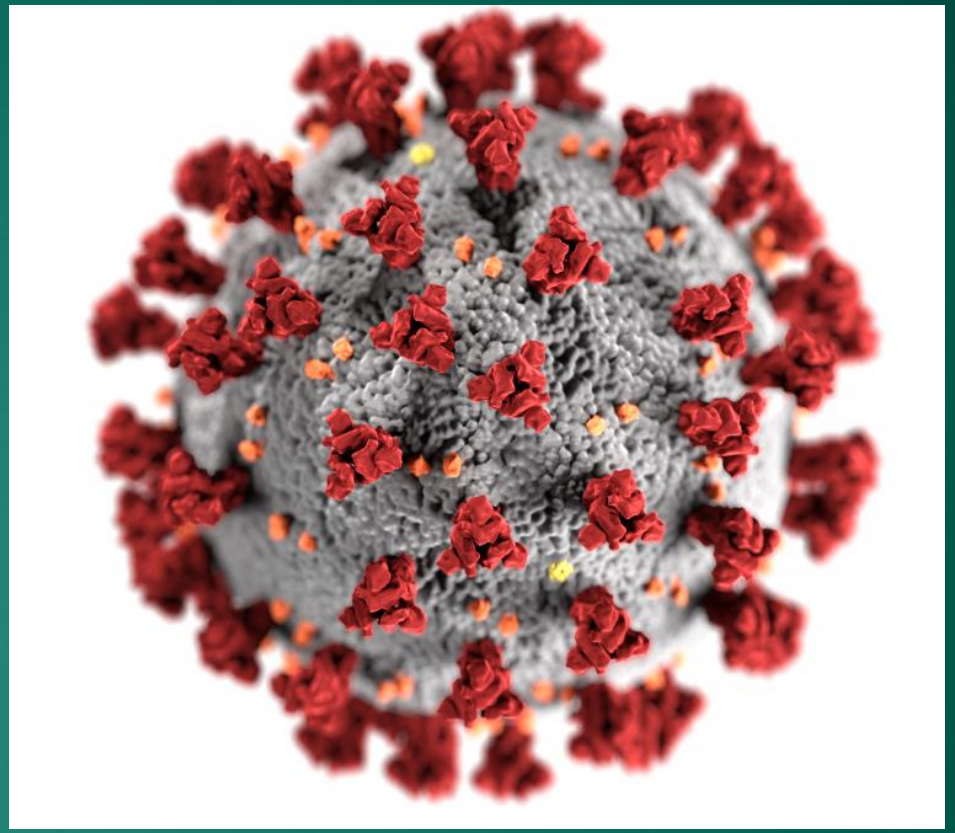
COVID-19 incidence and outcome by affluence/deprivation across three pandemic waves in Ireland



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National Health Protection Conference, 12th October 2023

Influenza pandemic 1918

The influenza pandemic was initially called “The Great Leveller”, affecting rich and poor alike.

However, subsequent research showed a disproportionately greater impact on poorer populations.

When COVID struck a century later, the initial motto was that “We are all in this together …”

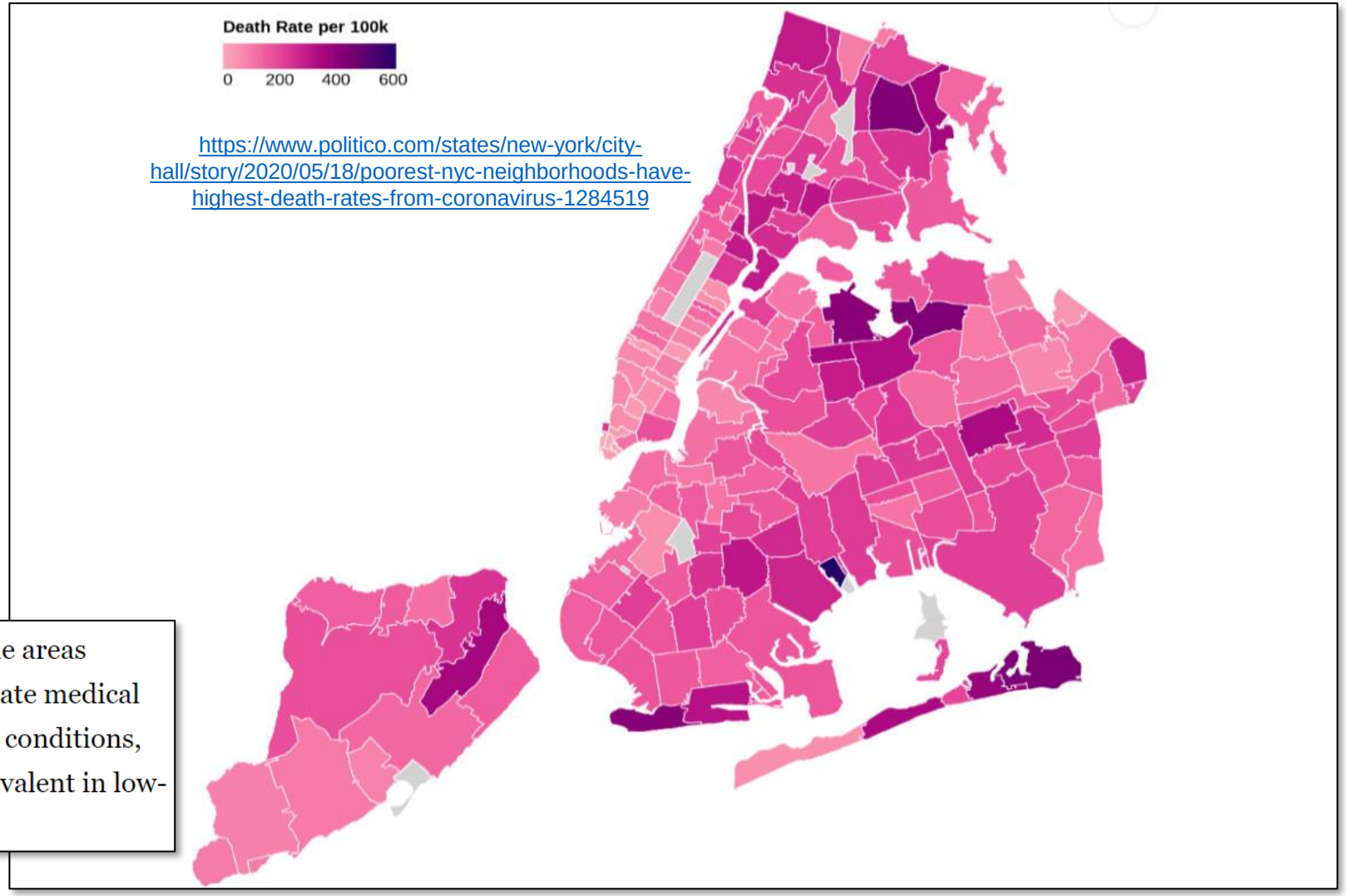
But were we?

