



COVID-19 deaths in Irish Nursing Homes: exploring variation and association with the adherence to national regulatory quality standards

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1. Summary

The study:

- The COVID-19 pandemic has disproportionately affected nursing home residents worldwide, with Ireland having one of the highest reported proportions of COVID-19 deaths in this setting.
- In Ireland, the publication of a 'league table' of crude number of deaths in affected care facilities sparked controversy on grounds of being potentially inaccurate and unhelpful.
- We reviewed published unofficial mortality data together with official data on quality standards published by the Irish regulator.

Findings:

- There was substantial disagreement between the crude number of deaths and the mortality proportion per 100 beds.
- The association between crude number of deaths and maximum occupancy was significant with a moderate effect size (Spearman's $\rho = 0.38$, $p < 0.001$, $n = 146$).
- We found no significant association between occupancy-adjusted mortality and percentage of non-compliance with inspection standards (Spearman's $\rho = -0.09$, $p = 0.315$, $n = 140$). Specifically, we found no association between compliance with staffing, governance/management, premises and infection control.
- There was a mildly significant association between higher compliance with staff training and higher occupancy-adjusted mortality. A multivariate regression analysis on $n = 140$ suggested a mild effect of higher overall non-compliance with lower adjusted mortality.
- This might seem counterintuitive, but a hypothesis is that perhaps higher mortality centres cater for more complex and vulnerable residents and hence may invest more in staff education and development. The data from which this report is based is not nuanced enough to test this hypothesis and a full understanding would require detailed case-mix data.

Discussion:

- League tables with crude COVID-19-related nursing home deaths are likely to be unhelpful and data should at least be adjusted for the size of the facilities. Even in the latter case, extrapolation to quality of care is likely to be inappropriate. Much research is needed to shed light into this complex topic and for this we urgently need a minimum dataset for care homes in Ireland.

2. Background

The COVID-19 pandemic has disproportionately affected nursing homes residents worldwide, with Ireland having one of the highest reported proportions of COVID-19 deaths in this setting (62%), a figure so far surpassed only by Canada (82%).^{1,2}

On the 28th of May 2020, the Irish Times published a breakdown of 1,030 deaths in 167 Irish facilities caring for older people across the country, including community hospitals, long-stay units, residential institutions and nursing homes. The figures were reported to have been obtained from the Irish Health Service Executive, include those who died with both suspected and confirmed cases of COVID-19, and being up to date as of 26th May 2020.³

The publication of this 'league table' of crude number of deaths sparked controversy, with some nursing homes claiming that the data was inaccurate.⁴ Geriatricians expressed in social media that such approach was disappointing, unhelpful and a potential cause of further anxiety for those with relatives in those nursing homes, as well as for staff caring for them;⁵ and that labelling nursing homes as "good" or "bad" or engaging in "blame games" may be futile and does not help nursing homes recover; indeed, why some nursing homes seem to be affected more than others is complex and unclear, and we owe it to residents, families and staff in those nursing homes to try to understand these factors.⁶ Indeed, it is not clear if the crude number of COVID-19-related deaths in nursing homes says anything about the quality of the care provided to the residents of these facilities.

The crude number of deaths reported in the league table was not, for example, adjusted for the number of beds in each nursing home. In addition, there was no attempt to match the deaths data to publicly available data on compliance by these centres with official quality standards, as reported in the Health Information and Quality Authority (HIQA) inspection reports.⁷ For example, quality dimensions that may be related to the proportion of COVID-19 deaths in nursing homes could include suitable and safe staffing; staff training and development; governance and management; safe and suitable premises; and infection control standards.

To help alleviate the controversy and highlight potential unintended consequences of crude reporting of mortality data, the aim of this report was to provide estimates on number of COVID-19 deaths per 100 nursing home beds, and in addition correlate the latter indicator to the latest information available on quality standards for each nursing home.

