

Excess Mortality in Dublin during the Covid-19 Pandemic: Using RIP.ie as a geographical source

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Introduction

Due to the increasing prevalence of Covid-19 nationally in the latter half of 2020, concern has been rising as to how the resurgence of the disease will impact Dublin as the capital and largest city within Ireland. One indicator of the deadly impact of Covid-19 within the city is to identify excess deaths reported within different districts of Dublin, to begin to detect underlying factors that relate to recognisable population health impacts in each area. To do this, we examined excess death notices posted to RIP.ie for Dublin across 2020, relative to previous years. Using RIP.ie as an effective near real-time indicator of excess mortality linked to Covid-19, we explored the deeper patterns associated with this excess mortality within the city, which became a hub for the resurgence of the disease in Autumn 2020. In this short paper we investigate the underlying factors that have affected the levels of mortality associated with Covid-19 within Dublin. In particular, we examine evidence that points toward Covid-related deaths being 50% higher in Dublin's more deprived districts, a finding that mirrors wider global research on the differential impacts of the disease (Bambra *et al.*, 2020).

Method

In Ireland traditionally, death notifications were posted in national and local newspapers, but in recent years an open-source website, RIP.ie, has become the *de facto* reporting source for recent bereavements, with most posts occurring within one day (CSO, 2020) of an individual's death. Given a time lag of 63 days in the formal notifications of deaths

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nationally (CSO, 2020; Rigby *et al.*, 2017), RIP.ie has proved an accurate predictor of mortality nationally (CSO, 2020) and allowed for the equivalent of a rapid citizen science response at a time when it was much needed. Postings to RIP.ie included information on surnames, but also dates of death or date of posting, and a listed location including ‘Town’, ranging from a townland name up to a large town, and county. In Dublin, postings frequently include a postal district which was crucial in allowing for more detailed geographical analysis. Using RIP.ie deaths notices, we grouped Dublin City and County Postal Codes together (Figure 1) to examine the number of excess postings from January-September 2020. To get a more accurate picture of the significance of Covid-19 mortality in Dublin, we also analysed notices posted in 2020 to RIP.ie relative to the previous five years. Examining monthly notices posted to RIP.ie relative to previous years also helped identify those parts of the city most affected by the disease in terms of excess mortality during the pandemic.

Has Covid-19 affected Dublin’s districts equally?

Underlying patterns identified within Dublin showed that the disease did not affect all districts equally. In addition, the districts naturally varied in socio-economic levels, population density, and age structure, making some districts more vulnerable to the impacts of Covid-19 than others.

To investigate how excess mortality might be associated with Covid-19, we used the first 3-digit part of the Irish Eircode to match the RIP.ie posting. This 3-digit Eircode (D01, D02 etc.) corresponded to the older Dublin districts that were labelled as Dublin 1, 2 etc. (Figure 1). Furthermore, postal codes were chosen as a suitable base geography due to their size and organisation along town/village lines, similar to the wider national RIP.ie database. A target of an average of 10 posts per month was needed for robust identification of excess mortality, which meant that several postal codes needed to be grouped together as collective districts. These districts are listed in Table 1.¹



Figure 1: Dublin groupings based on the postal codes in the county.

Table 1: A list of Dublin groupings based on the postal codes in the county.

District	Individual Postal Code
Dublin North	Balbriggan, Garristown, Oldtown, Ballyboughal
Dublin North East	Lusk, Skerries, Rush, Malahide
Dublin West	Lucan, Dublin 22
West Inner Dublin	Dublin 20, Dublin 10
Dublin 6/6W	Dublin 6, Dublin 6W
Inner City Dublin	Dublin 1, Dublin 2
Donaghmede	Dublin 13, Dublin 17

The relative change of notices posted onto RIP.ie in each of the Dublin districts is shown in Figure 2, identifying those that had excess deaths 100% above normal and suggesting the potential effects of Covid-19. The dotted line in each plot represents the previous maximum level of notices posted onto RIP.ie in previous years. Twenty-one out of twenty-three districts showed a clear peak over the previous maximum during March and April in the first wave of the pandemic. Certain districts such as Inner-city Dublin (which had shown two smaller peaks in June and July following its April peak), Dublin North East and West Inner Dublin began to show a slight rise over the previous maximum and could indicate early effects of the remove autumnal spike in cases.