Picture source:
https://www.buckscountycouriertimes.com/news/20190923/mxfctter-museum-to-mark-historic-influenza-pandemic/1

Deprivation and COVID-19: New York

In zip codes where 30% live in poverty, early COVID-19 death rates were 232 per 100,000.

In more well-off neighbourhoods (<10% living in poverty), death rates were 100 per 100,000



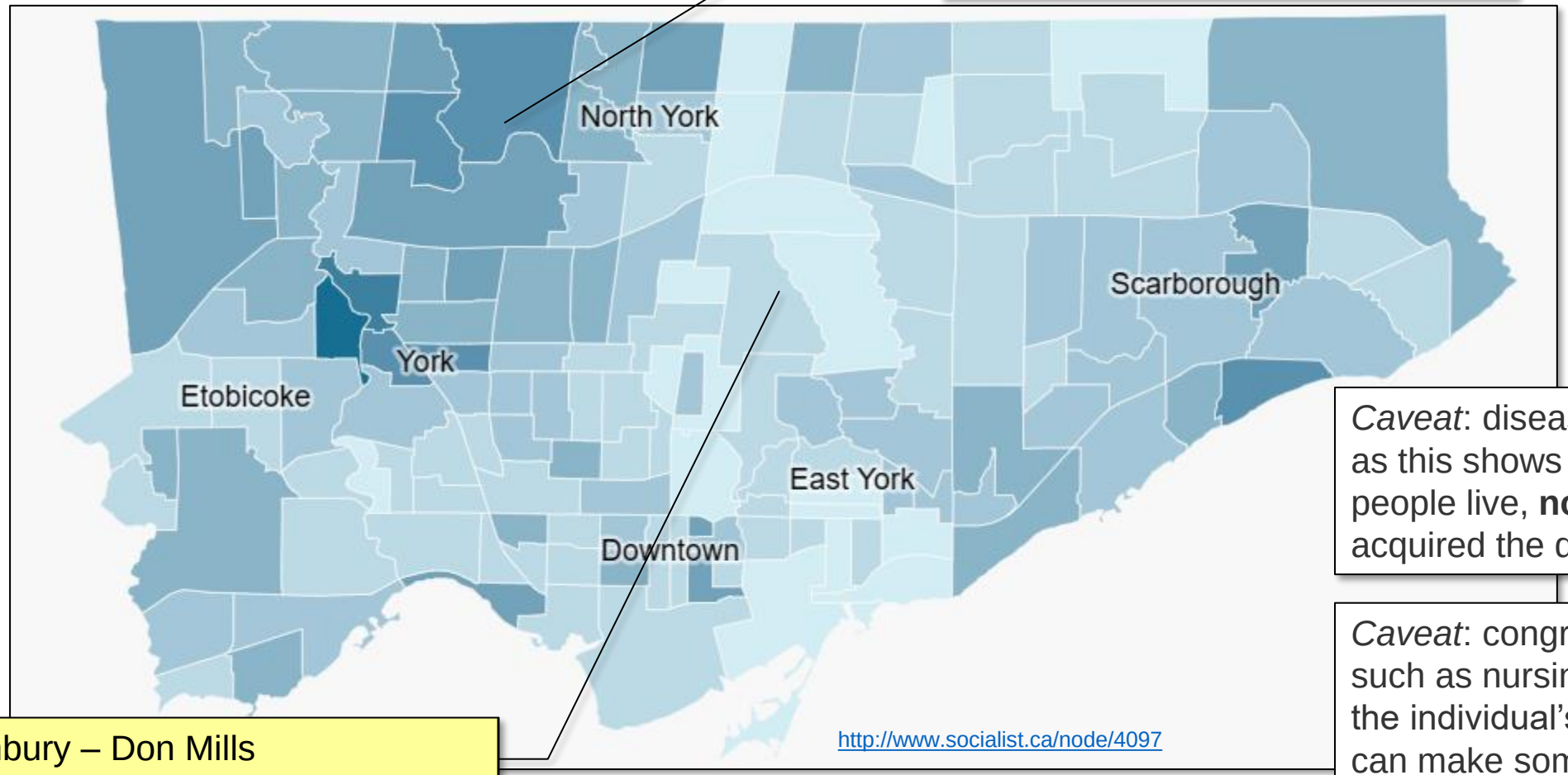
https://www.politico.com/states/new-york/city-hall/story/2020/05/18/poorest-nyc-neighborhoods-have-highest-death-rates-from-coronavirus-1284519

> Mayor Bill de Blasio said Monday evening that the same areas suffering from Covid-19 deaths have long lacked adequate medical care that might have prevented some of the underlying conditions, such as diabetes and hypertension, which are more prevalent in low-income communities.

https://www.politico.com/states/new-york/city-hall/story/2020/05/18/poorest-nyc-neighborhoods-have-highest-death-rates-from-coronavirus-1284519

Deprivation and COVID-19: Toronto

York University Heights
906 cases per 100,000



Banbury – Don Mills
87 cases per 100,000

Caveat: disease mapping such as this shows where infected people live, **not** where they acquired the disease

