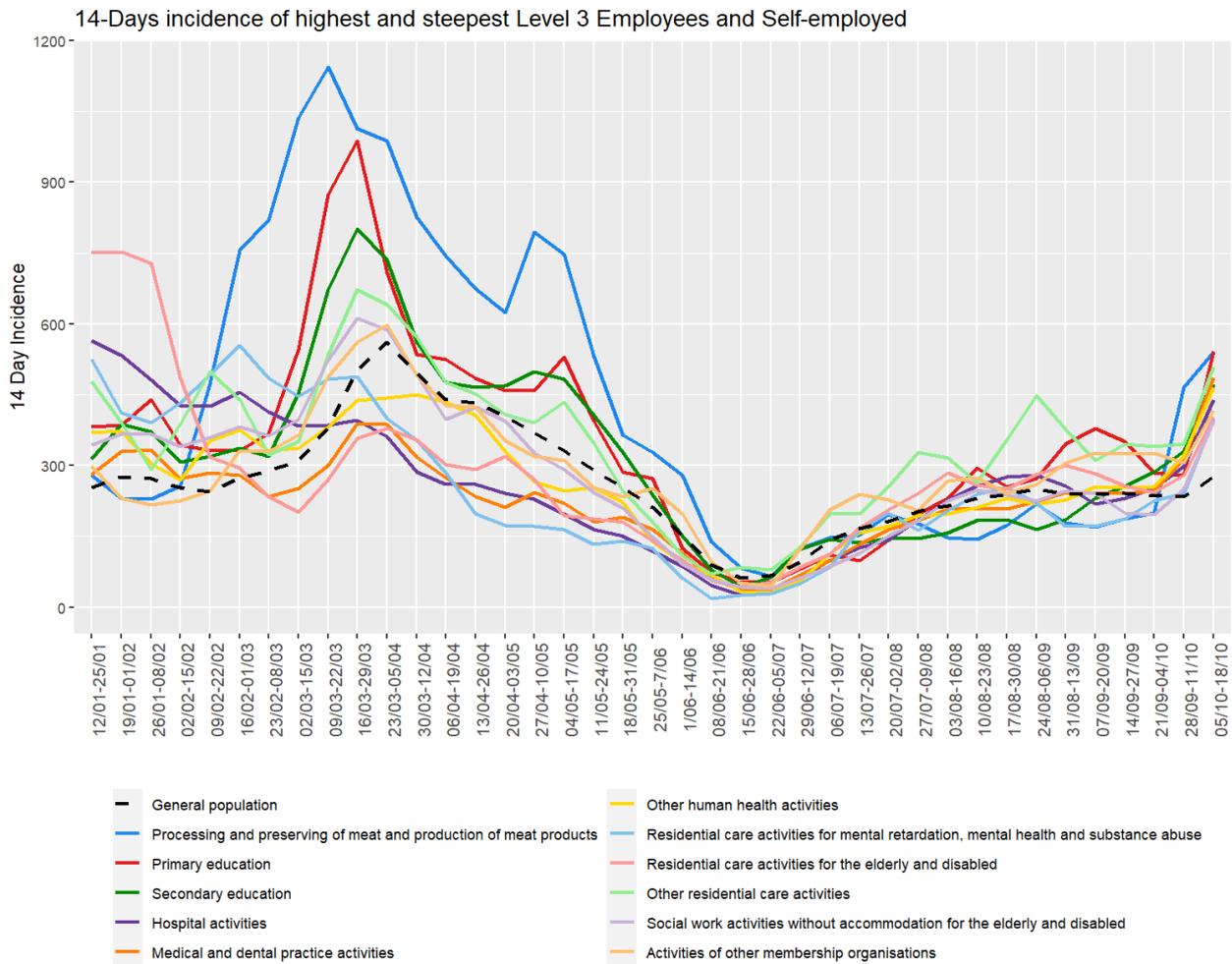


Figure 3: 14-Day incidence of COVID-19 infection in sectors with the highest incidence at Level 3 in both employees and self-employed

14-Days incidence Education per Level 3 Sector

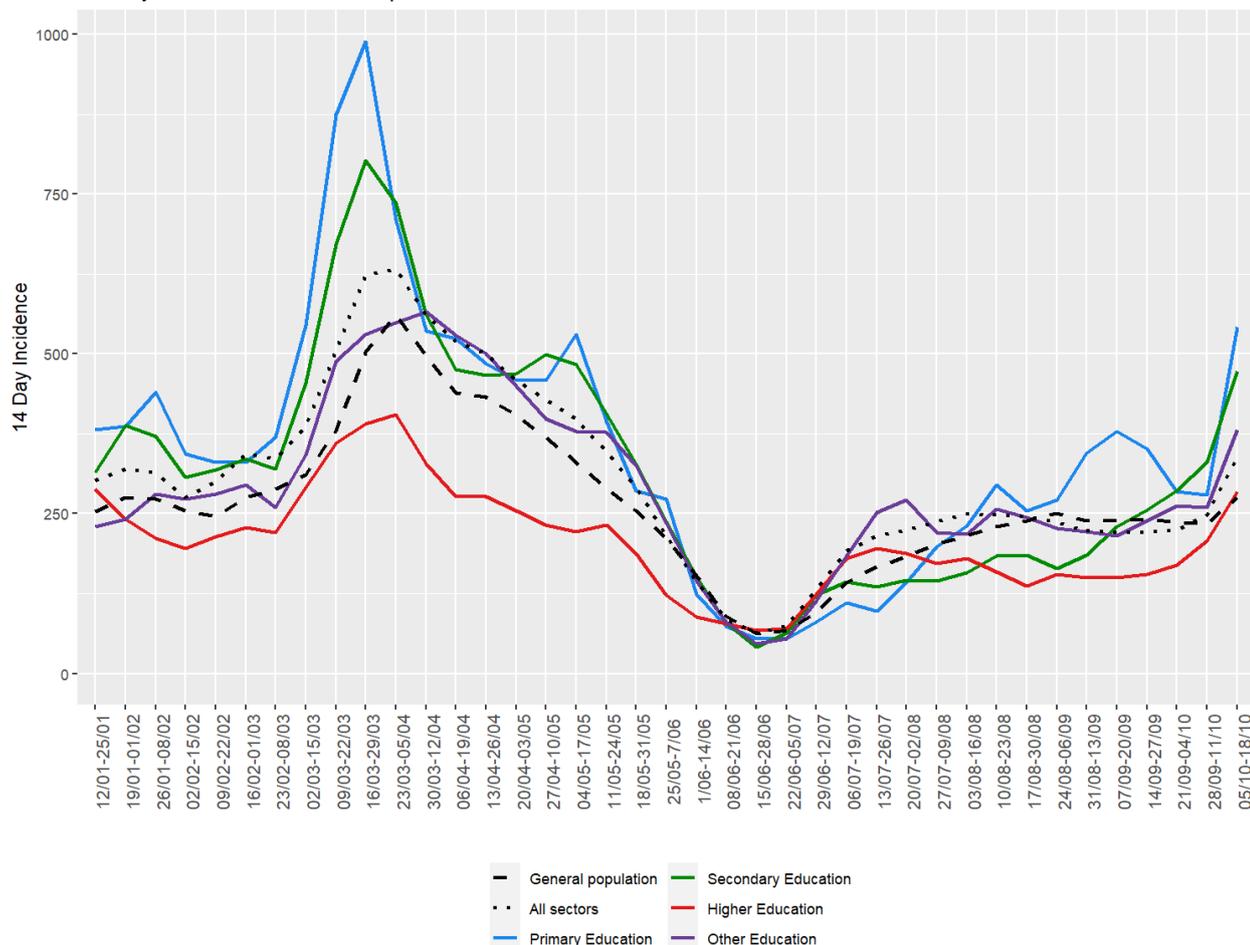


Figure 4: 14-Day incidence of COVID-19 infection in Education sectors at Level 3 in both employees and self-employed