¹ <https://ltccovid.org/wp-content/uploads/2020/05/Mortality-associated-with-COVID-21-May-7.pdf>

² <https://www.irishtimes.com/news/health/ireland-has-one-of-the-highest-rates-of-covid-19-deaths-in-care-homes-in-world-1.4260140>

³ <https://www.irishtimes.com/news/ireland/irish-news/the-human-cost-of-covid-19-ireland-s-care-homes-with-the-most-deaths-revealed-1.4264170>

⁴ <https://www.irishtimes.com/news/ireland/irish-news/the-human-cost-of-covid-19-ireland-s-care-homes-with-the-most-deaths-revealed-1.4264170>

⁵ <https://twitter.com/lilycogan/status/1266009753886642177>

⁶ <https://twitter.com/SPKennelly/status/1266657207158018048>

⁷ <https://www.hiqa.ie/reports-and-publications/inspection-reports>

3. Methodology

The type of facility and crude mortality data were taken directly as published in the Irish Times interactive map.⁸

For each of the 167 facilities named in the Irish Times map, a search was conducted on the website of the Irish Health Information and Quality Authority (HIQA)⁹ and the maximum occupancy figure was taken from each facility's general description.

A maximum occupancy-adjusted COVID-19 mortality proportion was calculated by multiplying the Irish Times crude number * 100 and dividing it by the maximum occupancy figure. This provides an estimate of the number of deaths per 100 beds in each facility.

For each facility, we then retrieved the latest available HIQA Inspection Report and collected the following information:

- Date of inspection
- Date of publication of the inspection report
- Number of residents on the date of inspection
- Number of outcomes/regulations that were inspected against
- Number of outcomes/regulations found to be non-compliant
- A non-compliance ratio was calculated for each facility by multiplying the number of non-compliant items * 100, and dividing it by the total number of items inspected
- Where specifically reported, we also collected level of compliance (not compliant, compliant, substantially compliant) on the following:
 - Suitable and safe staffing
 - Staff training and development
 - Governance and management
 - Safe and suitable premises
 - Infection control standards

We ranked the 20 facilities with the highest estimated number of deaths per 100 beds and compared this with the published list of the 20 facilities with the highest total number of deaths.

Continuous variables were visualised with histograms and their normality was tested with the 1-sample Kolmogorov-Smirnoff test. Descriptive statistics were given as mean with standard deviation (SD), median with interquartile range (IQR), or percentage.

The association between two non-normally distributed continuous variables was visualised by means of a scatter plot, and tested statistically by means of the non-parametric two-sided Spearman's rank correlation coefficient. The associations between specific compliance levels and deaths per 100 beds were visualised by means of box-and-whiskers plots and also tested statistically with the Spearman's coefficient. As regards the effect size of the correlation coefficient, 0.00-0.29 was considered mild, 0.30-0.59 moderate and 0.60-1.00 strong.

⁸ <https://www.irishtimes.com/news/ireland/irish-news/the-human-cost-of-covid-19-ireland-s-care-homes-with-the-most-deaths-revealed-1.4264170>

⁹ <https://www.hiqa.ie/find-a-centre>

A multivariate binary logistic regression model was computed to predict the outcome of at least 10 deaths per 100 beds, with the following predictors: type of facility (dummied) and non-compliance ratio. A second multivariate logistic regression model added specific non-compliance with staffing, staff training/development, governance/management and premises.

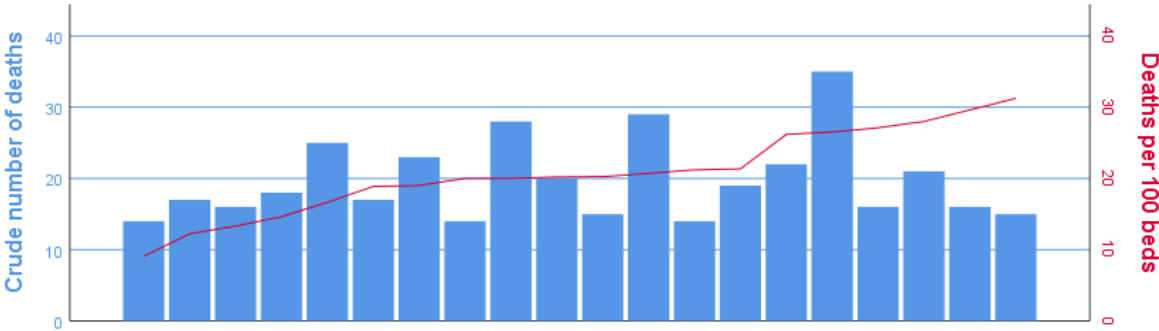
In all statistical analyses, the threshold for significance was set at $p < 0.05$. Missing data was reported as such and not imputed.