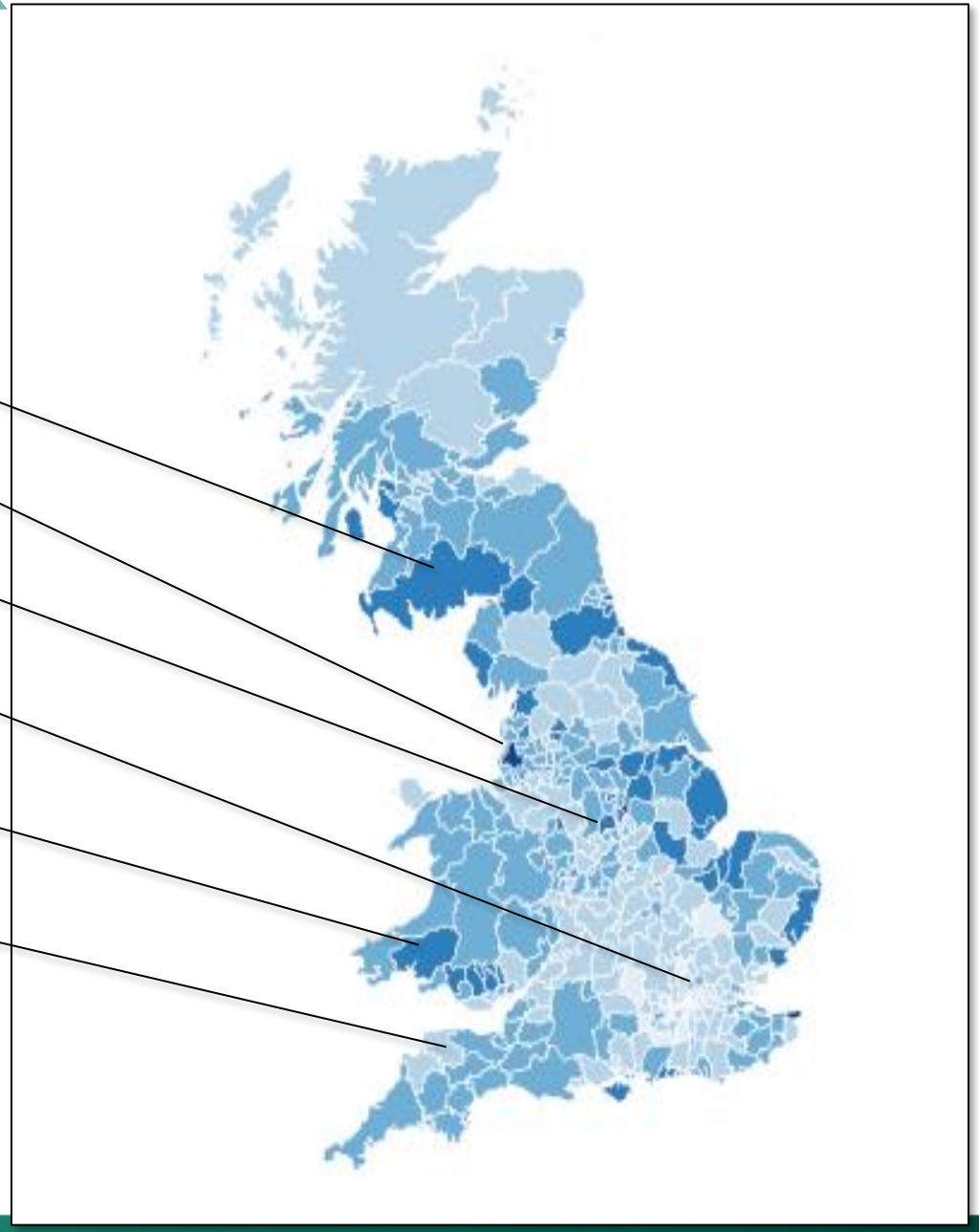
Caveat: congregated settings, such as nursing homes, outside the individual's "usual" address can make some mapping difficult to interpret

https://www.thestar.com/news/city-hall/new-maps-show-toronto-s-covid-19-hot-spots/article_1110ffac -922b-56ce-a6a3-ae54b95a8cc7.html