Table 3: 14-Day incidence of COVID-19 infection in sectors with the highest incidence at Level 3 on 18 October 2021

DESCRIPTION	NACE-code	Total number of workers	Incidence (95%CI) all workers	Incidence (95%CI) employees	Incidence (95%CI) self-employed	Percentage of self-employed workers
Primary education	852	7934	542(402;730)	556(408;757)		9.29
Processing and preserving of meat and production of meat products	101	19593	541(447;654)	568(469;688)	156(39;622)	6.55
Other residential care activities	879	16471	510(412;631)	522(421;647)		3.54
Medical and dental practice activities	862	45585	487(427;555)	483(403;579)	492(407;595)	48.10
Secondary education	853	407611	473(452;495)	473(452;495)		0.21
Other human health activities	869	54506	466(412;527)	458(386;543)	476(399;568)	47.62
Hospital activities	861	217768	439(412;468)	438(411;467)		0.33
Activities of other membership organisations	949	35492	417(355;490)	431(364;511)	322(194;533)	13.53
Residential care activities for the elderly and disabled	873	68983	403(358;453)	393(349;443)		1.29
Residential care activities for mental retardation, mental health and substance abuse	872	41750	400(344;465)	388(332;453)		1.81
Social work activities without accommodation for the elderly and disabled	881	49114	395(343;455)	383(332;442)		1.09
Working population		4510651	338(333;343)	338(333;343)		
General population			276	276	276	

3.4 Level 4 work sector

In the sectors at level 4 with a minimum of 3,000 workers, the sectors with a 14-day incidence on 18 October 2021 significantly higher than the working population average are: Processing and preserving of poultry and meat (sector 1012, 1011), Manufacture of kitchen furniture (sector 3102), Other human resources provision (sector 7830), Education (sector 8520, 8531), Health care (sector 8622, 8621, 8610), Residential care (sector 8790, 8730, 8720), Motion picture, video and television production (sector 5911), Child day-care (sector 8891), Activities of other membership organisations (sector 9499), Social work activities without accommodation for the elderly and disabled (sector 8810), Public order and safety activities (sector 8424) and General public administration activities (sector 8411) (Table 4 and Figure 5).

14-Days incidence of top 15 Level 4 Employees and Self-employed

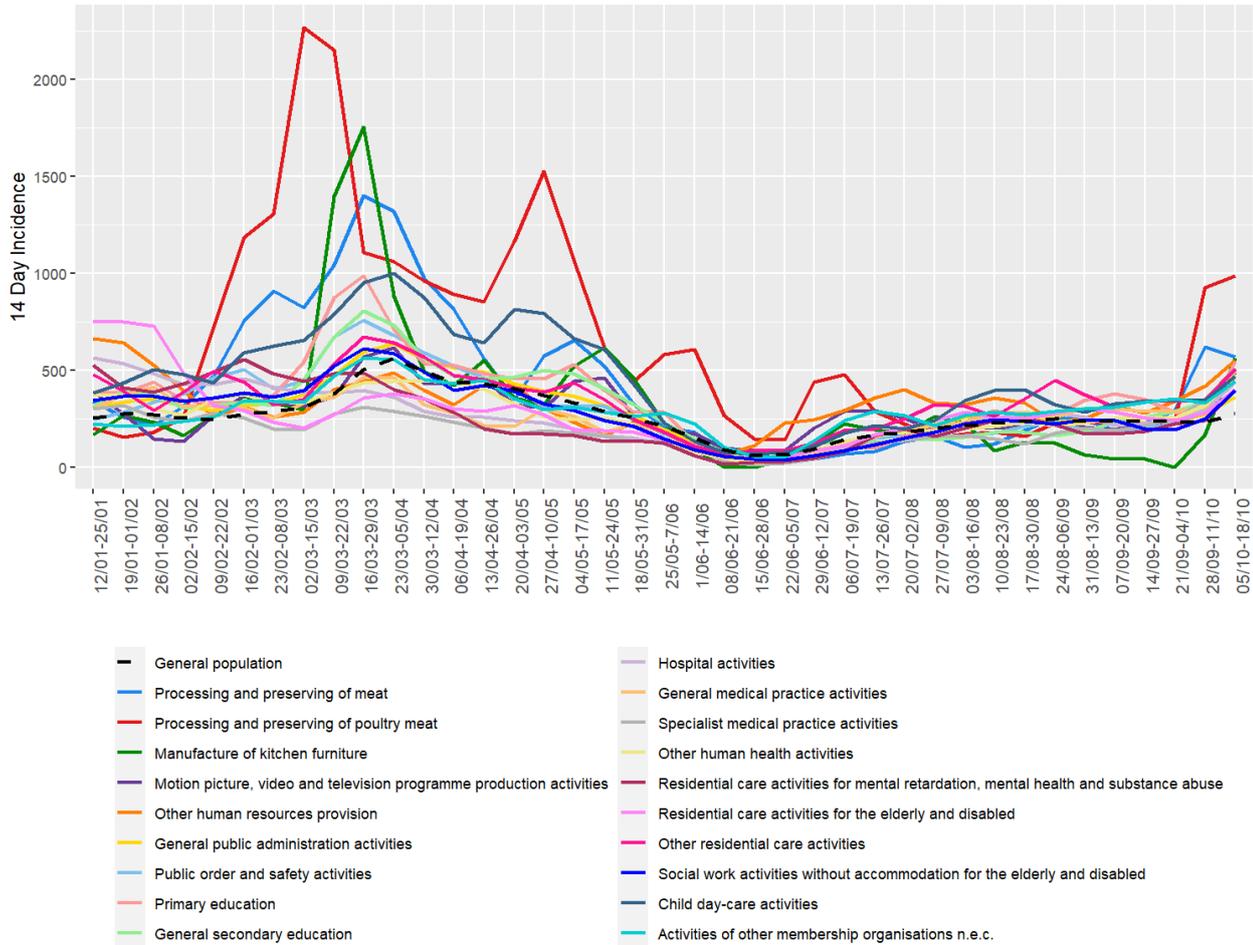


Figure 5: 14-Day incidence of COVID-19 infection in sectors with the highest incidence at Level 4 in both employees and self-employed

Table 4: 14-Day incidence of COVID-19 infection in sectors with the highest incidence at Level 4 on 18 October 2021