4. Results

Of the 167 facilities reported in the Irish Times map, 132 (79.0%) were classified as a Nursing Home, 22 (13.2%) as a Residential Institution, and 13 (7.8%) as a Community Hospital/Long-stay Unit.

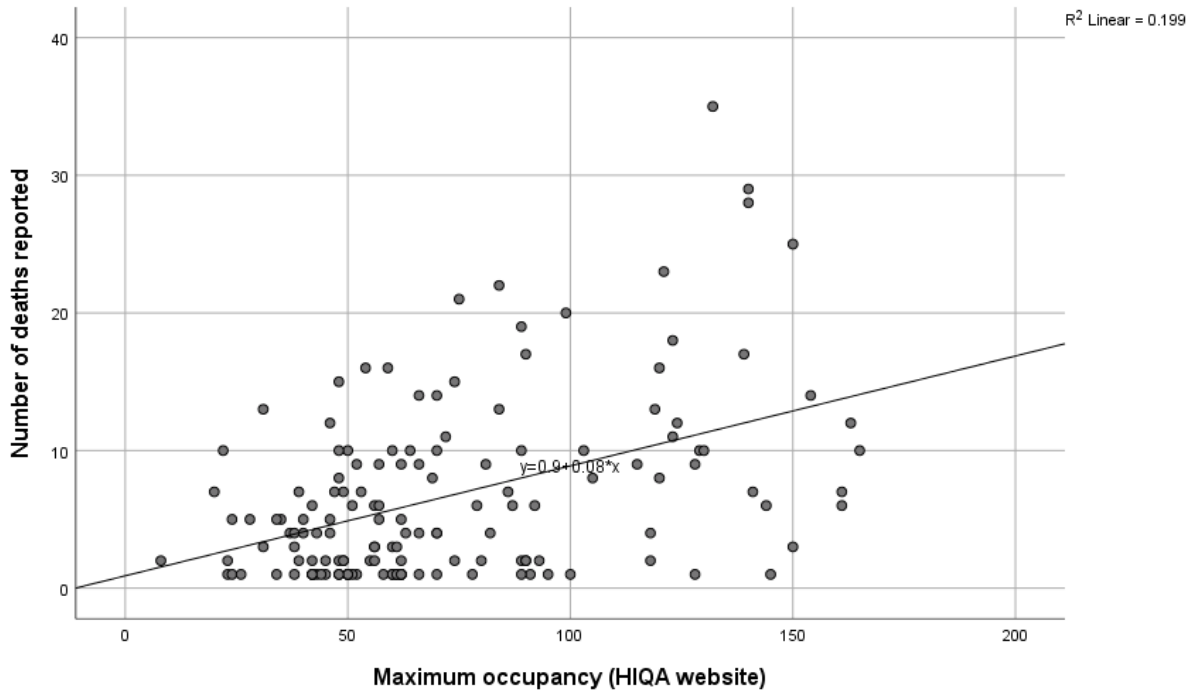
The visual relationship between the total number of deaths and deaths per 100 beds in the twenty facilities reported by the Irish Times to have the highest number of deaths is presented in Figure 1.

Figure 1. Visual relationship between the total number of deaths and deaths per 100 beds in the twenty facilities reported by the Irish Times to have the highest number of deaths.



From the HIQA website, we could retrieve maximum occupancy information for 146 centres. The mean (SD) maximum occupancy was 72.9 (36.5) beds (range 8 – 165). Figure 2 shows the scatterplot between number of deaths and maximum occupancy in $n=146$.

Figure 2. Scatterplot between number of deaths and maximum occupancy in n=146.

