The Second Wave of Covid-19 in Bielefeld: 2020-09-05 to 2021-03-06

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Bielefeld is a city of (officially) 338,980 inhabitants in northern Germany, two-thirds of the way from Cologne in the West to Hannover, the mid-point of the east-west railway between Berlin and Cologne, where the north-south railway between Hamburg and mid-/southern-German cities crosses the east-west line. The Cologne-Berlin railway traverses a pass in Bielefeld on the long Teutoburg Wood ridgeline, which extends from the Dutch border near Rheine over some 110 km south-eastwards to Bielefeld, rising as it goes to some 300 m a.s.l. near Bielefeld (118 m) then continuing to rise south-east beyond Bielefeld for another almost 50km to the highest point, Velmerstot, between 440 and 468 m a.s.l., some 200-230 m above the valley below. The wide and flat pass is the likely reason why Bielefeld is here. The pass is dominated on its eastern flank by the imposing Sparrenburg castle, below which sits the old city.

Bielefeld has a densely-built central part containing about half the population. The other half of the population is dispersed around what using to be neighbouring towns and villages, up to 10-15 km away, but which are now incorporated into the city. There is quite a lot of green space and farmland in between the outlying population concentrations. Bielefeld is said to be the nineteenth-largest German city. It lies near the eastern edge of the region of Westphalia ("Westfalen") in the state of North-Rhine Westphalia (NRW, "Nord-Rhein-Westfalen"), and just north of the Duchy of Lippe, which stayed independent of the Prussians under its own Dukes. The surrounding region is known as Ostwestfalen-Lippe.

This note discusses infections and hospitalisations in Bielefeld (BI) from early September 2020, when the city began publishing daily new infections on its WWW site. In October 2020, it became clear that there was a second wave of infection, and that it was increasing rapidly. Before that time, I had not kept track of daily figures.

A "lockdown light" in response to this second wave was implemented nationwide in Germany on Monday 2020-11-02. There is a "Corona Protection Regulation" (CoronaschutzVO) in each state of the German Federation, which is time limited (typically for a month to six weeks in the future). There are video meetings between Chancellor Merkel and the Minister-Presidents of the individual states at which they attempt to reach a consensus on what shall be in the next CoronaschutzVO. The States each determine what their health measures should be; this is state-level lawmaking, not federal-level. The Federation, represented by Chancellor Merkel), has here an advisory role only. At each meeting, there has been a serious and often difficult attempt to reach consensus, and it seems some states always decide to do things a little differently from others. The new state regulations appear a few days after the meeting, and take effect a few days after that, when the previous regulation runs out.

The new infections per day since March, when infections began in Bielefeld, may be found for readers of German at https://www.bielefeld.de/de/covi/ . There are daily reports containing specific data, from which the figures below are taken.

New daily infections have been regularly published from 2020-09-05 onwards. Hospitalisation/ICU patient numbers have been reported daily from 2020-10-20 onwards. “New infections” are reported in paperwork originated in Bielefeld and forwarded to the NRW state health ministry, which forwards them in turn to the Robert Koch Institute, the federal public health institute, which collates them and reflects them back, nominally on a daily basis, and then Bielefeld city publishes them on its WWW site. As we shall see, there were some significant discrepancies in late December to early January, as there was a lag in preparing the paperwork (which includes far more information than just “how many new infections were registered” and thus takes time to prepare). This had political repercussions, engendering travel restrictions which the Bielefeld mayor then had to argue the NRW Health Ministry out of, on the basis that the “official” figures were not real.

The odd part about this to me is the kerfuffle this caused locally. The local Neue Westfalische newspaper (NW) had a full page of readers' letters commenting on the situation, and there were calls for the city Crisis Team Leader to resign. At the same time, what some of us consider to be a far greater problem, namely a lack of vaccination, was going almost unremarked. The city had prepared a vaccination centre in the city exhibition hall , ready to dispense up to 2,000 injections per day, by mid-December 2020. But there weren't any vaccines, other than for the small mobile vaccination teams which had started visiting care homes and old people's homes. The general population has had to wait until February 8th, 2021 for vaccinations to begin for those over 80 years of age in the vaccination centre. Throughout February, the slow pace of vaccination finally became a pressing theme.

The second wave of Covid-19 in Bielefeld started most obviously in the fourth week of September (after 2020-09-22). There had been a superspreader event on 2020-09-15, a family party, which ended up secondarily-infecting some 70 people or so and causing the closure or partial closure of 11 Bielefeld schools. The influence of that event on the new-infection statistics becomes apparent in the figures from 2020-09-26 onwards, ending on 2020-10-04. That influence was manifest starting 11 days after the event (although of course some infections occurred in connection with the event before that) and persisting for about a week.

I thought this time lag an important datum at the time, qualified by the tortuous route taken by the numbers, described above. However, shortly after this superspreader blip, the second wave began in earnest and the identification-test-trace-isolate approach to individual events lost its previous effectiveness. Infections were coming from all points of the compass, not necessarily identifiably careless gatherings or returning travellers. ID was shot. Test&trace procedures continued to work, but under considerable stress. Further help was offered by the army. I understand we had some 80 people working on it at the peak, but cannot source this figure at present.