DESCRIPTION	NACE-code	Total number of workers	Incidence (95%CI) all workers	Incidence (95%CI) employees	Incidence (95%CI) self-employed	Percentage of self-employed workers
Processing and preserving of poultry meat	1012	4158	986(727;1336)	986(727;1336)		3.61
Processing and preserving of meat	1011	7206	569(419;772)	603(441;824)		10.25
Manufacture of kitchen furniture	3102	3180	566(357;897)			25.81
Other human resources provision	7830	5244	553(385;795)	523(354;773)		8.93
Primary education	8520	7934	542(402;730)	556(408;757)		9.29
Specialist medical practice activities	8622	19066	514(422;626)	511(353;739)	515(408;650)	71.69
Other residential care activities	8790	16471	510(412;631)	522(421;647)		3.54
General medical practice activities	8621	17000	500(404;618)	458(354;592)	621(426;904)	26.13
Motion picture, video and television programme production activities	5911	8961	491(366;659)	512(356;736)	454(274;752)	38.47
General secondary education	8531	395634	481(460;503)	481(460;503)		0.17
Child day-care activities	8891	28785	469(396;555)	456(382;544)	671(381;1178)	6.27
Other human health activities	8690	54506	466(412;527)	458(386;543)	476(399;568)	47.62
Activities of other membership organisations n.e.c.	9499	27416	445(373;531)	463(384;559)	343(203;578)	15.01
Hospital activities	8610	217768	439(412;468)	438(411;467)		0.33
Residential care activities for the elderly and disabled	8730	68983	403(358;453)	393(349;443)		1.29
Residential care activities for mental retardation, mental health and substance abuse	8720	41750	400(344;465)	388(332;453)		1.81
Social work activities without accommodation for the elderly and disabled	8810	49114	395(343;455)	383(332;442)		1.09
Public order and safety activities	8424	53708	391(342;447)	391(342;447)		0.18
General public administration activities	8411	346133	362(343;383)	362(343;383)		0.12
Working population		4510651	338(333;343)	338(333;343)		
General population			276	276	276	

3.5 Level 5 work sector

In the sectors at level 5 with a minimum of 3,000 workers, the sectors with a 14-day incidence on 18 October 2021 significantly higher than the working population average are: Processing and preserving of poultry and meat (sector 10120, 10110), Secondary education (sector 85311, 85319), Manufacture of kitchen furniture (sector 31020), Health care (sector 86103, 86909, 86220, 86210, 86904, 86906, 86101, 86104), Other human resources provision (sector 78300), Youth work associations (sector 94991), Other associations (sector 94999), Residential care (sector 87901, 87301), Nurseries and crèches (sector 88911), Other forms of social services without housing (sector 88999), Local Police (sector 84242) and Public Centers for Social Welfare (sector

84115) (Table 5 and Figure 6).

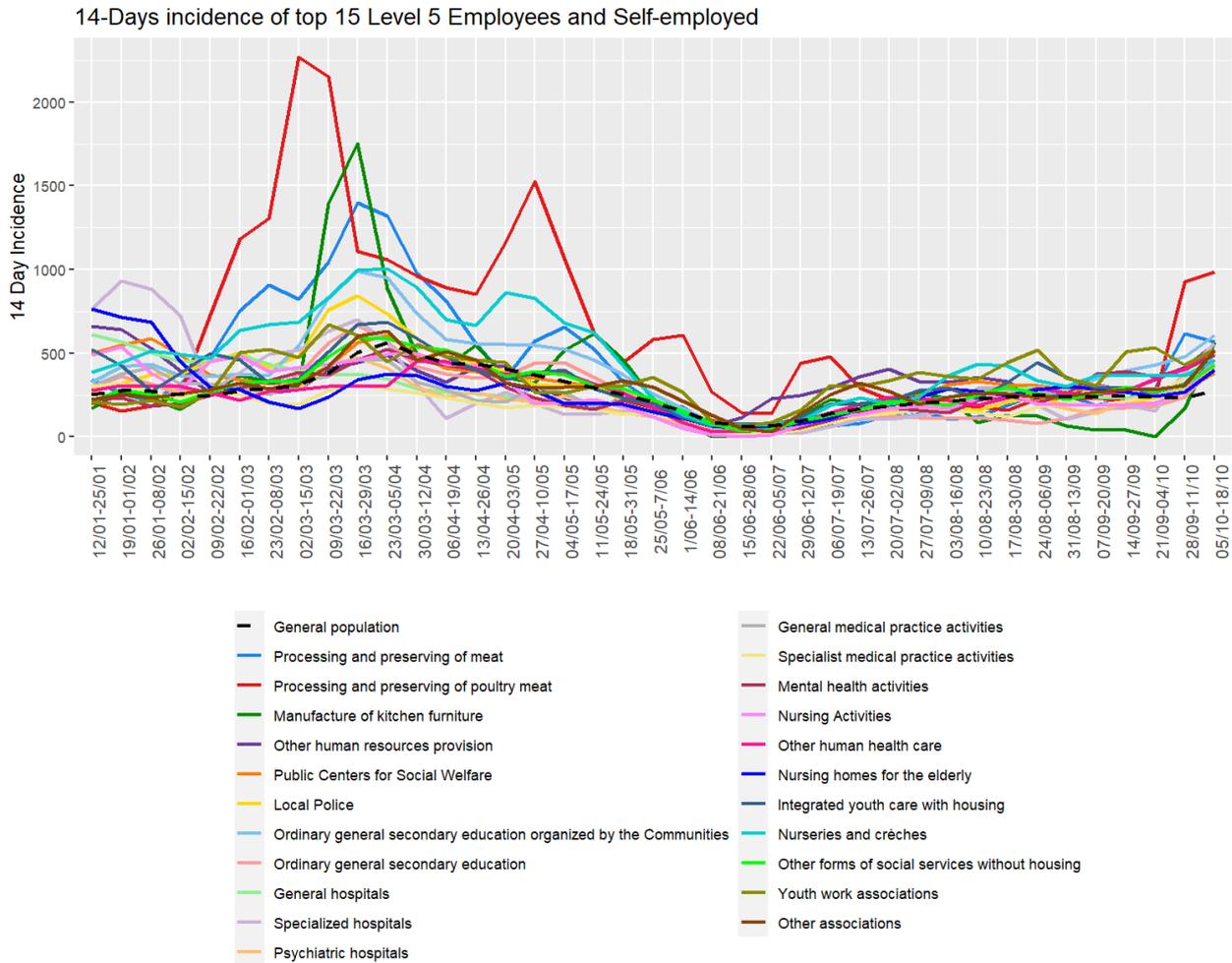


Figure 6: 14-Day incidence of COVID-19 infection in sectors with the highest incidence at Level 5 in both employees and self-employed

Table 5: 14-Day incidence of COVID-19 infection of sectors with the highest incidence at Level 5 on 18 October 2021