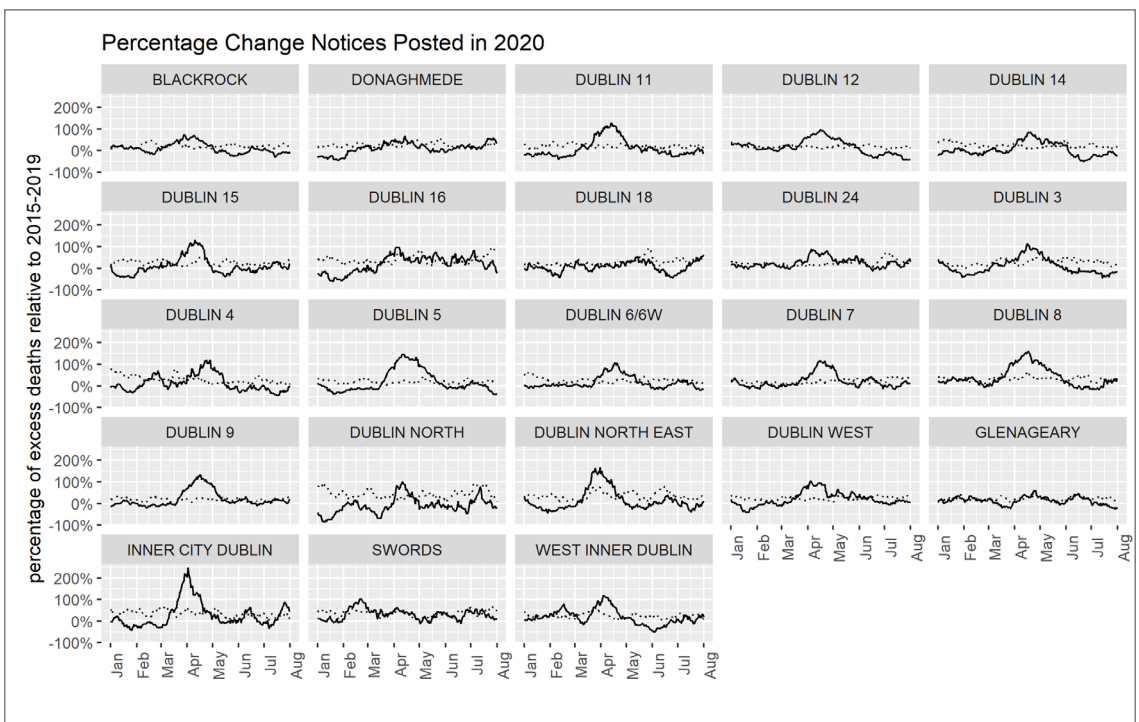


Figure 2: Percentage change in notices posted onto RIP.ie in each Dublin district in 2020 relative to the average from 2014–2019. Dotted line indicates the maximum postings from 2014–2019.

Comparing Dublin’s districts, Figure 2 shows that each district experienced differing fluctuations in relative mortality. If we assume that districts with high peaks in relative mortality, centered around April 2020, were associated with Covid-19, it is important to understand why some districts were more intensely affected by the disease than others. Initially, it could be assumed that districts that experienced higher peaks were associated with higher population density as respiratory diseases spread more rapidly in more densely populated areas due to higher likelihood of transmission between infected and susceptible people. However, after investigating the relationship between population density and mortality, this proved not to be the case.