There is an unusually large figure on 2020-11-04. An explanation could be the following. The previous week, the Chancellor and state Minister-Presidents had had their usual meeting, decided on and announced the stringent “lockdown-light” measures starting Monday, November 2nd. People may have exploited the last few days of comparative laxity, leading to higher new-infection figures after the incubation period. Since by this point the main transmission is “community

transmission" rather than secondary infections stemming from a superspreader event, the blip manifests itself corresponding to the average incubation time, rather than over a longer chain of infections as noted above from the September 15th superspreader event. (The sudden reduction on 2020-11-11 in the new infections per 100,000 residents in the last 7 days, denoted forthwith as ni10^{5}r7d, results from the very high figure of new infections on 2020-11-04 dropping out of the average.)

On 2020-11-10, the local Neue Westfalische newspaper (NW) summarised the developments of the previous few weeks in a short article. In early October, Bielefeld was worried about reaching the trigger-number of 35 ni10^{5}r7d. We reached that figure, which triggered legal restrictions, on 2020-10-15. The day afterwards, we reached the second trigger-number of 50 ni10^{5}r7d, which triggered even more restrictions. Then the numbers just "blew up". It was not an encouraging time.

The city began publishing the hospitalisation figures from 2020-10-20. Those figures did not necessarily track the new-infection figures. From general experience with the progression of the disease (see *Peter Bernard Ladkin, A Rough Timeline of Key Points in Covid-19 Progression, preprint 2021-01-08*) one would expect them to be five days to a week behind, but in fact they stayed relatively constrained in November, even as the number of infections climbed. That suggests one of two things, or both. Either (a) the burden of new infections was shifting to classes of people less likely to suffer severely; or (b) more people were being tested and identified as positive. I am guessing that both played a role. The predominance of infection shifted to under-30's, and at the same time tests became more easy to obtain, so more asymptomatic or paucisymptomatic people were being identified than before.

I also introduce my own measure of the progress of infections. From the new-infection figures, I calculate what I call the 7-day-modified-incidence (7dmi) as follows. For each day, I take the new infections over each of the previous 7 days, remove the highest daily value and the lowest daily value, and average the five remaining values, giving the resulting number to one decimal place. This is a trivial technique to smooth outliers in the daily numbers. Outliers occur when accounting adjustments are made, or when reporting is delayed, or when reporting catches up. For example, weekends regularly cause blips in the figures, lower on Saturdays and Sundays and correspondingly higher at the beginning of the week (this can also be seen the national figures). I think the smoothing effect is clear in the 7dmi figures. I start the 7dmi calculation on 11 September.

The reported ni10^{5}r7d figure is taken directly from the BI-WWW site. I have not checked the figures for this period. I start to calculate my own estimate in the New Year, when the city started to report difficulties with the numbers.

Figures from 2020-09-05 to 2020-12-01

The new infection measures show an unceasing rise. It continues to a high point of over 100 7dmi on 2020-11-27 to 2020-11-30. (It will reduce somewhat, but then rise to over 100 7dmi again during 2020-12-17 to 2020-12-21, in the next group of figures).

Date	BI-ni10^{5}r7d	new inf's	7dmi
2020-09-05	8.1	0	
2020-09-06	8.7	5	
2020-09-07	8.7	0	
2020-09-08	8.7	7	
2020-09-09	6.9	1	
2020-09-10	7.8	5	
2020-09-11	7.2	5	3.2
2020-09-12	8.7	6	4.4
2020-09-13	10.5	11	4.8
2020-09-14	10.5	0	4.8
2020-09-15	9.3	3	4.0
2020-09-16	10.8	6	5.0
2020-09-17	10.2	3	4.6
2020-09-18	9.6	3	4.2
2020-09-19	9.3	5	4.0
2020-09-20	8.1	7	4.0
2020-09-21	8.1	0	4.0
2020-09-22	7.2	0	3.4
2020-09-23	6.3	3	2.8
2020-09-24	8.1	9	3.6
2020-09-25	8.7	5	4.0
2020-09-26	12.9	19	4.8
2020-09-27	16.8	20	7.2
2020-09-28	16.8	0	7.2
2020-09-29	22.5	19	11.0
2020-09-30	27.6	20	14.4
2020-10-01	30.6	19	16.4
2020-10-02	33.9	16	18.6
2020-10-03	30.9	9	16.6
2020-10-04	28.8	13	15.2
2020-10-05	28.8	0	15.2
2020-10-06	24.3	4	12.2
2020-10-07	21.3	10	10.4
2020-10-08	20.6	17	10.4
2020-10-09	20.9	17	10.6
2020-10-10	23.9	19	12.2
2020-10-11	24.8	16	12.8
2020-10-12	24.8	0	12.8
2020-10-13	30.2	24	15.8
2020-10-14	34.1	23	18.4
2020-10-15	43.7	49	19.8