DESCRIPTION	NACE-code	Total number of workers	Incidence (95%CI) all workers	Incidence (95%CI) employees	Incidence (95%CI) self-employed	Percentage of self-employed workers
Processing and preserving of poultry meat	10120	4158	986(727;1336)	986(727;1336)		3.61
Ordinary general secondary education organized by the Communities	85311	157331	607(570;647)	607(570;647)		0.01
Processing and preserving of meat	10110	7206	569(419;772)	603(441;824)		10.25
Manufacture of kitchen furniture	31020	3180	566(357;897)			25.81
Specialized hospitals	86103	4659	558(380;818)	545(369;805)		1.50
Other human resources provision	78300	5244	553(385;795)	523(354;773)		8.93
Youth work associations	94991	5153	524(360;763)	532(360;786)		8.86
Other human health care	86909	11090	523(405;676)		523(401;682)	93.20
Other associations	94999	12524	519(407;661)	566(437;733)	325(163;649)	19.82
Integrated youth care with housing	87901	12741	518(407;659)	525(412;669)		2.82
Specialist medical practice activities	86220	19066	514(422;626)	511(353;739)	515(408;650)	71.69
General medical practice activities	86210	17000	500(404;618)	458(354;592)	621(426;904)	26.13
Mental health activities	86904	6953	489(350;684)	604(390;934)	385(228;649)	53.43
Nursing Activities	86906	16667	462(370;577)	434(339;555)	653(387;1100)	12.93
Nurseries and crèches	88911	25383	457(381;548)	442(365;535)	681(378;1225)	6.43
General hospitals	86101	179365	441(411;473)	440(410;472)		0.26
Other forms of social services without housing	88999	36597	429(367;501)	423(359;498)	517(300;888)	6.96
Psychiatric hospitals	86104	32619	420(355;496)	409(345;485)		0.37
Ordinary general secondary education	85319	206715	417(390;446)	417(390;446)		0.02
Nursing homes for the elderly	87301	59000	400(352;454)	397(349;451)		1.08
Local Police	84242	36500	400(340;470)	400(340;470)		0.11
Public Centers for Social Welfare	84115	94723	379(342;420)	379(342;420)		0.14
Working population		4510651	338(333;343)	338(333;343)		
General population			276	276	276	

Finally, when considering specifically the non-medical contact professions, such as hairdressers and beauty saloons, we see the incidence following the increasing trend, similar to the working population average, except for the hairdresser employees (Figure 7).

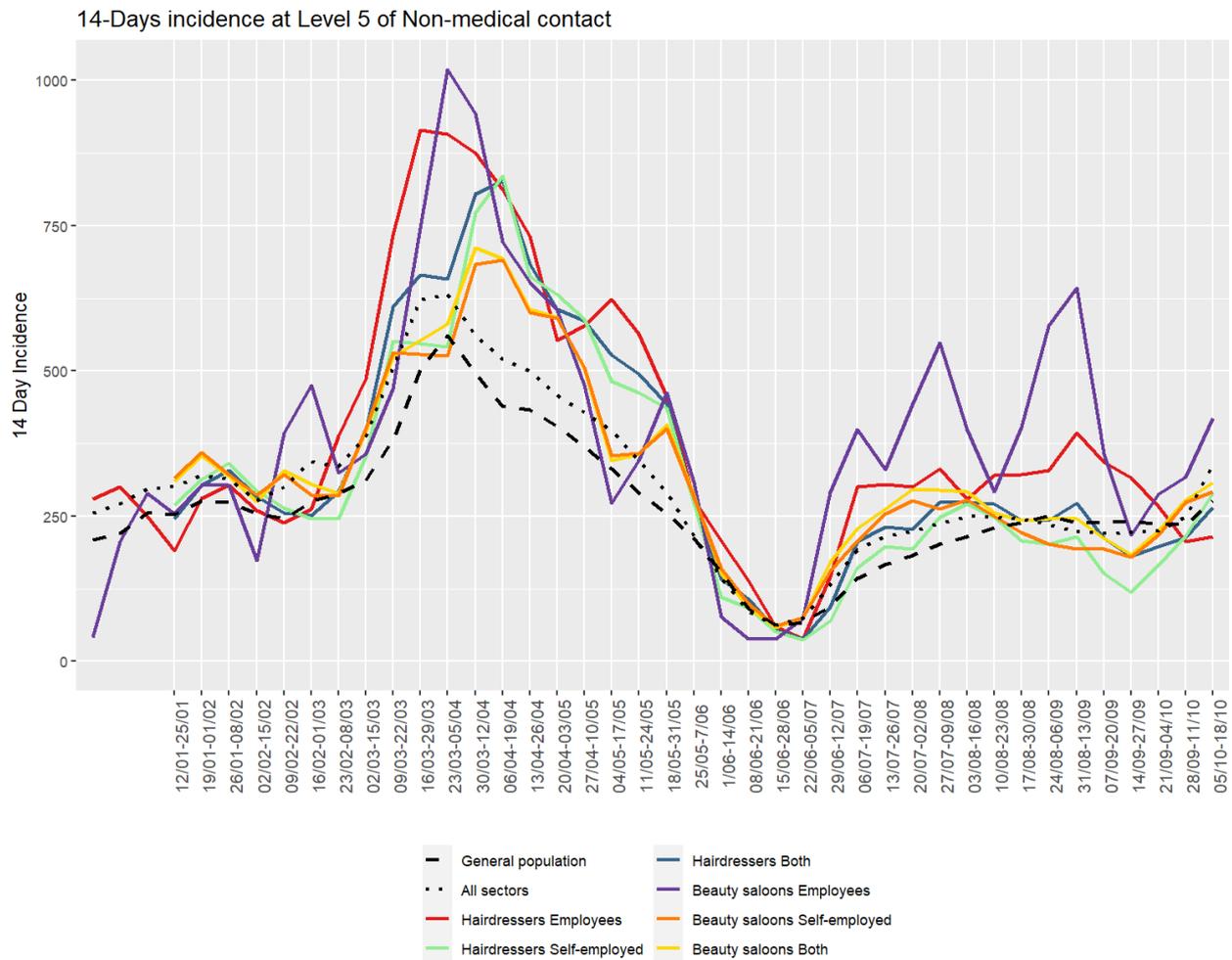


Figure 7: 14-Day incidence of COVID-19 infection at Level 5 of non-medical contact professions.

3.6 Additional analyses

3.6.1 Cross-level overview

When contemplating the 14-day incidences across NACE-BEL sectors, it is possible to gauge the contribution of each sub-level sector to the higher level incidence (Figure 8).

The 14-day incidence in the Education (sector P) is markedly elevated compared to the working and general population, mainly due to Primary and Secondary education (sector 854) (Figure 8).

Also, the incidence in the Human health and social work sector (sector Q) is increased compared to the working and general population average. Elevated incidences are present in almost all subsectors of Human health (sector 86) and Residential care (Sector 87), additional to Child day-care activities (sector 8891)(Figure 8).

Although the 14-day incidence in Public administration and defence (sector O), Arts, entertainment and recreation (sector R) and Other service activities (sector S), around the working population average, individual subsectors show an increased incidence. General public administration (sector 8411), Public order and safety (sector 8424), Youth work associations (sector 94991) and Other associations (sector 94999) show increased incidences compared to the working population.

The incidence in Transportation and storage (sector H) and Accommodation and food service activities (sector I) is significantly below the working population average.