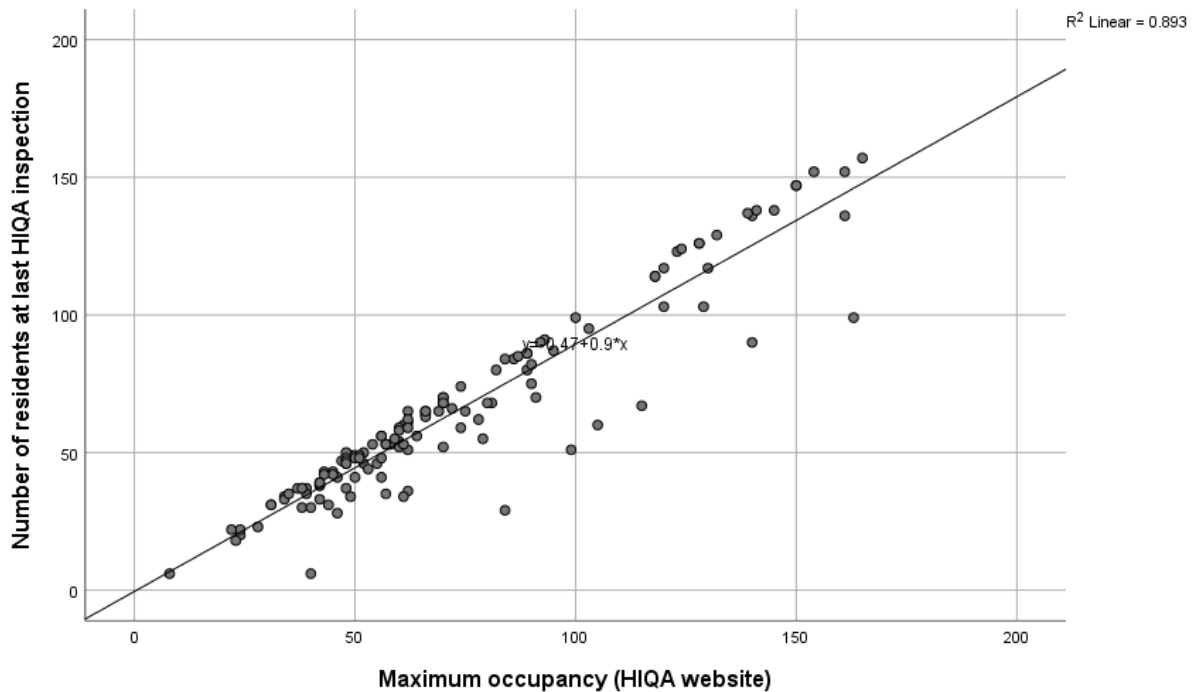


As per two-tailed non-parametric Spearman's rank correlation coefficient, the association between number of deaths and maximum occupancy was significant and of moderate strength (Spearman's rho= 0.38, $p < 0.001$).

From the original Irish Times list of 167 facilities, we could only retrieve a HIQA inspection report for 140 (83.8%). Of the 27 facilities without a HIQA inspection report, 14 were classified by the Irish Times as a Residential Institution and further 2 as a Community Hospital/Long-stay Unit.

Figure 3 shows the relationship between maximum occupancy and the number of residents reported in the HIQA inspection reports ($n=140$, Spearman's rho = 0.93, $p < 0.001$).

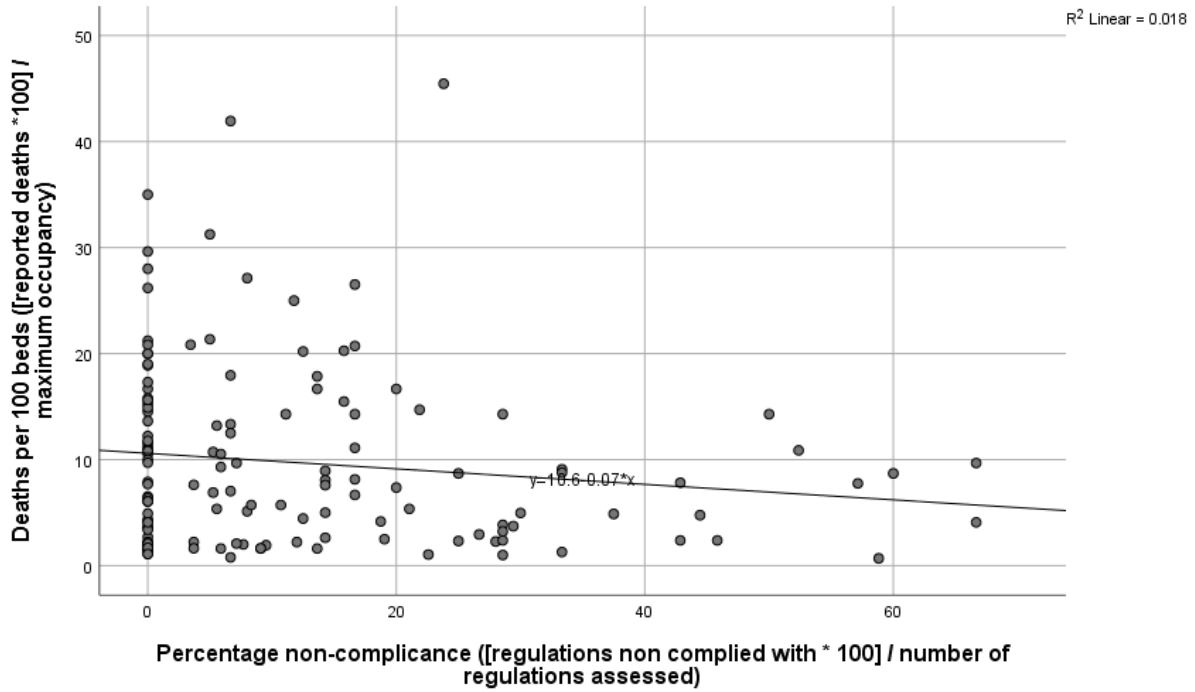
Figure 3. Relationship between maximum occupancy and the number of residents reported in the HIQA inspection reports (n=140).