2020-10-16	51,5	43	25.0
2020-10-17	50.0	17	24.6
2020-10-18	56.6	35	28.4
2020-10-19	58.3	6	28.4
2020-10-20	61.6	33	30.2
2020-10-21	65.5	40	33.6
2020-10-22	63.7	46	33.6
2020-10-23	73.9	71	34.2
2020-10-24	90.1	71	45.0
2020-10-25	99.0	68	51.6
2020-10-26	103.8	36	52.2
2020-10-27	109.5	35	52.2
2020-10-28	114.3	56	55.4
2020-10-29	120.3	66	59.4
2020-10-30	129.6	100	59.4
2020-10-31	131.1	77	60.6
2020-11-01	130.2	65	60.0
2020-11-02	131.1	39	60.6
2020-11-03	141.2	69	66.6
2020-11-04	163.1	129	75.4
2020-11-05	164.3	68	75.8
2020-11-06	163.7	100	75.8
2020-11-07	166.1	85	77.4
2020-11-08	167.0	68	78.0
2020-11-09	175.1	66	78.0
2020-11-10	178.6	81	80.4
2020-11-11	163.4	77	75.8
2020-11-12	170.3	91	80.4
2020-11-13	172.7	108	80.4
2020-11-14	176.5	99	83.2
2020-11-15	177.7	72	84.0
2020-11-16	175.3	58	84.0
2020-11-17	162.5	38	79.4
2020-11-18	166.4	91	82.2
2020-11-19	164.6	83	80.6
2020-11-20	162.8	103	80.6
2020-11-21	175.6	140	81.4
2020-11-22	172.1	61	79.2
2020-11-23	173.0	61	79.8
2020-11-24	199.0	125	92.6
2020-11-25	195.4	80	90.4
2020-11-26	209.2	128	99.4
2020-11-27	221.4	143	106.8
2020-11-28	211.6	108	100.4

2020-11-29	211.6	68	101.8
2020-11-30	204,1	35	101.8
2020-12-01	181.6	50	86.8

People credited the “lockdown light” measures of November with dampening the growth of new infections. That might be seen in the period from 2020-11-12 to 2020-11-23 in the 7dmi figures. But then they shoot up again from ~80 to a new plateau 25% higher at ~100 three days later on 2020-11-26.

I pause the numbers here, because the subsequent numbers incorporated an administrative peculiarity. The city administration had difficulties with reporting numbers over the Christmas-New Year's holiday season, which had some political consequences. There arose a reporting backlog over the Christmas-New-Year's break. So there was a burst of reporting in early January as the backlog was being reduced. The real numbers were then considerably lower than the reported numbers. As noted in a little more detail below, the city had to negotiate with the NRW Ministry of Health to avoid travel restrictions, which would have been imposed based on reported numbers. It seems to have taken up to January 26 to recover the nowcast.

Official Figures from 2020-12-01 to 2021-01-12

The numbers developed “officially” as follows from early December through the 7dmi high points in mid December up to mid-January. The reporting procedures are as follows. Numbers are reported by BI city (with extensive additional paperwork per subject) to the NRW state health ministry, are then forwarded to the Robert Koch Institute (RKI), the federal public-health agency, and the RKI reports the numbers in two ways, actual date and date of report. These numbers are reflected back from RKI to BI city. The figures directly below reflect what is recorded at the end of this chain.

BI city had been saying through early January that the numbers published do not reflect the actuality of local infections. The line I draw between 5th January and 6th January indicates the point at which the local NW newspaper started reporting not only the “official” numbers reflected through the RKI but also alternative numbers, derived directly from the Bielefeld health authority, for “new” infections. The new-infection figures for 2021-01-05 to 2021-01-08 clearly show the effect of the backlog being recorded.

I shall consider the alternative “real” numbers below.

Date	ni10^{5}r7d	new inf's	7dmi
2020-12-01	181.6	50	86.8
2020-12-02	190.9	111	93.0
2020-12-03	190.9	127	92.8
2020-12-04	181.9	116	90.6
2020-12-05	178.9	98	88.6
2020-12-06	188,5	95	94.0
2020-12-07	196.6	62	96.4
2020-12-08	204.7	78	99.6

2020-12-09	193.3	73	92.0
2020-12-10	180.7	89	86.6
2020-12-11	179.8	112	86.6
2020-12-12	184.3	114	89.4
2020-12-13	179.2	77	85.6
2020-12-14	176.5	53	85.8
2020-12-15	187.3	111	93.2
2020-12-16	194.8	100	97.8
2020-12-17	205.3	119	102.8
2020-12-18	202.0	101	100.6
2020-12-19	202.6	118	101.4
2020-12-20	201.4	74	100.8
2020-12-21	206.5	67	100.8
2020-12-22	195.4	73	93.2
2020-12-23	190.0	82	89.6
2020-12-24	193.9	130	89.6
2020-12-25	181.3	61	82.8
2020-12-26	159.2	43	71.4
2020-12-27	148.1	37	65.2
2020-12-28	143.6	52	62.2
2020-12-29	148.4	91	65.8
2020-12-30	143.3	65	62.4
2020-12-31	129.6	84	61.0
2021-01-01	120.0	---	61.0
2021-01-02	107.1	29	59.5
2021-01-03	102.3	21	57.5
2021-01-04	91.6	17	49.8
2021-01-05	87.1	75	47.5

2021-01-06	99.6	106	52.3
2021-01-07	119.4	150	57.8
2021-01-08	175.9	219	76.2
2021-01-09	204.1	94	89.2
2021-01-10	207.1	32	91.4
2021-01-11	211.6	32	91.4
2021-01-12	238.8	168	110.0

On 2021-01-13, in an article by Susanne Lahr, the NW reported that the BI administration was working through a backlog of case paperwork from the Christmas-New Year break and that the official figures from RKI (in the list above) did not reflect the reality of new infections in BI. The NW newspaper had in fact been saying that for some days, without saying what the “real” numbers “should” be. The article by Lahr gave those “real” numbers, dating back to 6th January. I drew the line, above, at 2021-01-05.