The sectors Manufacturing (sector C) and Wholesale and retail trade (sector G) are sectors with the highest number of sublevels. In all manufacturing sectors the incidence is below or close to the working and population average, except for the Processing and preserving poultry and meat (sector 1011, 1012) and manufacture of kitchen furniture (sector 3102). In all subsectors of Sale of motor vehicles (sector 45) Wholesale (sector 46)

and Retail sale (sector 47), the incidence is similar or below the working population average (Figure 8).

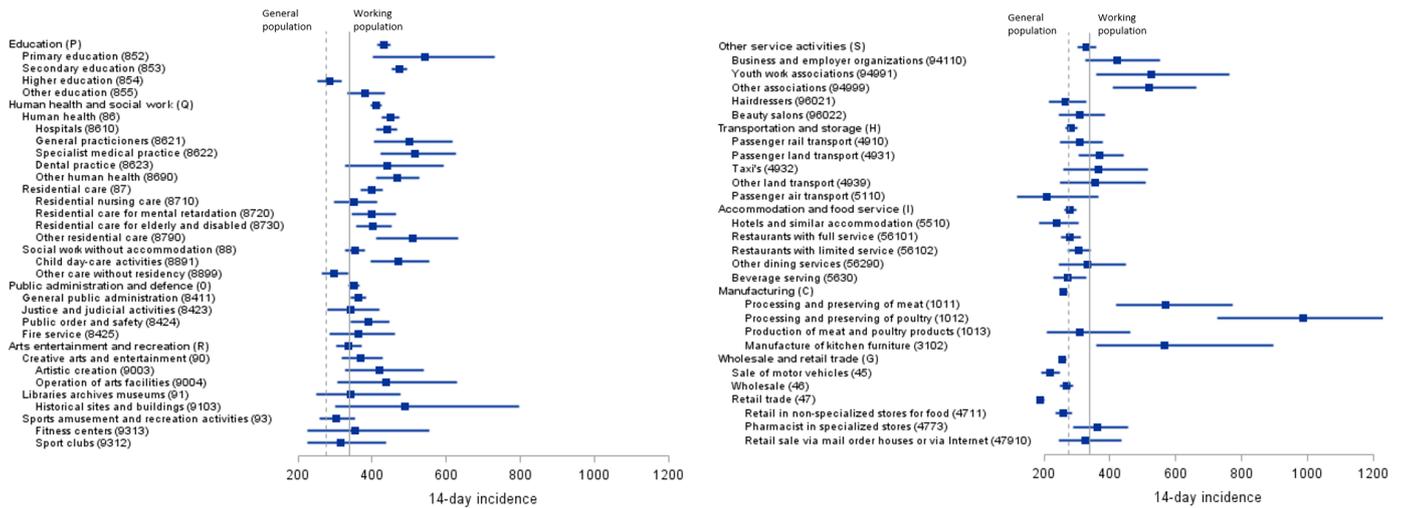


Figure 8: Forest plot of 14-Day incidence and 95% CI of selected sectors on 4 October 2021 in both employees and self-employed.

3.7 Contact tracing

In 2020–2021 about 800,000 employees are under medical surveillance of IDEWE. Among these, 22,120 COVID-19 index cases were registered between 22 July 2020 (week 30) and 14 October 2021, for whom the customer segment, region and the registration date are known for 21,834 index cases.

The 14-day incidence declined in all segments and regions since 11 May 2021 and reached the lowest point on 29 June 2021 of 10 cases per 100,000 employees (Figure 9). Between the third week of July and the end of August incidences stabilized around 28 per 100,000. Since the end of the summer holidays, incidence is rising again to 73 per 100,000 on 12th October. This increase is mostly due the education segment after reopening of schools. The incidence is highest in education (210 per 100,000). The region with the highest incidences are Turnhout (134 cases per 100,000). Note that two factors, mentioned above, may cause bias in the figures: employees of some large companies are not included and beside employees, external persons are also registered as an index case. Especially students and pupils may influence the figures of Education.

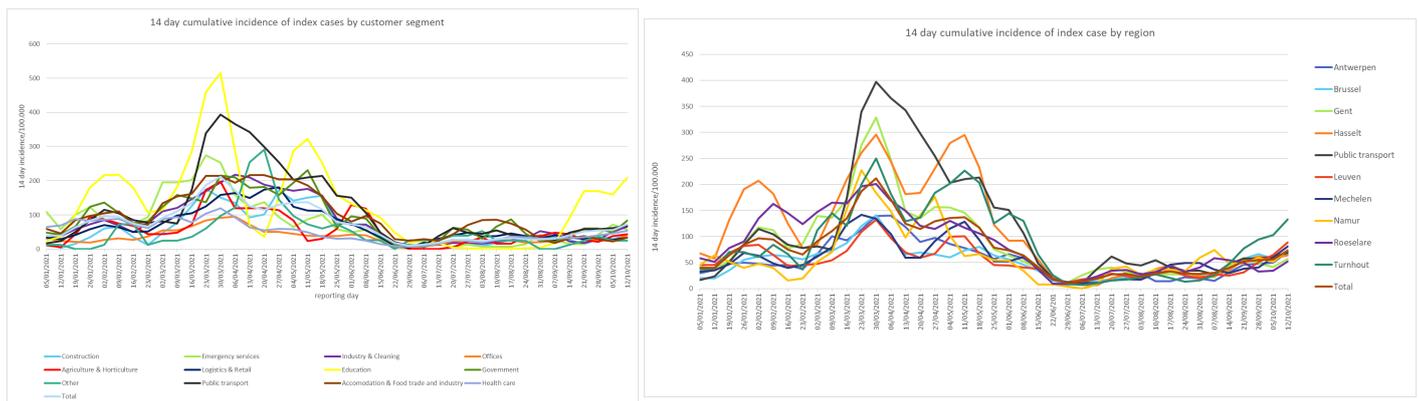


Figure 9: 14-Day incidence of index cases by segments under surveillance (left) and by region (right)

Since the establishment of the tracing app on 29 October 2020, there are 16,051 index cases of whom high-risk contacts were recorded. Of 15,921 index cases, the customer segment and region is known. The mean number of high-risk contacts in segment Education, Emergency services and Public Transport is above 1, while in the Hasselt region a higher mean number of high-risk contacts is reported in the period 29 October 2020–14 October 2021 (Figures 10).