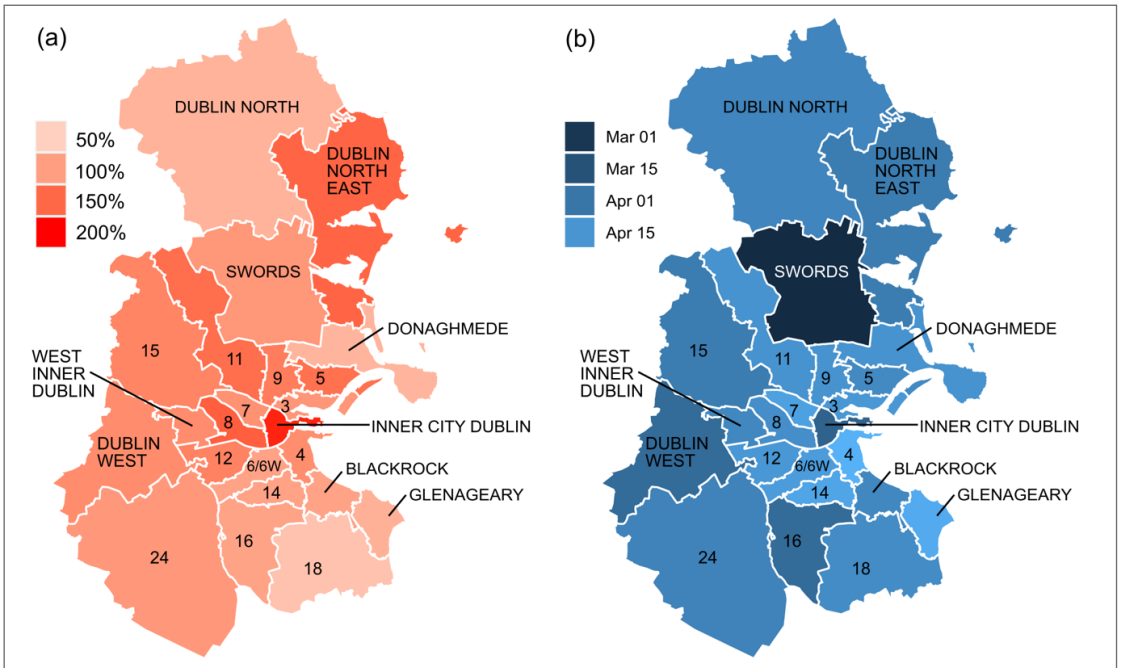


Figure 3: (a) Percentage of maximum excess postings to RIP.ie in 2020 (until October 2020) relative to the previous 5 years and (b) the date of occurrence of the maximum.

Figure 3a offers a picture of how these districts were affected in terms of excess mortality associated with Covid-19, showing percentage excess postings to RIP.ie for each Dublin district. To calculate the percentage of excess deaths notices to each Dublin district, we calculated the mean number of monthly notices in each district for the previous five years. The monthly notices of each district in 2020 were then divided by the mean monthly notices to get a monthly ratio for each district in 2020. The maximum monthly ratio was then assigned to each district. Acquiring the ratio of each district allowed the mortality data to be standardised for each district, highlighting potential districts that were worst affected by Covid-19. Few districts in Dublin had peaks in excess mortality less than twice the normal levels. However, there did not appear to be a striking geographical pattern in the observed results.

The date that each district in Dublin reached its maximum number of postings on RIP.ie ranged from March through to the end of April, as the impacts of the virus were felt across the county during the first wave of the pandemic (Figure 3b). For instance, the early peak in mortality in Swords during the first wave in March could potentially indicate where the virus first began, particularly due to its proximity to Dublin Airport. Indeed, the role of air travel as a crucial node in the diffusion of contemporary disease outbreaks is well established (Kamel-Boulos and Geraghty, 2020).

Structural/environmental characteristics that affect mortality levels in Dublin

In looking more closely at both environmental and structural factors that might potentially explain these patterns, we considered four variables that have been associated with high Covid-related excess mortality: deprivation, population density, age structure, and density of nursing homes reporting deaths in a district. The first three have established histories in relation to spatial inequalities but the latter has emerged as an important new factor during the pandemic (Kearns *et al.*, 2014).

Deprivation

While contested as a measure, deprivation has been associated with general excess mortality and morbidity at a variety of scales (Rigby *et al.*, 2017). Rolleston and Galea (2020) has acknowledged that assuming the virus is non-discriminating is 'not the complete truth'; areas that are 'already vulnerable by way of social and economic disadvantage' are most at risk of higher levels of mortality associated with the virus. This tallies with established health geography research around context and composition (Cairns *et al.*, 2012) as well as a growing body of research identifying the clearly differential impacts of the pandemic on deprived and marginalized populations (Bambra *et al.*, 2020). A closely linked characteristic, socio-economic status (SES) also shapes the health of an area, and the capacity of that area's population to withstand the impacts of Covid-19. Established research recognises that low SES affects life expectancy, housing, employment, educational attainment, and income (Rolleston and Galea, 2020). These factors can directly influence the risk of contracting Covid-19, and as a result, influence the level of mortality in areas. For instance, where people can afford to reside can have an immediate impact on their risk of contracting the disease and living in shared housing can result in decreased ability to physically distance (Rolleston and Galea, 2020). The same can be said for low-skilled jobs that require public contact, jobs that are frequently worked by the economically disadvantaged (Rolleston and Galea, 2020). In addition, many people that reside in more deprived areas do not have the option of working from home and rely on public transport as a means of travelling to work, immediately putting themselves at risk of encountering the disease. Furthermore, individuals living in deprived areas are more likely to have 'less access to high quality healthcare and suffer from more illnesses that