The figures January 6th – January 12th are given by Lahr's article as 151, 110, 96, 91, 10, 35, 66. However, these are not always identical with the figures coming from the modified daily reports from the Stadt BI at https://www.bielefeld.de/de/covi/ .

BI published figures from January 13 until January 20 distinguished between the "real" new infections in the previous days, and the "official" figure which includes the backlog. I call the "real" number ni1d (for "new infections in 1 day"). BI is at this time also reporting the last-7-days actual figure, which I call ni7d, as well as the "real" ni10^{5}r7d figure. The ni10^{5}r7d figure is obtained by dividing ni7d by 3.34, since Bielefeld has about 334,000 residents. I take the ni1d figures for the last seven days to calculate 7dmi.

Even though I work with the BI-given ni1d, the reader will notice that my arithmetic differs from that given by BI for both ni7d and ni10^{5}r7d on many days up to January 25. I have no explanation for this, except to suggest that my arithmetic appears to be better than theirs. The figures annotated with an asterisk (*) are clarified in the following notes.

Date	BI-ni10^{5}r7d	PBL-ni10^{5}r7d	ni1d	BI-ni7d	PBL-ni7d	7dmi
2021-01-06			151			
2021-01-07			110			
2021-01-08			96			
2021-01-09			94*			
2021-01-10			32*			
2021-01-11			32*			
2021-01-12	209.0*	164.7	35*	698*	550	73.4
2021-01-13	167.4*	139.2	66	559*	465	64.6
2021-01-14	147.6*	133.5	91	493*	446	63.6
2021-01-15	138.3*	124.3	65	462*	415	57.8
2021-01-16	129.9*	115.0	63	434*	384	52.5
2021-01-17	129.0*	107.5	7	431*	359	52.2
2021-01-18	123.3	102.7	16	412*	343	49.0
2021-01-19	130.9	119.5	91	437*	399	60.2
2021-01-20	128.5	128.4	96	429	429	65.2
2021-01-21	116.2	115.3	47	388	385	56.4
2021-01-22	113.8	113.8	60	380	380	55.4
2021-01-23	118.0	113.8	63	394	380	55.4
2021-01-24	126.1	128.1	55	421	428	63.2
2021-01-25	125.5	127.5	14	419	426	63.2
2021-01-26	111.7	112.3	40	373	375	53.0
2021-01-27	103.1	103.0	65	344	344	53.0
2021-01-28	103.7	103.6	49	346	346	53.4
2021-01-29	96.8	96.7	37	323	323	48.8
2021-01-30	84.2	84.1	21	281	281	40.4
2021-01-31	72.8	72.8	17	243	243	32.8

* Notes:
    - On January 9 – 12, the revised ni1d on the BI WWW site is slightly different from that given by Lahr. January 6 – 8 here are from Lahr; January 9 – 11 are the BI-site figures.
    - The ni1d figure for January 12 is taken from a quote from the BI Crisis Team leader in the NW newspaper, who distinguished between the "official" figure of 168, which includes a number of cases from the holiday-season backlog, and the 35 new infections reported.
    - On January 13-15, two figures are given on the BI site: the "official" figure and ni1d. The site also reports ni7d, but none of the figures corresponds with the equivalent sum of seven ni1d figures.

Notice these figures give radically different values on 2021-01-12 to those coming from the "official" RKI-reflected figures given earlier. There was a political consequence, as noted above. The state NRW had passed a law which says that travel from districts exhibiting a ni10^{5}r7d of greater than 200 must impose a travel restriction of not more than 15 km from the city/town boundary on its residents. BI was explicitly in that class, according to the "official" figures reflected back from RKI. Our BI mayor argued with the state government that in fact the "official" numbers were misleading, reflecting the backlog of paperwork that was being worked through. I presume he gave the NRW government the numbers just above. The residential travel restriction was lifted.

The Bielefeld numbers seem to be back on arithmetic track as of January 26th apart from a slight discrepancy on that day (in Notes Part 22, I counted the ni7d at 375 for that date, and the BI official figures are 373).

Figures from 2021-02-01 to 2021-03-06

I report these figures in two halves, since as of 2021-02-20 the reporting mode changes. Up until 2021-02-19, BI was reporting its own figures as of 16.00 on the current day. From 2021-02-20, the BI WWW site started reporting figures that RKI had established for BI up to midnight of the previous day. The change in reporting seems to have perturbed the arithmetic again, as we shall see.