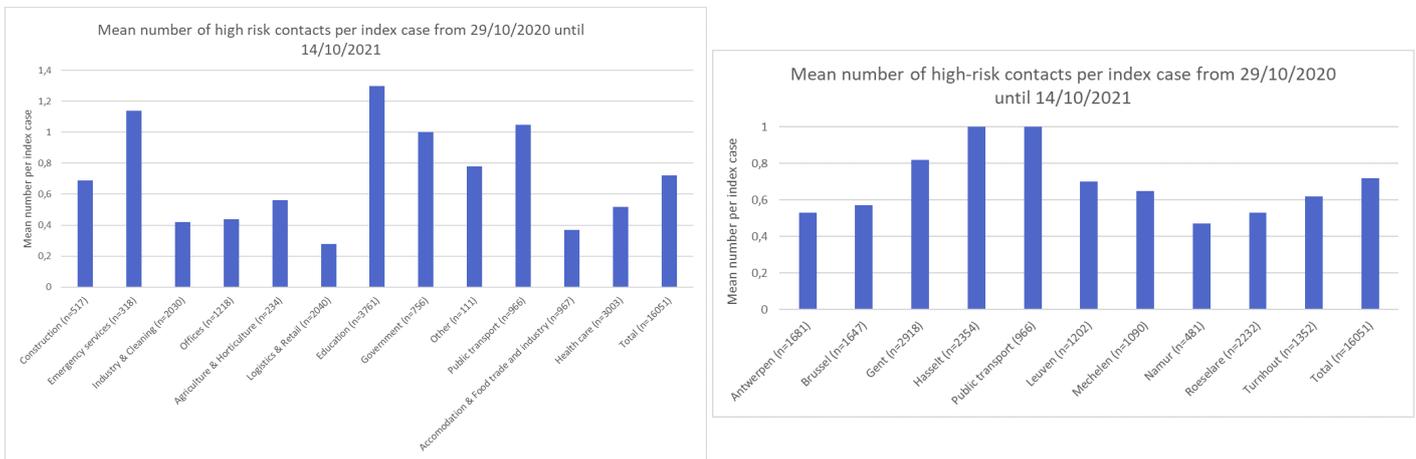


Figure 10: The mean number of high-risk contacts per index case by segments under surveillance (left) and by region (right)

The number of high-risk contacts per index case varies from 0 to 62, with more than 99% being lower than 10 high-risk contacts. Seventy-two percent had 0 high risk contacts. A sole high number of high-risk contact for an index will influence the mean number for a segment importantly, especially when groups are small. To avoid extremely high numbers of contacts influencing results, we report the percentage of index cases who had two or more high-risk contacts per four weeks.

The percentage of index cases with two or more high-risk contacts is increasing in all segments and in all regions in the most recent period (29 September– 14 October 2021), reflecting the changed behavior on the work floor, after alleviation of mitigation measures (Figure 11).

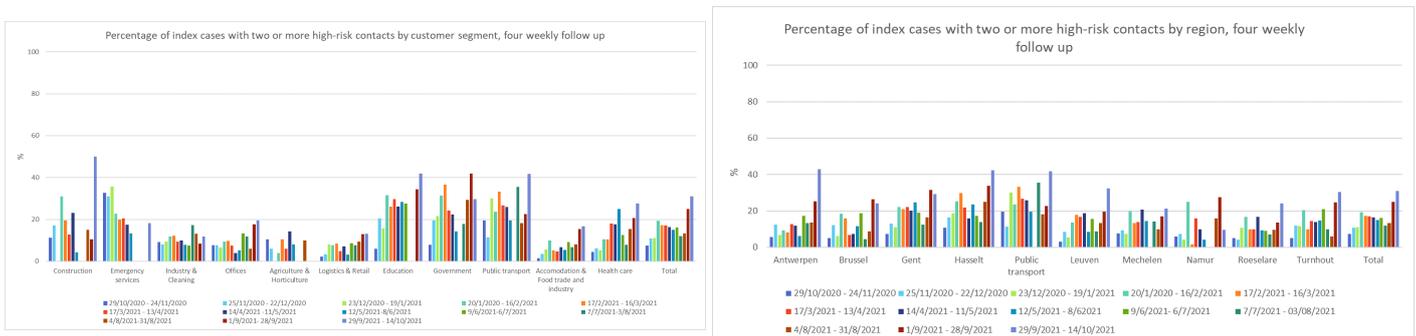


Figure 11: Four weekly percentage of index cases with two or more high-risk contacts by segments under surveillance (left) and by region (right)

Since 11 March 2021, index cases are asked if they contracted COVID-19 during work and if they did, which were the circumstances or the source of the infection. Note that pupils and other external index cases were left out of the following analyses.

From 7,430 index cases, we have information about perceived work relatedness of the source of infection. While 39% of the index cases does not know whether the infection took place at work, 20% responded that they were certainly or probably infected at work (Figure 12 left). From 2,304 (31%) of the index cases that answered they were certainly, probably, or possibly infected at work, further information was obtained on how the infection took place (Figure 12 right). A majority of the index cases (62%) indicates to know the source of infection at work.

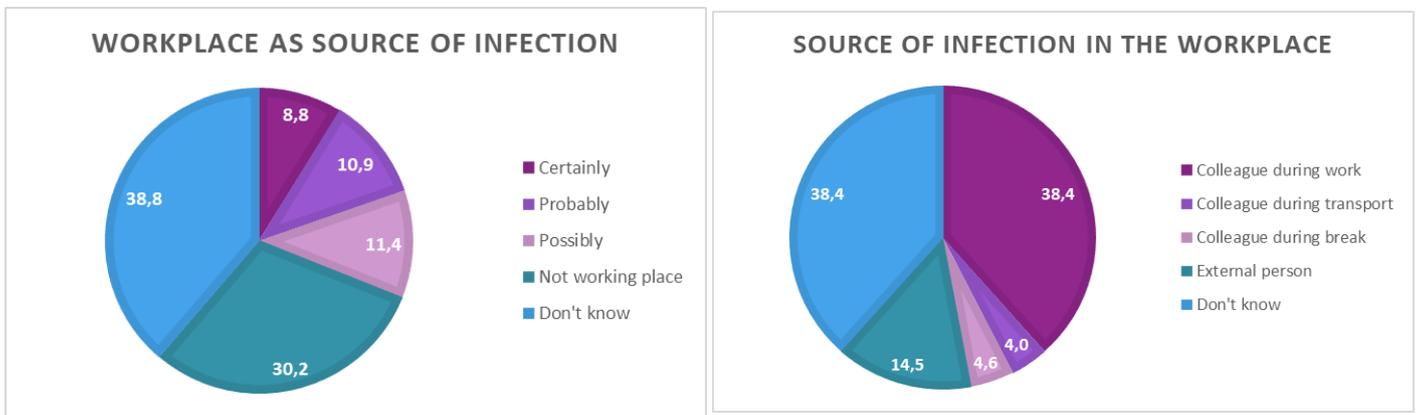


Figure 12: Distribution of the probability and source of infection at work by index case

After the decline to zero of the pupil index cases in education during the summer holidays 2021, there is again around 40% of the cases in the education segment attributable to pupils since the reopening of primary and secondary education on September 1st (Figure 13 left). The interpretation of these data should be undertaken, however, with caution. Index cases in schools, both pupils and teachers, are reported to IDEWE by CLBs and schools in order to reach high-risk contacts among teachers and provide them with prescriptions for PCR tests and quarantine. The working method is, however, not the same for all CLBs and schools and therefore notification of index cases may differ between CLBs and regions. Moreover, index cases with only low risk contacts are often not reported to our service, because they do not need prescriptions for tests or quarantine. This might lead to an underestimation of index cases among pupils and teachers. Note that pupils are tested on a larger scale since January 2021.