Deprivation and COVID-19: UK

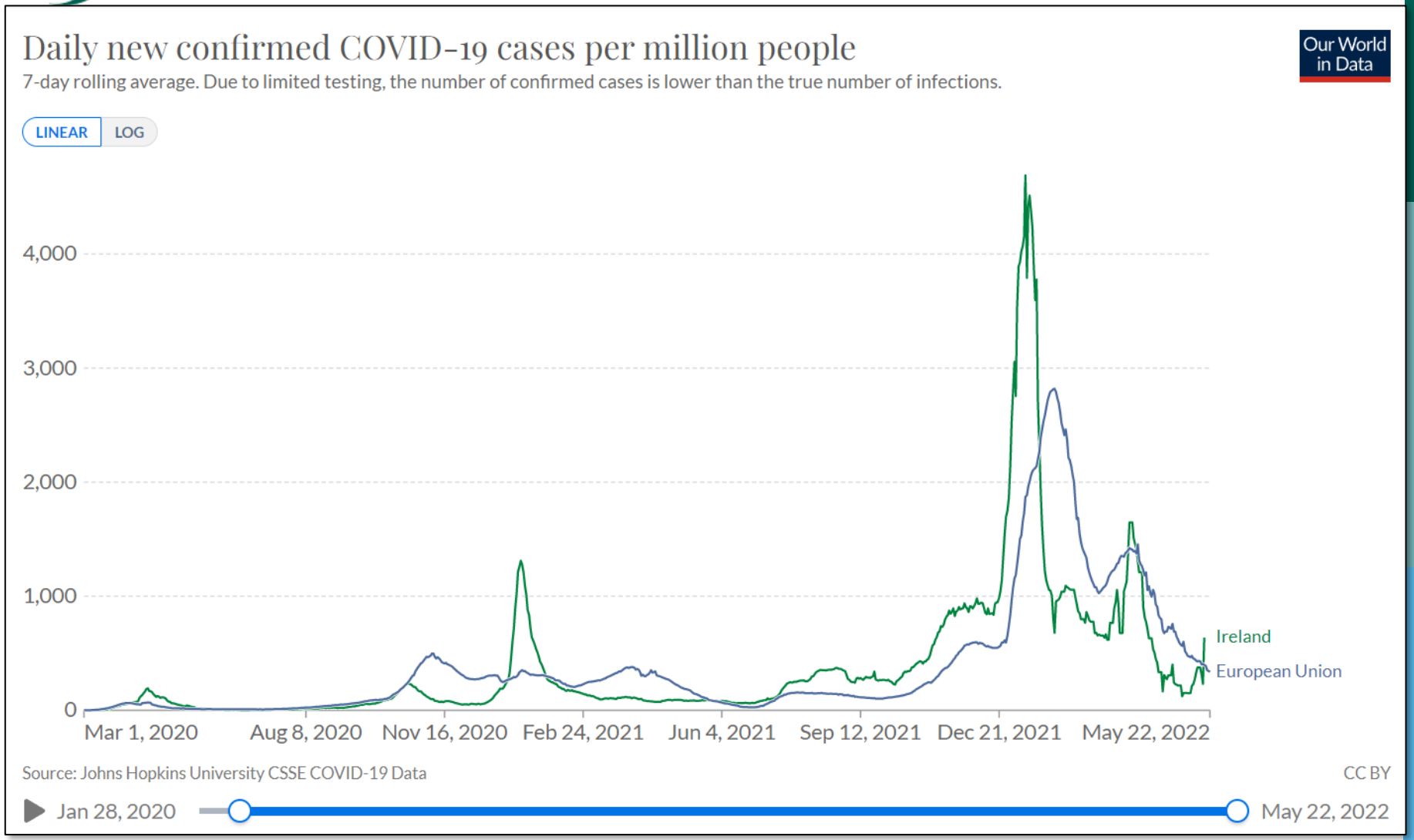
COVID-19 mortality rates <65 yrs were 3.7 times higher in most deprived, compared with least deprived areas.

- South-East Scotland 74.0 deaths per 100,000
- North-West England 22.0 deaths per 100,000
- West Midlands England 21.7 deaths per 100,000
- London 25.5 deaths per 100,000
- South Wales 44.5 deaths per 100,000
- South-West England 6.4 deaths per 100,000



https://www.health.org.uk/news-and-comment/charts-and-infographics/what-geographic-inequalities-in-covid-19-mortality-rates-can-tell-us-about-levelling-up

Irish context



https://ourworldindata.org/explorers/coronavirus-data-explorer

https://covid19ireland-geohive.hub.arcgis.com/

1,551,835

Total cases by 18th May 2022

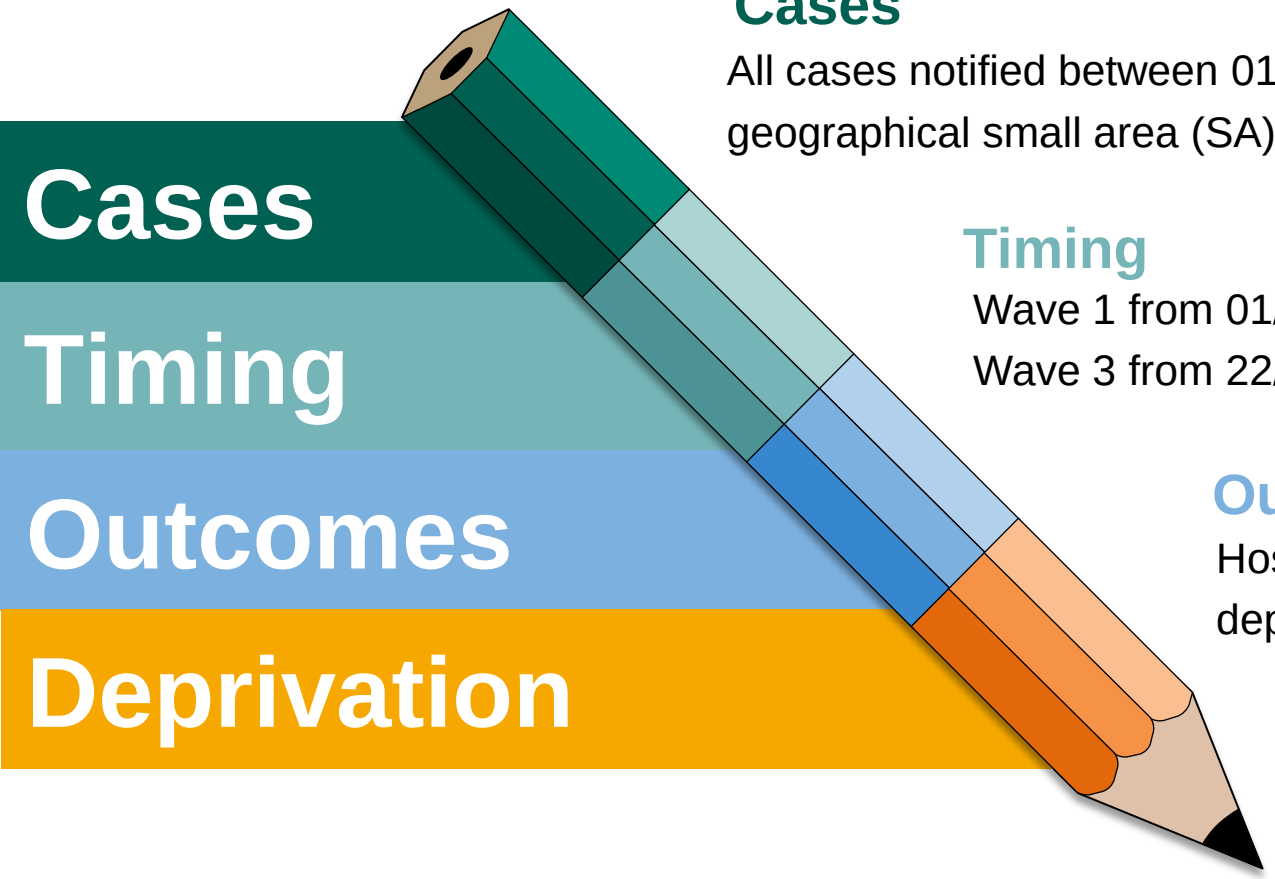
7,244

Total deaths by 18th May 2022

Were outcomes worse for those from more deprived populations?