Date	ni10^{5}r7d	ni1d	ni7d	7dmi
2021-02-01	71.8	11	240	32.8
2021-02-02	74.8	50	250	34.8
2021-02-03	62.8	25	210	29.8
2021-02-04	57.2	30	191	26.0
2021-02-05	53.9	26	180	23.8
2021-02-06	53.6	20	179	23.6
2021-02-07*	49.4	3	165	22.4
2021-02-08*	47.6	5	159	21.2
2021-02-09*	35.6	10	119	17.2
2021-02-10*	32.9	16 (15)*	110	15.4
2021-02-11*	31.7	26	106	15.4

2021-02-12*	29.3	18	98	13.8
2021-02-13/14*	28.1	20	94	12.8
2021-02-15	29.6	10	99	12.8
2021-02-16	35.6	30	119	16.0
2021-02-17	41.3	34	138	18.8
2021-02-18	42.2	29	141	19.4
2021-02-19	42.2	18	141	19.4

Notes: *

- On 2021-02-10, there was an infection noted that was said to have come from a late determination on 2021-02-06. So from 2021-02-14 the new infections on 2021-02-10 are to be counted as 15 rather than 16.
- On Sunday 2021-02-07 there was an exceptionally heavy snowstorm, followed by substantially more snow also on 2021-02-08, all of which drastically restricted mobility up to at least Sunday 2021-02-14. I imagine that fewer people will have been tested during this time, so corresponding fewer positives will have been noted. It may also have an effect upon the figures subsequently, since it engendered a particularly strenuous form of lockdown.

From 2021-02-20, BI reports the numbers given for BI by the Robert Koch Institute at 00.00 on the date given. The arithmetic seems to me to have gone awry again. I report the "official" RKI-derived figure (prefixed with "RKI-"), and also calculate ni10^{5}r7d and ni7d myself from the published ni1d figures (prefixed with "PBL-"). I have no idea why there would be a discrepancy, but there is.

Date	RKI-ni10^{5}r7d	PBL-ni10^{5}r7d	ni1d	RKI-ni7d	PBL-ni7d	7dmi
2021-02-20	39.5		18	132*		
2021-02-21	41.3		23	138*		
2021-02-22	43.7		11	146*		
2021-02-23	40.7		5	136*		
2021-02-24	36.2		22	121*		
2021-02-25	38.0		28	121*		
2021-02-26	34.7	38.6	22	116	129	19.2
2021-02-27	33.2	39.5	21	111	132	19.8
2021-02-28	36.5	38.0	18	122	127	18.8
2021-03-01	34.4	35.3	2	115	118	17.6
2021-03-02	31.4	34.1	1	105	114	17.0
2021-03-03	28.1	33.5	20	94	112	16.6
2021-03-04	29.3	33.8	29	98	113	16.6
2021-03-05	28.1	32.0	16	94	107	15.4
2021-03-06	26.9	30.8	17	90	103	14.6

Notes: *

- the figure of 132 on 2021-02-20 makes no sense. In the six days (not even 7) from 2021-02-15 to 2021-02-20 there were 139 new infections, from the figures given. Add to that 139 the total from 2021-02-14 (which is unknown, since the figures for 2021-02-13 and 2021-02-14 were reported together) and there are going to be even more.
- I am not sure there is any point to attempting to disentangle the warp in arithmetic caused by the change in reporting, in particular since even the new reporting regime appears to have its arithmetic difficulties. So I begin the 7-day figures ni7d, ni10^{5}r7d and 7dmi for the new reporting regime on 2021-02-26.

The lowest infection 7-day infection figure as well as the lowest 7dmi was attained on 2021-03-06. Thereafter, numbers have started to increase again. That makes it reasonable to declare the end of the second wave on 2021-03-06.

Hospitalisations, ICU Occupancy, and Deaths

Another measure of what has been happening is perhaps to be gleaned from the hospitalisation rate. This is likely also to be somewhat more stable than the positive-test numbers, since records of who is in hospital or not are definitive.

Figure 2 of Çevik et al, Virology, transmission, and pathogenesis of SARS-CoV-2, Br. Med. J. 2020;371:m3862, 2020-10-23, doi: https://doi.org/10.1136/bmj.m3862 , puts the typical hospitalisation date some 12 days after infection. We can observe below that peak hospitalisation in Bielefeld occurred on Twelfth Night, 2021-01-05. That fits with increased transmission occurring during traditional German family celebrations on 2020-12-24. (In Germany, Christmas is celebrated with family in the afternoon and evening of Christmas Eve. Christmas Day is calm. People go for walks.) Some of us were worried that there might be another spike corresponding with New Year, because of partying in public. However, public partying was banned this year, and fireworks were not sold, although it was legal to use those you already had, and some few people did. It seems from the infection numbers that people followed the guidance and basically "stayed at home" on New Year.

Using the timeline of Çevik et al (*op. cit.*), admission to ICU tends to occur 4 or so days after hospitalisation. We can observe that peak hospitalisation was 4th-5th January, and peak ICU on 9th-10th January, which fits with that delay period.

I started calculating the percentage of those hospitalised who were in the ICU, but over the period it really doesn't seem to reflect much. The numbers are small enough that variations in ratio are very variable and thereby not informative. I give the percentage where I did calculate it, though, to validate this observation.

The hospitalisation figure started fairly low, and began to take off when BI city started reporting in earnest, on 2020-10-26. There was genuine worry at various times that capacity could be reached. However, there was an arrangement in place with other hospitals in the region to accommodate patients there if necessary, and vice versa. Regional capacity was stretched but not reached.