Since the tracing app came in use, the social security number of most index cases is registered. Age is calculated from the social security number and is available for most index cases. In contrast to the previous school year 2020, the majority of the index cases (77%) in school year 2021 is aged under 12 years (and unvaccinated) (Figure 13 right). Note that some type of schools might be over- or underrepresented in comparison to the Belgian school landscape, as a result of which the proportion of age groups might not be representative for the Belgian school population. Before 20 January 2021, biweekly numbers of cases are too small to allow for an interpretation, as well as the period 31 March–13 April 2021 and 9 June–6 July 2021.

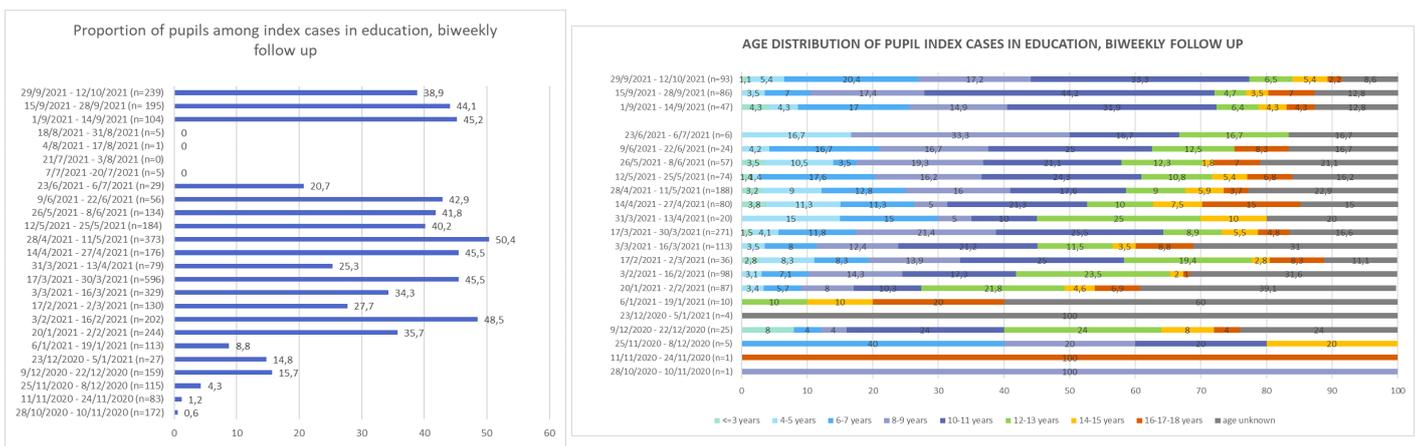


Figure 13: The evolution of index cases of pupils in school (left) and their age distribution (right).

Since 7 June 2021, the vaccination status of index cases is registered, with the type of vaccine if applicable. The vaccination dates are retrieved from vaccinet to evaluate if a person can be considered fully protected. Because only the date of the notification of the index case is available and not the date of a positive PCR test, index cases are considered fully protected if the second dose (or the only dose in case of the Johnson and Johnson vaccine) is administered 3 weeks or more before the date of notification. The assumption is made that the latency between a positive PCR test and the registration via de contact tracing app is maximally 1 week.

From 2,256 adult index cases we had information about their vaccination status: 1,520 were partially or completely vaccinated (1,020 Cominarty, 306 Vaxzevria, 94 Moderna and 100 Johnson % Johnson) (Figure 14

left). With a vaccination coverage in the working population of 85% since September 2021 (Figure 14 right, data derived from Sciensano), it is important to evaluate these breakthrough index cases. The mean time between notification of infection and the second vaccine dose (or the only dose in case of Johnson & Johnson) for the breakthrough cases was 97.7 days (SD 52), minimum 15 days, maximum 242 days.

Vaccination coverage of the population changed rapidly from June until September and is reaching a plateau since that time. The amount of index cases who received only one dose or who became infected within 15 days after their last vaccination dose made up the majority of vaccinated cases until August 2021 and drops to 1% in October 2021. As a consequence most vaccinated index cases are expected to be fully protected (Figure 15 left). The vaccine effectiveness (VE) in fully vaccinated and protected workers is estimated using the screening method (see Giesecke: Modern infectious disease epidemiology):

$$\begin{aligned}
 VE &= \frac{(PPV - PCV)}{(PPV(1 - PCV))} \\
 &= \frac{0,84 - 0,81}{0,84(1 - 0,81)} \\
 &= 0,19
 \end{aligned}$$

with PPV= the proportion of the entire population vaccinated and PCV= the proportion of cases that has been vaccinated.

Note that this result and the seemingly declining biweekly evolution (Figure 15 right) of the vaccine effectiveness, suggesting insufficient or waning protection, should be interpreted with caution. First, it concerns effectiveness in symptomatic as well as asymptomatic SARS-CoV-2 infection, while vaccine efficacy studies focused on protection against symptomatic disease, more specifically severe disease, hospitalization and death. It is crucial to monitor the vaccine effectiveness against severe disease, which may be different from effectiveness to infection. Secondly, the screening method assumes that vaccinated and unvaccinated individuals are equally exposed to infection, while social contact data indicates that vaccinated individuals have more close contacts and attend in more social activities than unvaccinated individuals. Also, employees in sectors with frequent close contacts with potentially infected individuals, like health care and education, have a high vaccination coverage, but also a higher risk of being exposed the infection. Hence, the exposure to infection may be different between vaccinated and unvaccinated individuals, affecting the screening method estimation of VE. Finally, an unvaccinated individual is not necessarily unprotected against infection. It is plausible that a proportion of the unvaccinated employees were previously infected and at least temporarily protected against the infection. This would also affect the effectiveness estimate.