are associated with high mortality, such as diabetes, heart disease, and pulmonary issues’ (Finch and Hernandez-Finch, 2020, 2). The rapid spread of Covid-19 within these areas could therefore have catastrophic impacts in terms of mortality.

Thus, we decided to look at the deprivation levels of each district in Dublin to investigate if the varying socio-economic characteristics of each district was linked to high excess mortality, as posted to RIP.ie. The percentage of excess deaths relative to 2015-2019 in each district is plotted against the area’s average deprivation score in Figure 4. Although applying the index to each district had the effect of smoothing the internal variation within districts, it still acted as an effective general indicator. The index is scaled between -2 and +3, where higher positive values represent areas that are more socially and economically disadvantaged. We divided the deprivation index for each district into five quintiles, each being one-fifth of the range between least deprived and most deprived. Districts identified with high peaks in Figure 2, such as inner-city Dublin, Dublin 11, Dublin 8, Dublin 7, Dublin 12 and West Inner Dublin, followed a pattern of higher excess mortality associated with a high deprivation level. Dublin’s most deprived districts, Inner-city Dublin and Dublin 8, had 50% higher relative excess deaths than Dublin’s least deprived districts, such as Blackrock. The correlation between percentage of excess deaths in 2015-2019 and deprivation score was 0.7. To check the sensitivity of the correlation strength to Inner-city Dublin, we removed this potential outlier. In this case, the correlation between the two variables decreased to 0.5, still showing a strong positive relationship between the two variables and confirming a potential pattern between Covid-related excess mortality and deprivation level with a p-value of <0.001.

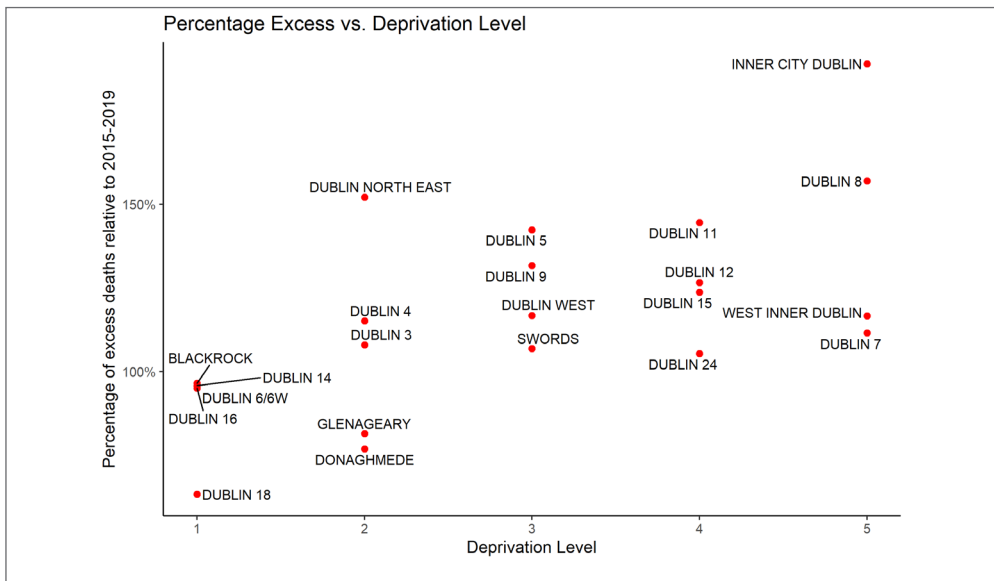


Figure 4: Percentage of excess notices posted onto RIP.ie plotted against Deprivation Score