The numbers seem to reach a first plateau of around 100 in mid-November, so 2-3 weeks after they "took off", and stayed there for a week. Then they went up 10%-20% and remained in this band through Christmas. Three days after Christmas they went up again, peaking on Twelfth Night 45% higher than they had been at Christmas. Then they reverted by mid-January to the mid-November level, and started going down just before the end of January, and are in mid-February at levels last seen at the beginning of November.

The numbers went from around 40 at the beginning of November to just under 160 on Twelfth Night, and back down to the 40ish level at the beginning of March. That is a factor of 4 from late-October to peak, and then down the same amount. Over the same period, the 7dmi went up by a factor of 3 and then back down to similar level as late-October. That suggests that the peak of infection included people more likely to be hospitalised. I don't know why that would be so. There was talk of a higher rate of new infections amongst twenty-somethings, but this group is generally *less* likely to be hospitalised with moderate to severe Covid-19, so that cannot explain the comparative increase. We shall see below that BI suffered a disproportion number of deaths in the 80-90 age range, considered below; it may have been that the hospitalisation increase was also predominantly amongst this group. BI city admin has been saying for some time that there had been an infection wave in care-homes and old-people's-homes. Such a phenomenon could account for it. The numbers as they are here do not prove it, though.

I don't think these numbers show any changes in effectiveness of hospital care. That could have been reflected, say, in a lowering proportion of those in ICU, but this proportion continues to be variable. I don't see anything in the numbers other than what we already know, that Covid deaths are predominantly but not exclusively older people (late-70's onwards).

Given that hospitalisation occurs on average some 12 days after known infection according to Çevik et al, I include the hospitalisation data for 12 days after 2021-03-06, the end of infection for the second wave. The hospital/ICU numbers continue to show a general decrease over this time period.

Date	Hospitalised	In ICU	% in ICU	Deaths
2020-10-20	15	9		
–				
2020-10-23	25	7		
–				
2020-10-26	35	9		
2020-10-27	39	10		
2020-10-28	38	9		
2020-10-29	38	8		
2020-10-30	41	10		
2020-10-31	43	11		
2020-11-01	49	12		
2020-11-02	–	–		
2020-11-03	69	14		

2020-11-04	74	21	
2020-11-05	–	–	
2020-11-06	79	22	1
2020-11-07	88	30	1
2020-11-08	90	30	
2020-11-09	88	28	
2020-11-10	86	29	1
2020-11-11	84	31	
2020-11-12	83	30	1
2020-11-13	74	29	2
2020-11-14	84	29	1
2020-11-15	96	33	
2020-11-16	104	34	
2020-11-17	100	32	
2020-11-18	98	33	1
2020-11-19	103	37	
2020-11-20	102	36	1
2020-11-21	–	–	
2020-11-22	96	37	
2020-11-23	105	39	1
2020-11-24	111	42	
2020-11-25	120	44	3
2020-11-26	107	38	1
2020-11-27	106	36	
2020-11-28	108	37	2
2020-11-29	110	38	3
2020-11-30	–	–	
2020-12-01	113	43	
2020-12-02	–	–	3
2020-12-03	–	–	4
2020-12-04	110	42	3
2020-12-05	107	41	1
2020-12-06	110	38	
2020-12-07	–	–	
2020-12-08	124	40	
2020-12-09	115	36	1
2020-12-10	117	40	4
2020-12-11	117	38	4
2020-12-12	121	40	2
2020-12-13	113	36	
2020-12-14	–	–	1
2020-12-15	121	39	4
2020-12-16	114	35	5
2020-12-17	113	34	2

2020-12-18	114	35		
2020-12-19	–	–		1
2020-12-20	104	35	34	
2020-12-21	107	31	29	1
2020-12-22	111	2	29	5
2020-12-23	116	36	31	3
2020-12-24	104	35	34	
2020-12-25	–	–		2
2020-12-26	–	–		
2020-12-27	121	36	30	
2020-12-28	133	43	32	
2020-12-29	142	39	27	9
2020-12-30	137	42	31	9
2020-12-31	–	–		2
2021-01-01	–	–		
2021-01-02	142	39	27	
2021-01-03	142	39	27	
2021-01-04	151	40	26	6 (additional from 2020-12-27)
2021-01-05	159	41	26	
2021-01-06	144	40	28	
2021-01-07	140	40	29	5
2021-01-08	124	39	31	2
2021-01-09	126	44	35	7
2021-01-10	117	42	36	2
2021-01-11	–	–		
2021-01-12	116	40	34	4
2021-01-13	106	38	36	16
2021-01-14	103	41	40	5
2021-01-15	98	36	37	10
2021-01-16	101	37	37	3
2021-01-17	103	38	37	1
2021-01-18	100	40	40	1
2021-01-19	98	36	37	9
2021-01-20	101	36	36	5
2021-01-21	108	34	31	6
2021-01-22	102	32	31	4
2021-01-23	92	29	32	1
2021-01-24	98	25	26	5
2021-01-25	103	23	22	
2021-01-26	105	22	21	7
2021-01-27	104	25	24	3
2021-01-28	96	23	24	3
2021-01-29	90	18	20	5
2021-01-30	84	19	23	3