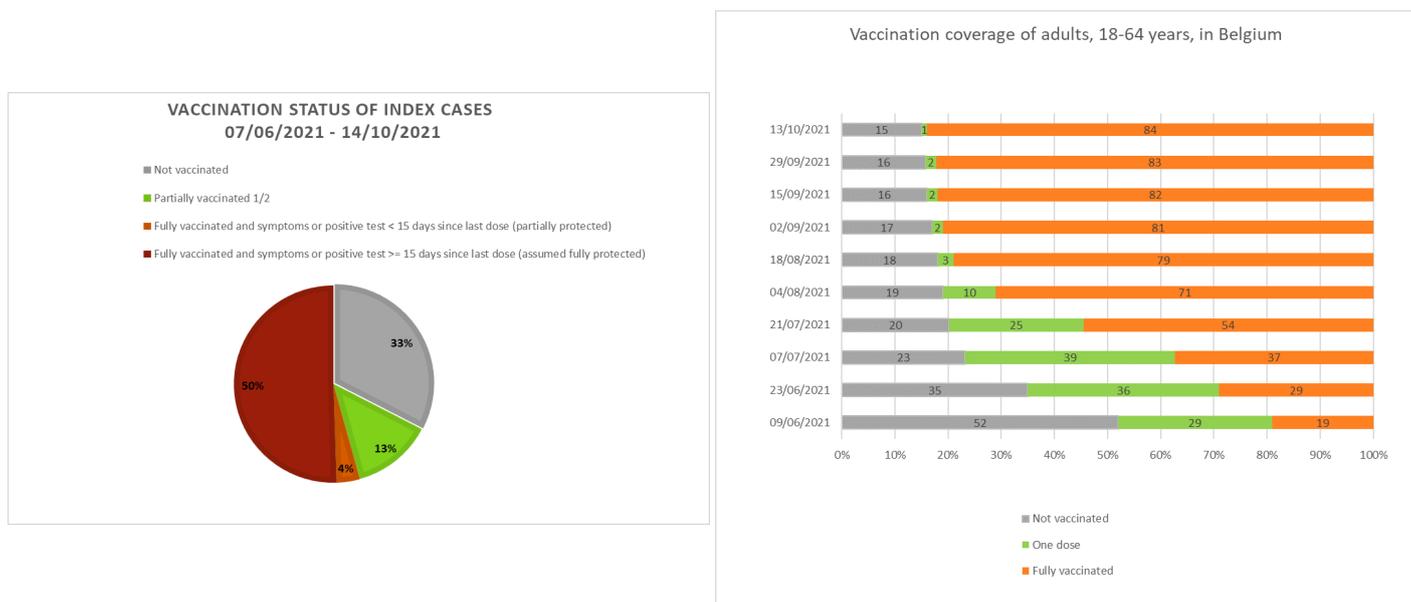


Figure 14: Distribution of the probability of vaccination in the general population (right) and the vaccination status of index cases (left).

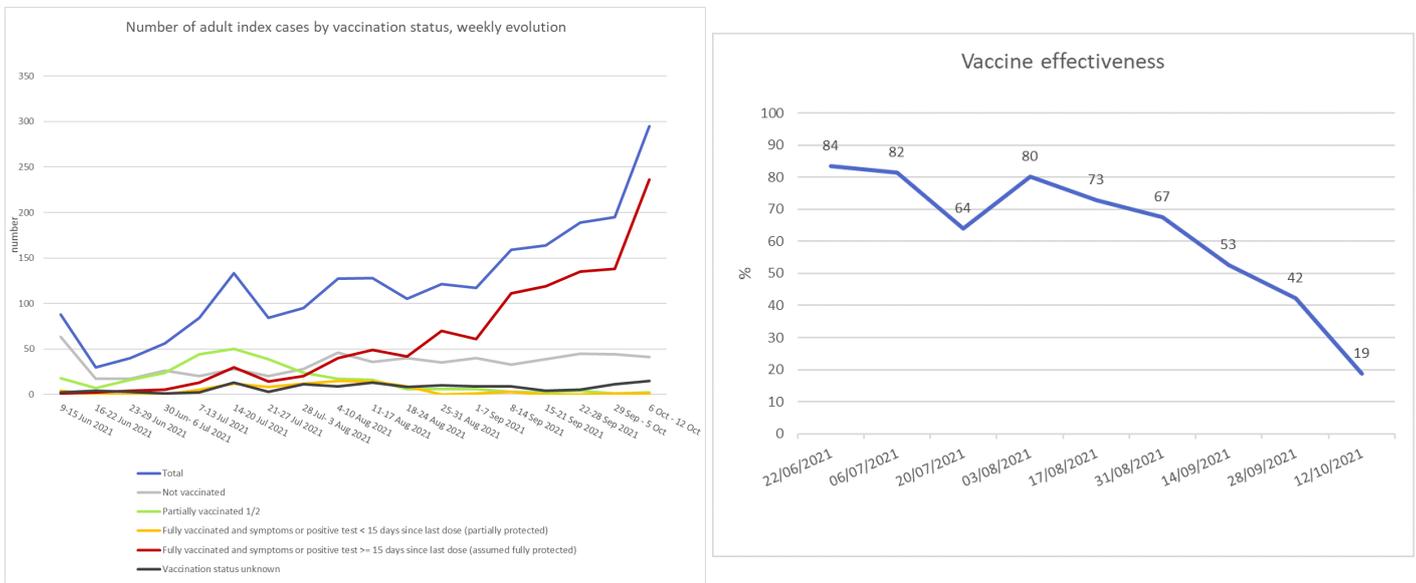


Figure 15: The weekly evolution of index cases and their vaccination status (left) and the vaccine effectiveness (right).

4 Conclusion

Despite the limitations of the data, both the contact tracing as the RSZ/ONSS data demonstrates a rapid increase of the 14-day COVID-19 incidences in the last week in most sectors, with the highest incidences in education, health care and residential care. As a result of the increase in these large sectors, the incidence in the general population is again below the incidence in the working population, despite a large proportion of incidences in the general population is coming from children. Vigilance is required in sectors with close contact to young children, and in those sectors where workers are exposed to high-risk close physical proximity, and where climate conditions are difficult to control.

Although no conclusions can be drawn regarding the location of infection (workplace or elsewhere) nor the location of employment (at work, telework, or temporarily unemployed) of the employees in the RSZ/ONSS data, the contact tracing in the segments under surveillance by IDEWE shows that in the index cases, where this information was available, 9% indicated that the workplace was certainly the source of infection.

It is clear that in most sectors at level 1 the 14-day incidence follows the sharply increasing pattern that is observed in the working population. The contact tracing shows a larger increase in incidences in the education segment since the start of the school year, likely due to the presence of cases in children in the contact tracing, while the RSZ data concerns only employees.

It has been observed since the beginning of the pandemic that the climate and other conditions in the food processing industry is ideal for the transmission of SARS-CoV-2. The past 2 weeks, the 14-day incidences in the processing and preserving of poultry and meat industry were increased compared to the working population average. This sector, therefore, continues to need careful attention.

With an increased circulation of the delta variant of concern of SARS-CoV-2, it is important to carefully monitor incidence of COVID-19 in the sectors with high-risk, multiple close physical proximity, especially with younger, not yet vaccinated individuals. Youth work associations, Other associations, Primary and secondary education, Nurseries and crèches, Health care and Residential care sectors, all show higher incidences and require careful attention. Especially in the context of increased high-risk contacts, as shown by the contact tracing.

In sectors with multiple close physical proximity under increasing circulation of SARS-CoC-2 it may be worthwhile to re-evaluate hygiene protocols, as incidences are increased compared to the working population average in Public order and safety and General public administration. Although not yet increased compared to the working population, incidences in Create arts and entertainment are clearly high, suggesting careful

consideration of current protocols in this sector.

It is encouraging to note that employees in most manufacturing, retail and wholesale sectors are well protected, as they are often not able to telework. Also, the hygiene protocols in sports, amusement and recreation (sector R) and accomodation and food service (sector I) seem to protect employees sufficiently under current increased circulation of SARS-CoV-2.

Finally, despite the high degree of vaccination, COVID-19 infection remains possible. Contact tracing data show that half (50%) of employees with a positive PCR-test were fully vaccinated. The vaccine effectiveness against infection (19% in the IDEWE contact tracing data) seems much lower than the expected protection against infection 6 months after vaccination. But vaccinated individuals may behave differently than unvaccinated individuals and/or unvaccinated people may be temporarily protected due to a previous infection. Continuous monitoring of breakthrough infections and especially protection against hospitalization is warranted.

Acknowledgments

We wish to thank Hilde Vanacker, Chris Verbeek and Hilde de Raeve for their contribution to the analysis of the contact tracing data.