Population Density, Age and Care Homes

Our World in Data (2020) linked London's high excess mortality associated with Covid-19 with its high population density and hard-to-avoid close physical contact on public transport and at work. Accordingly, it is assumed that countries with a higher fraction of adults in similar locations will be more inclined to have higher excess death rates (Our World in Data, 2020). In Dublin the greater use of public transport in comparison to the rest of the country allows the city's population to come into more frequent collective contact. Furthermore, in the initial outbreak of the disease, care homes were ill-prepared to effectively combat the spread of Covid-19 within their institutions, having insufficient PPE and insufficient access to Covid-19 tests. Consequently, residents were not well-shielded from potential infection from visitors and staff when the virus was in its inception (Our World in Data, 2020). Given the high density of particular areas in Dublin and that 60% of Covid-19 related deaths in Ireland were associated with care homes (The Irish Times, 2020) due to the virus disproportionately affecting older population cohorts, we additionally investigated if population density, age structure and the proportion of nursing homes in each Dublin district impacted mortality levels associated with Covid-19.

Figure 5 plots the percentage of excess deaths in 2020 relative to 2015-2019 against population density for each Dublin district. Figure 5 indicates that, while some districts such as Inner-city Dublin, a densely populated district, are more vulnerable to the disease, there is not a robust correlation between high excess mortality and population density. The correlation between the two variables returned a value of 0.3, indicating a moderate positive linear relationship. However, removing inner-city Dublin, the correlation between the two variables decreases to a value of 0.08, indicating no linear relationship. With a p-value of 0.122, the relationship between the two variables was not significant. In truth, Dublin is a relatively low-density city for its size, and this maybe explain that result (Lawton and Punch, 2014)

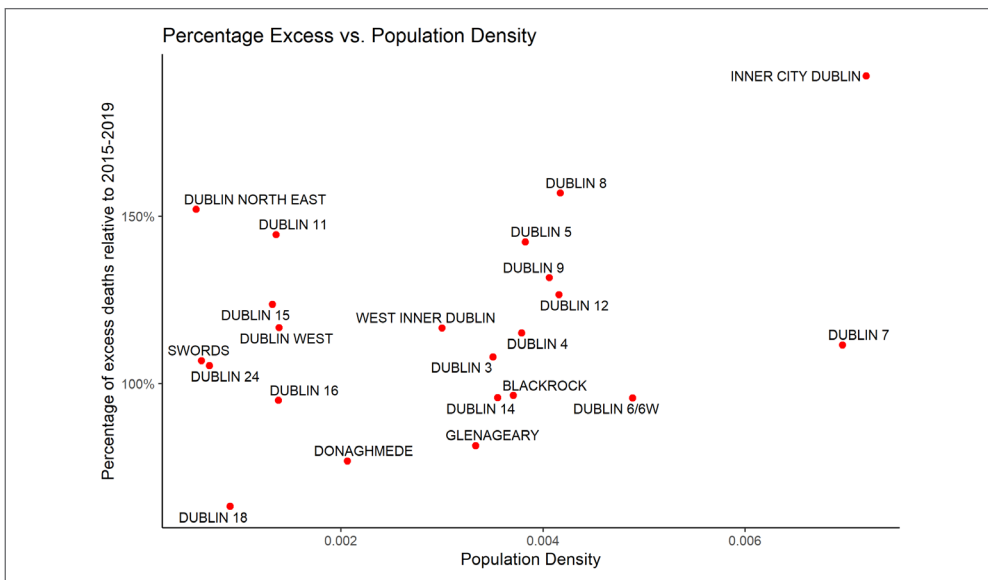


Figure 5: Percentage of excess notices posted onto RIP.ie plotted against population density of each Dublin district.

Figure 6 shows the percentage of excess deaths in 2020 relative to 2015-2019 against the proportion of the population over 70 years old in each district. The correlation between the two variables returned a value of -0.3, indicating a negative linear relationship (p-value: 0.248). Given the scale of analysis and the very mixed age profile of Dublin’s residents, this too is not a surprising result.