2021-01-31	–	–	3
2021-02-01	86	23	
2021-02-02	82	25	6
2021-02-03	77	23	2
2021-02-04	74	25	3
2021-02-05	72	28	5
2021-02-06	65	24	1
2021-02-07	–	–	
2021-02-08	65	24	
2021-02-09	67	20	3
2021-02-10	–	–	4
2021-02-11	64	21	1
2021-02-12	61	22	
2021-02-13	56	15	2
2021-02-14	49	14	
2021-02-15	54	18	
2021-02-16	58	25	2
2021-02-17	–	–	2
2021-02-18	62	17	1
2021-02-19	62	16	2
2021-02-20	51	16	
2021-02-21	51	15	
2021-02-22	–	–	
2021-02-23	–	–	2
2021-02-24	53	15	2
2021-02-25	51	15	
2021-02-26	46	14	
2021-02-27	45	13	
2021-02-28	43	14	
2021-03-01	41	15	1
2021-03-02	41	15	3
2021-03-03	39	14	2
2021-03-04	40	14	1
2021-03-05	44	15	1
2021-03-06	46	16	
2021-03-07	51	16	
2021-03-08	50	16	1
2021-03-09	47	17	1
2021-03-10	42	13	3
2021-03-11	41	12	
2021-03-12	40	13	
2021-03-13	37	11	
2021-03-14	–	–	
2021-03-15	40	13	

2021-03-16	35	11	1
2021-03-17	35	9	
2021-03-18	29	10	

The hospitalisation rates are unlikely to have been affected by the snowstorm on 2021-02-07 and its effect on the subsequent week, since people needing to be in hospital with Covid-19 were able to get there – the fire service used its off-road vehicles for emergency response and was able to travel everywhere. We can notice that these numbers have been falling; this likely represents a decline in incidence – as well as, unfortunately, a number of deaths.

Before October, there had been 10 deaths in Bielefeld (9 were reported in real time, and 1 additional was reported on 2020-11-20). In October there was one further death, reported on 2020-11-20. In November, there were 21 deaths. The total number of deaths due to Covid-19 in Bielefeld on 2020-12-01 was 32, out of 4,542 illnesses. That gives a CFR of 0.71%.

From 2020-12-01 to 2020-12-28 there were 46 deaths. Then 2020-12-29 to 2020-12-31 there were 20 more recorded. We know that BI was having some problems with recording numbers at this time; it is likely that these numbers reflect deaths over the Christmas period more generally.

December 2020 thus recorded 66 deaths, more than twice as many as in the entire nine months from the first instance of Covid-19 in BI in March 2020 to November 2020. The number of deaths recorded in January 2021 is 116, an increase of 76% over December. There were an additional 16 deaths between 2020-12-27 and 2021-01-04 which I have not included in the December/January totals. If we spread them half-and-half between December and January, that would give 74 December deaths and 124 January deaths, for an increase of 68%.

In contrast, February 2021 saw 38 deaths, which is 51% of the December deaths and 31% of the January deaths. January 2021 was thus particularly severe. It seems in February 2021 that the death totals went down significantly, at end February back to the kind of rate seen in November 2020. Here are 7-day total deaths from 2020-12-01 to 2021-03-15:

2020-11-10 to 2020-11-16: 5
2020-11-17 to 2020-11-23: 3
2020-11-24 to 2020-11-30: 9
2020-12-01 to 2020-12-07: 11
2020-12-08 to 2020-12-14: 12
2020-12-15 to 2020-12-21: 13
2020-12-22 to 2020-12-28: 10
2020-12-29 to 2021-01-04: 26
2021-01-05 to 2021-01-11: 16
2021-01-12 to 2021-01-18: 40
2021-01-19 to 2021-01-25: 30
2021-01-26 to 2021-02-01: 24

2021-02-02 to 2021-02-08: 17
2021-02-09 to 2021-01-15: 10
2021-02-16 to 2021-01-22: 7
2021-02-23 to 2021-03-01: 5
2021-03-02 to 2021-03-08: 7
2021-03-09 to 2021-03-15: 4

There is a glitch in the total-deaths numbers given on the BI WWW site between 2021-01-12, when there were said to be 140 total deaths (which tallies) and 2021-01-14, when there were said to be 167 total deaths, which does not tally, because on 2021-01-13 there were 16 deaths registered and on 2021-01-14 there were 5 deaths, which yields a total of 161 based on the figure from 2021-01-12. The subsequent city arithmetic uses the 167 figure. So either there were more deaths in this period than registered, or there was an arithmetic mistake which has not been corrected.

On 2021-03-18 there had been 289 deaths amongst 10,395 cases, reports the BI WWW site for the date of 2021-03-18. These figures yield a CFR of 2.8% (to 2 significant digits). This is almost three times higher than the general figure of 1% https://ourworldindata.org/grapher/covid-19-cumulative-confirmed-cases-vs-confirmed-deaths .

The distribution of deaths by age group from 2020-10-01 until 2020-03-02 [-03-18] is as follows, calculated from the case-specific ages given in the BI daily reports:

Age	Total
50-59	6
60-64	5
65-69	7
70-74	17
75-79	25
80-84	58
85-89	71
90-94	49
95-99	24
Unknown	10
–	–
Total	272

These can be compared with the death rates for 2021 for Germany overall, from the German government statistical agency Statista, from https://www.statista.com/statistics/1105512/coronavirus-covid-19-deaths-by-gender-germany/ , edition of 2021-03-17 (at time of writing, the latest edition).