Methodology

Retrospective cohort study of routinely notified COVID-19 cases confirmed by PCR and recorded in CIDR



Cases

All cases notified between 01/03/2020 and 13/05/2020. Cases were georeferenced to geographical small area (SA), equivalent to 50-100 households

Timing

Wave 1 from 01/03/2020 – 01/08/2020; Wave 2 from 02/08/2020 – 21/11/2020; Wave 3 from 22/11/2020 – 13/05/2021 (end of study period)

Outcomes

Hospital admission; ICU admission; death (all compared by deprivation index at SA)

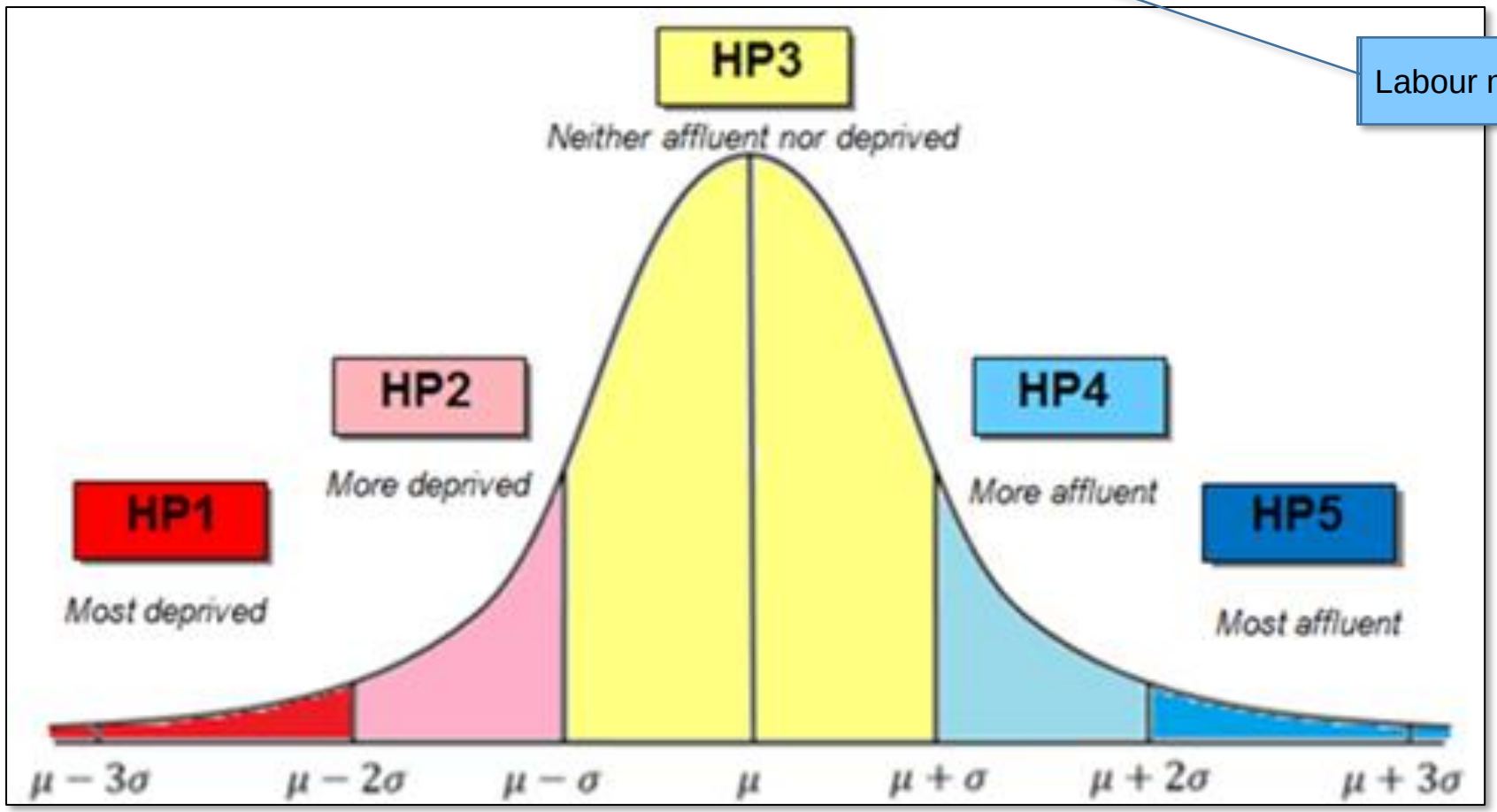
Deprivation score

Based on the 2016 Pobal HP Deprivation Index, applied to CSO national Census for 2016