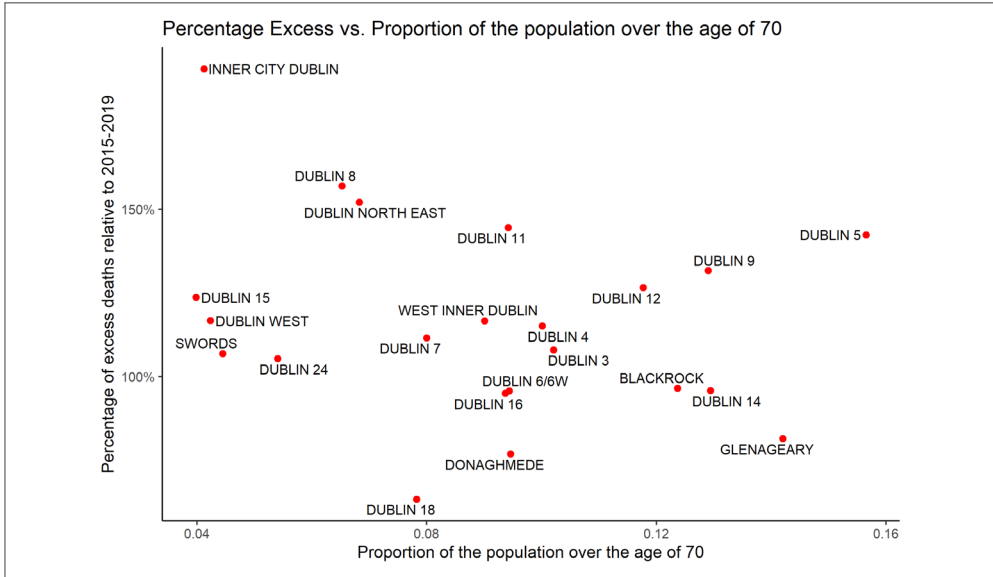


Figure 6: Percentage of excess notices posted onto RIP.ie plotted against districts with a high proportion of the population over 70 years old.

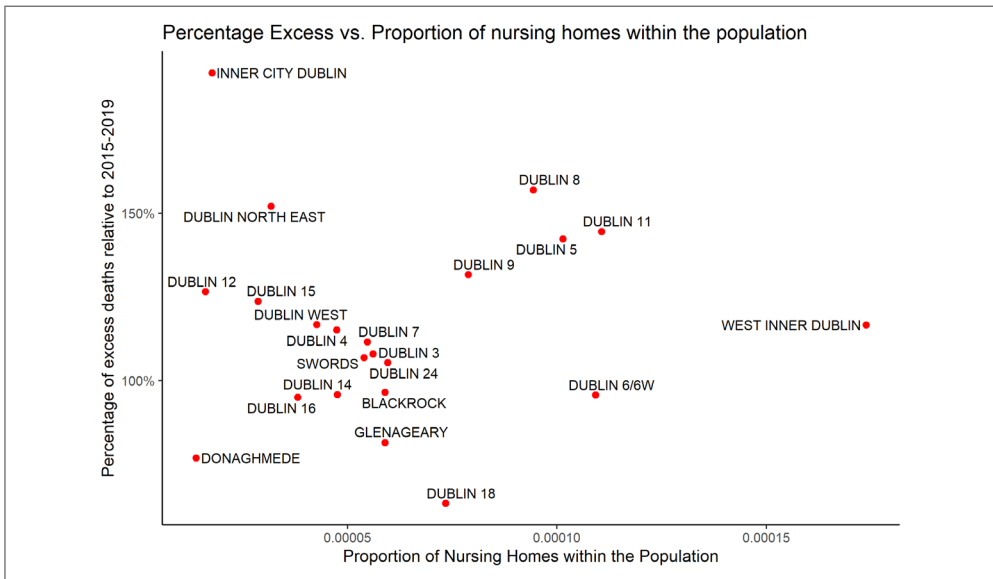


Figure 7: Percentage of excess notices posted onto RIP.ie plotted against the proportion of nursing homes within the population of each Dublin district.

Figure 7 plots the percentage of excess deaths relative to 2015-2019 against the proportion of nursing homes reporting Covid-19 deaths within the population of each district. The correlation between the two variables returned a value of 0.01, indicating no linear relationship (p-value: 0.949). Given that nursing homes may draw their residents from across the city, and the heterogenous location of those homes, this may also explain that limited association.