To do this, I group my categories into decade age bands. I call these “classes” and give them a roman numeral for ease of discussion. I calculate the proportion of the total in each class, to one rounded decimal point. (Note that, because of the rounding, the percentage totals of BI only add up

to 99.8; the percentage totals of Germany do sum to 100, though.)

Class	Age	BI	Propn	Germany	Propn
I	50-59	6	2.3%	1,911	2.6%
II	60-69	12	4.6%	5,679	7.8%
III	70-79	42	16.0%	14,214	19.5%
IV	80-89	129	49.2%	34,151	46.9%
V	90 & over	73	27.7%	16,899	23.2%
	Unknown	10			
–					
Total (of known age)		262		72,854	

Looking at the proportions in the various classes, the BI figures are lower in Classes I – III than the German figures, and noticeably higher in Classes IV and V. It turns out that the BI deaths amongst 80-and-overs are some 10% higher than in Germany as a whole. Here are the figures.

Class	Age	BI	Propn	Germany	Propn
I + II + III		60	22.9%	21,804	29.9%
IV + V		202	77.1%	51,050	70.1%
Total (of known age)		262		72,854	

There are three possible factors, besides pure chance, for this difference. First, there could be more Bielefeld residents of the age group 80+ than average in Germany. Second, there could be more residents 80+ in care homes/old people's homes than average in Germany; these have been sources of superspreading events in many places, including some in BI as reported in the NW. Third, Bielefeld may have suffered more superspreading events in care homes/old people's homes than average. On the basis of publicly available numbers from Statista and BI city, I cannot judge the contribution of any of these three factors. Statista groups all those 65 and over into one group, and does not differentiate.

The distribution of residents as of 2020-12-31 was as follows, according to BI city from https://www.bielefeld.de/de/rv/ds_stadtverwaltung/presse/stas/ak/ :

Age	Number
Under 18	57,720
18-64	213,774
65-79	43,629
80 & over	23,857

This entails that 19.9% of Bielefeld's population is 65+. This compares with 21.7% in Germany as a whole, from Statista https://www.statista.com/statistics/1086197/men-and-women-by-age-group-germany/ This suggests that BI is not "top heavy" with older people, rather more weighted to younger than the average. This suggests that the second and third factors, concerning the care home/old people's home situation, may have played a greater role in deaths from Covid-19 in Bielefeld than elsewhere.

The numbers given above lead to the following distribution of deaths by age class in BI:

Age	Number	Died of Covid-19	Proportion (approx.)
0-64	271,494	10 [11]	~ 1 in 25,000
65-79	43,629	47 [49]	~ 1 in 900
80 & over	23,857	195 [202]	~ 1 in 120

No one doubts how severe the Covid-19 pandemic is (rather, those few who doubt it are likely deluded). Some people have liked to compare it with influenza, because people die of influenza also. But the situations do not at all compare. Here are the statistics for deaths in Germany from influenza from 1998-2018 (the source graph is in German, but the graph itself contains only dates and numbers, so is readable by those who do not read German: https://de.statista.com/statistik/daten/studie/5942/umfrage/sterbefaelle-in-folge-von-grippe-seit-1998/)

1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
239	364	267	72	102	300	125	301	66	99

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
91	277	115	225	72	447	79	700	410	1,176	3,029

Summary: there are under 500 a year, countrywide, with many years under 100. In 2009, the year of the H1N1 pandemic, there were only 277 deaths. But in the four years 2015-2018, there were 700, then 410, then 1,176, then 3,029 deaths from influenza.

As of March 21st, 2021 (the first day of spring) there are almost 75,000 Covid-19 deaths in Germany. The first Covid-19 cases were late January 2020, notably a small but well-contained superspreading event in Bavaria; then followed the superspreading event at the Carnival celebration in Heinsberg district on February 15th, and then the first Bielefeld Covid-19 cases a few weeks later on March 7th. The first Bielefeld lockdown followed on March 15th, 2020.

The confluence of reduced deaths, reduced hospitalisations and reduced new infection rates last seen in mid-October (with lags for hospitalisation and then deaths, corresponding to disease progression; see Peter Bernard Ladkin, A Rough Timeline of Key Points in Covid-19 Progression, preprint 2021-03-01), as well as increasing figures since, suggest to me that 2021-03-06 is an appropriate choice of termination date for the second wave of Covid-19 in Bielefeld. The second

wave started in early September 2020, according to the figures, so it has lasted about six months.

The rise in infections since 2021-03-06, and the information from the Robert Koch Institute that R has recently been above 1, indicate that there might well be a third wave, following the dispersion of new, more infectious, B1.1.7 (first noted in SE GB), B1.351 (first noted in South Africa) and P1 (first noted in Brazil). There are cases of the first two variants already noted in Bielefeld. The spread of these variants may be dampened by vaccinations.

Finally, it is likely worth noting that the Bielefeld ni10^{5}r7d figure is at time of writing about half of the figure for NRW and half of the figure for Germany as a whole. Indeed, it is significantly lower than in all the surrounding districts. This may well change. Bielefeld does not form a “bubble”.