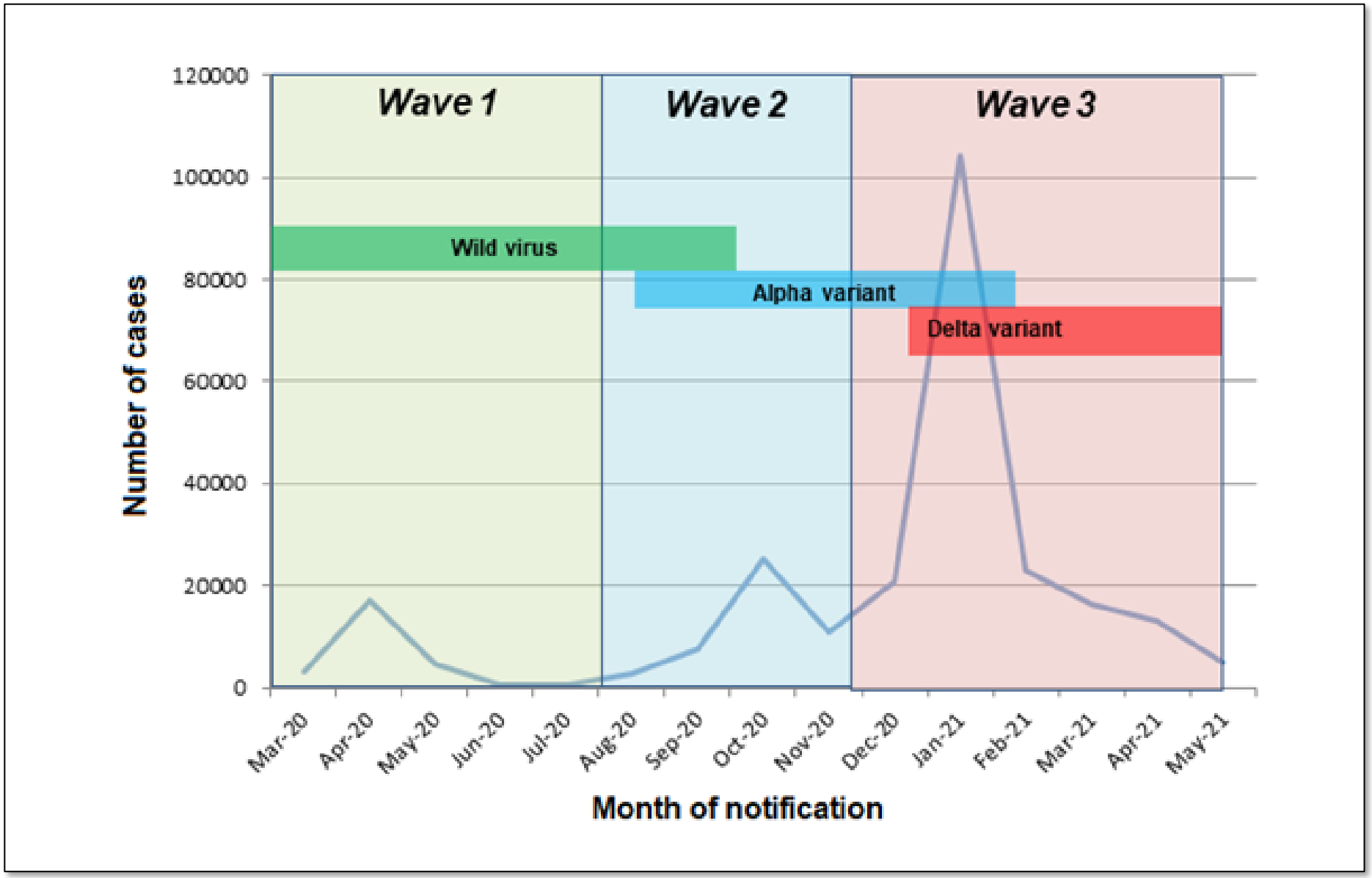
Deprivation index

HP index identifies **three dimensions**

- Demographic profile
- Social class composition
- Labour market situation



Time frame

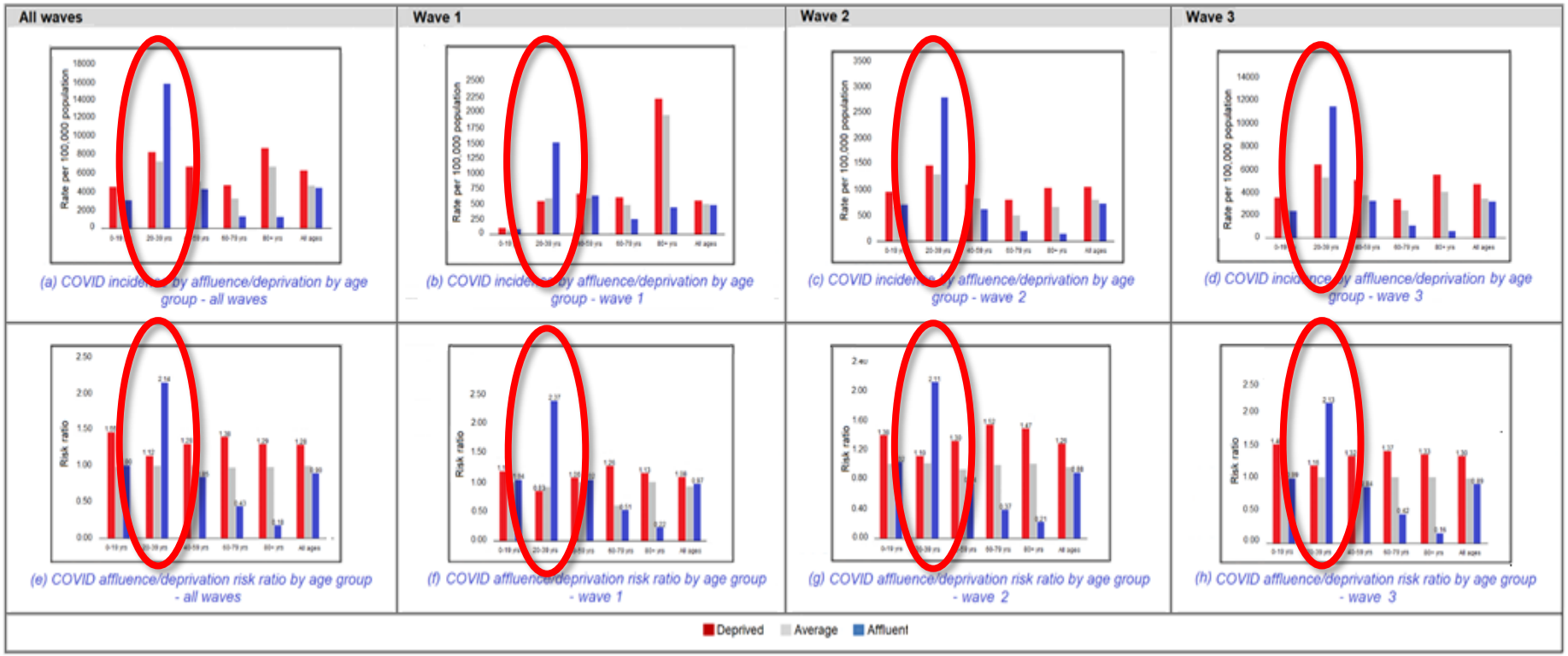

Wave 1
Wave 2
Wave 3
Wild virus
Alpha variant
Delta variant
120000
100000
80000
60000
40000
20000
0
Number of cases
Mar-20
Apr-20
May-20
Jun-20
Jul-20
Aug-20
Sep-20
Oct-20
Nov-20
Dec-20
Jan-21
Feb-21
Mar-21
Apr-21
May-21
Month of notification

Results: Deprivation and incidence

Across all* age groups, across all waves, RR for incidence was higher in deprived groups (HP1+HP2=red), compared to affluent (HP4+HP5=blue).

*Except for the 20-39 year age group, which showed greater RR towards the more affluent

COVID-19 incidence by affluence/deprivation by age group



COVID-19 affluence/deprivation rate ratio by age group

Results: Hospital admission model

Variable	Value	n	Adjusted Odds Ratio (aOR)	95% confidence Interval	Main effect size (eta-squared)	Total effect size (eta-squared)	*p*-value
Hospital admission (*n*=14,420)							
Age	*0-39*	2,454	1.00	(Ref)	0.613	0.716	-
	40-49	1,354	1.80	(1.66, 1.95)			<0.0001
	50-59	1,902	2.76	(2.56, 2.97)			<0.0001
	60-69	2,170	5.92	(4.91, 5.69)			<0.0001
	70-79	3,029	13.07	(12.14, 14.06)			<0.0001
	80+	3,693	13.26	12.31, 14.27)			<0.0001
Comorbidity	*Yes*	7,689	3.27	(3.11, 3.42)	0.236	0.328	0.0033
Wave of pandemic	*1*	3,328	1.00	(Ref)	0.015	0.029	-
	2	1,821	0.67	(0.62, 0.72)			0.0001
	3	9,457	0.82	(0.77, 0.88)			<0.0001
Outbreak-associated	*Yes*	6,030	1.07	(1.02, 0.12)	0.002	0.004	<0.0078
Deprivation	*HP3 (average)*	9,326	1.00	(Ref)	0.008	0.014	-
	HP1 & HP2	3,355	1.22	(1.15, 1.28)			<0.0001
	HP4 & HP5	1,739	0.97	(0.91, 1.04)			0.3918
Sex	*Male*	7,702	1.32	(1.26, 1.38)	0.012	0.021	0.5455
Model	*$X^2(13)=16680.95$ $p<0.0001$; Model R^2 value=0.2109*						

Admission to hospital associated with:

- Increasing age
- Comorbidity
- HP1 & HP2 (very deprived & deprived)

Results: ICU admission model

Variable	Value	n	Adjusted Odds Ratio (aOR)	95% confidence Interval	Main effect size (eta-squared)	Total effect size (eta-squared)	*p*-value
ICU admission (*n*=1,536)							
Comorbidity	*Yes*	1,396	27.82	(22.47, 34.46)	0.416	0.697	<0.0001