Conclusions

From our examination of factors that may affect levels of Covid-related mortality in Dublin, we have quantitatively established that social inequalities that persist throughout districts in Dublin have a statistically significant influence on mortality levels related to Covid-19. The significant relationship that exists between Covid-related mortality and area deprivation confirms that Covid-19 has differential impacts on Dublin's population depending on residential location. This suggests that approaches to combat the impacts of Covid-19 in Dublin should take into consideration the socio-economic dynamics that exist throughout the county's four authorities.

One fundamental problem is that restrictions set up to effectively avoid contracting the virus automatically shield the portion of population that are socially and economically more privileged. Yet the remainder of the population that reside in more deprived districts, who are less able to adapt to restrictions, are disregarded and more likely to be seriously impacted by the effects of the virus. An additional caveat is that usage of rip.ie amongst migrant communities is not widespread and they may not be fully represented. For one worker with a stable, well-paying job, restrictions may mean working from home and being protected from the virus. For another worker, restrictions may not provide such security and they may face the choice of going to work, and increasing their risk of contracting the virus, or staying at home and sacrificing their income. Ongoing research that continues to track these inequalities, and their very specific spatial expression, will continue to be necessary, both in the short-term, to provide better protection in further waves, and also to track ongoing and longer-term impacts that shape spatial justice over the next decades (Kearns *et al.*, 2014)

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References

- Bambra, C., Riordan, R., Ford, J. and Matthews, F., 2020.** The COVID-19 pandemic and health inequalities. *Journal of Epidemiology and Community Health*, 74(11), 964-8, <http://dx.doi.org/10.1136/jech-2020-214401>.
- Central Statistics Office, 2020.** Measuring Mortality Using Public Data Sources. <https://www.cso.ie/en/releasesandpublications/br/b-mpds/measuringmortalityusingpublicdatasources/> (accessed 16 November 2020).
- Cullen, P. & Holland, K., 2020.** Nursing or care homes account for almost 60% of coronavirus-related deaths, *The Irish Times* [online] 21 April 2020. Available at: <https://www.irishtimes.com/news/health/nursing-or-care-homes-account-for-almost-60-of-coronavirus-related-deaths-1.4233679> (accessed 24 September 2020).
- Finch, W.H. and Hernández-Finch, M.E., 2020.** Poverty and Covid-19: Rates of Incidence and Deaths in the United States During the First 10 Weeks of the Pandemic. *Frontiers in Sociology*, 5:47, <https://doi.org/10.3389/fsoc.2020.00047>.
- Kamel Boulos, M. and Geraghty, E., 2020.** Geographical tracking and mapping of coronavirus disease COVID-19/severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic and associated events around the world: how 21st century GIS technologies are supporting the global fight against outbreaks and epidemics. *International Journal of Health Geographics*, 19, 8. <https://doi.org/10.1186/s12942-020-00202-8>.
- Kearns, G., Meredith, D. and Morrissey, J. (eds), 2014.** *Spatial Justice and the Irish Crisis*. Dublin, Royal Irish Academy.
- Lawton, P. and Punch, M., 2014.** Urban governance and the 'European City': Ideals and realities in Dublin, Ireland, *International Journal of Urban and Regional Research*, 38 (3): 864-85, <https://doi.org/10.1111/1468-2427.12152>.
- Rolleston, R. and Galea, S., 2020.** *The Coronavirus Does Discriminate: How Social Conditions are Shaping the Covid-19 Pandemic* [online]. Available at: <http://info.primarycare.hms.harvard.edu/blog/social-conditions-shape-covid> (accessed 24 September 2020).
- Our World in Data, 2020.** *A pandemic primer on excess mortality statistics and their comparability across countries* [online]. Available at: <https://ourworldindata.org/covid-excess-mortality> (accessed 24 September 2020).
- Rigby, J. E., Boyle, M. G., Brunsdon, C., Charlton, M., Dorling, D., French, W., Noone, S. and Pringle, D., 2017.** Towards a geography of health inequalities in Ireland. *Irish Geography*, 50(1), 37-58, <http://dx.doi.org/10.2014/igj.v50i1.1263>.

Endnotes

- ¹ It is important to note that all other locations without an 'old' Dublin City district code were traditionally recorded as County Dublin. These now have separate 3-digit Eircodes, e.g., Balbriggan and Skerries are K34, but are merged in Table 1.