Age	*0-39*	133	1.00	(Ref)	0.196	0.443	-
	40-49	205	3.63	(2.78, 4.74)			<0.0001
	50-59	315	5.42	(4.24, 6.91)			<0.0001
	60-69	453	9.84	(7.77, 12.46)			<0.0001
	70-79	367	9.67	(6.74, 12.58)			<0.0001
	80+	85	1.66	(1.18, 2.23)			0.0034
Wave of pandemic	*1*	438	1.00	(Ref)	0.013	0.036	-
	2	183	0.63	(0.50, 0.78)			<0.0001
	3	937	0.90	(0.77, 1.05)			0.2035
Outbreak associated	*Yes*	517	1.30	(1.14, 1.49)	0.01	0.029	<0.0001
Travel associated	*Yes*	32	0.69	(0.47, 0.99)	0.014	0.044	0.0481
Deprivation	*HP3 (average)*	1,005	1.00	(Ref)	0.007	0.016	-
	HP1 & HP2	336	1.07	(0.92, 1.44)			0.3703
	HP4 & HP5	195	0.93	(0.76, 1.13)			0.4567
Sex	*Male*	1,008	0.54	(0.48, 0.62)	0.035	0.1	0.8931
Model				*$X^2(13)=3457.89$; $p<0.0001$; Model R^2 value=0.2609*			

ICU admission associated with:

- Increasing age
- Comorbidity
- Pandemic wave (lowest wave 2)

Results: Mortality model

Variable	Value	n	Adjusted Odds Ratio (aOR)	95% confidence Interval	Main effect size (eta-squared)	Total effect size (eta-squared)	*p*-value
Mortality (*n*=4,646)							
Age	*0-39*	30	1.00	(Ref)	0.387	0.747	-
	40-49	57	5.84	(3.28, 10.41)			<0.0001
	50-59	152	14.51	8.65, 24.35)			<0.0001
	60-69	437	66.49	(40.70, 108.62)			<0.0001
	70-79	1,121	219.76	(135.42, 356.62)			<0.0001
	80+	2,886	494.60	(305.56, 800.59)			<0.0001
Comorbidity	*Yes*	4,123	9.44	(8.29, 10.76)	0.149	0.445	<0.0001
Wave of pandemic	*1*	1,530	1.00	(Ref)	0.026	0.069	-
	2	386	0.44	(0.38, 0.51)			<0.0001
	3	2,767	0.89	(0.81, 0.98)			0.0237
Outbreak associated	*Yes*	3,083	1.73	(1.58, 1.89)	0.015	0.048	<0.0001
Travel associated	*Yes*	11	0.45	(0.23, 0.85)	0.030	0.109	0.0146
Sex	*Male*	2,486	0.83	(0.74, 0.92)	0.014	0.044	0.0006
Deprivation	*HP3 (average)*	3,204	1.07	(Ref)	0.004	0.011	-
	HP1 & HP2	1,053	0.93	(0.85, 1.02)			0.1382
	HP4 & HP5	389	0.83	(0.71, 0.97)			0.0146
Model	*$X^2(13)=15933.05$; $p<0.0001$; Model R^2 value=0.4863*						

Mortality associated with:

- Increasing age
- Comorbidity
- Pandemic wave (highest in wave 1)

Discussion

- Risk of being a confirmed case of COVID-19 is higher among the more deprived categories for all ages across all three pandemic waves (except for the 20-39 years age category, in whom the reverse pattern was found).

- High proportion (46%) of cases in the 20-39 age category were health care workers with both an increased occupational exposure to COVID-19 and a requirement for serial testing, leading to possible ascertainment bias.

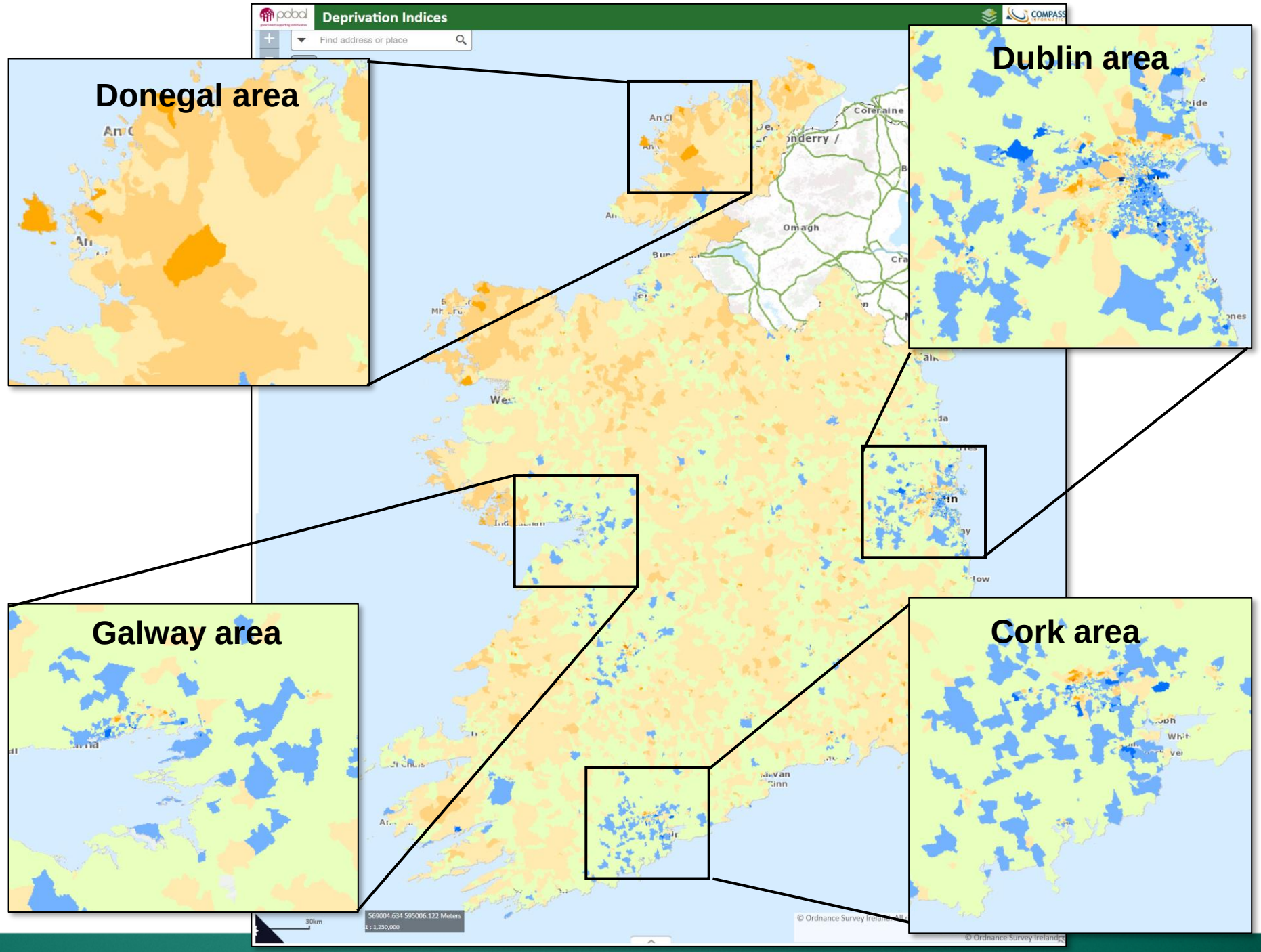
- Comorbidity and increasing age were consistently associated with all three outcomes.

- Deprivation was only associated with hospital admission (with very slight association between lower mortality and greater affluence).

- Overall, outcomes improved in later waves, possibly due to increased understanding and management of acute cases.

- Caveat: only PCR positive cases were included in the analysis, so we are unable to comment on any impact that may have been observed by including PCR-negative, clinically suspicious cases.

https://maps.pobal.ie/WebApps/DeprivationIndices/index.html



Conclusions

- Deprivation was not consistently associated with poor outcomes in an Irish context: associated with incidence and hospital admission, but not with ICU admission or mortality.
- In Ireland, as in Germany, earlier cases tended to be more affluent – tended to impact more affluent urban areas in the earliest weeks and months of the pandemic.
- Is the lack of a more defined deprivation gradient in Ireland due to: more ethnically homogenous population? Less urban ghettoization? Greater social equality?
- Need for more research into deprivation and its impact on COVID (and to include it as a factor in all epidemiological research), but also to consider the impact of gender.
- Our study suggests that there may be some truth to the saying that “we are all in this together”.

Thank you