In terms of the number of outcomes/regulations assessed during the 140 inspections, the mean was 16.0 (SD 7.2, range 5 – 32). Facilities had a mean non-compliance of 1.7 items (SD 2.2, range 0 – 11), with a median of 1 item (IQR 3). The mean percentage non-compliance was 12.1 (SD 15.7, range 0 – 67), with a median of 7 (IQR 17).

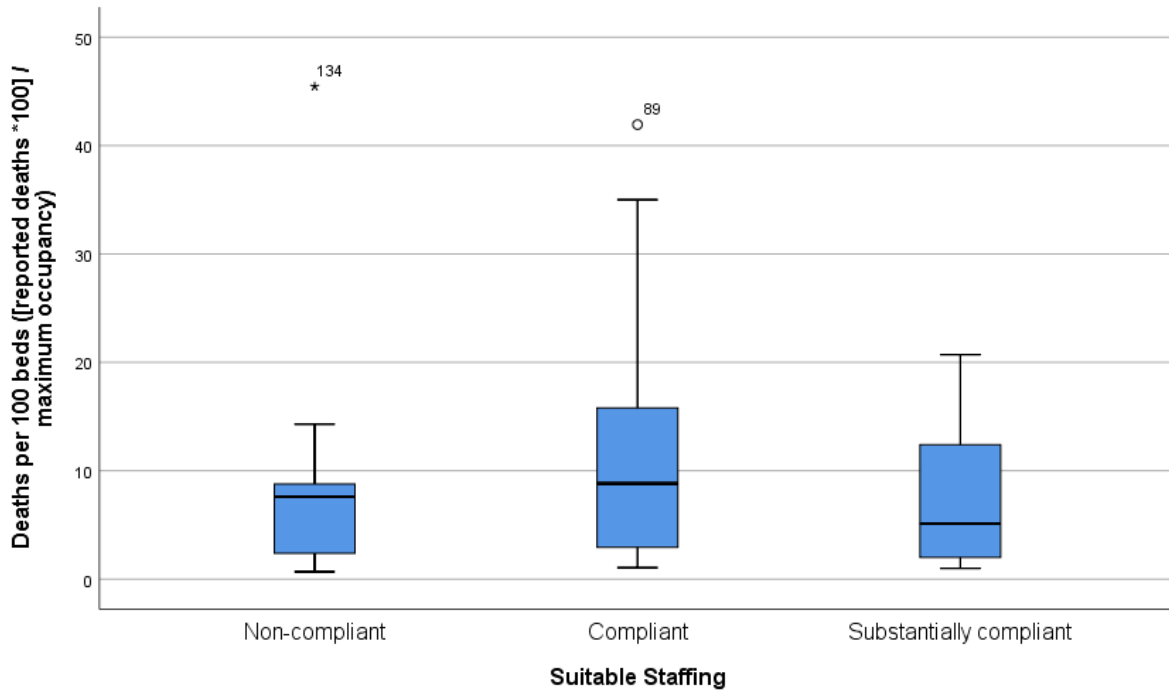
Figure 4 shows the relationship between occupancy-adjusted mortality and the non-compliance percentage (n=140). This association was not statistically significant (Spearman’s rho = -0.09, p=0.315).

Figure 4. Relationship between occupancy-adjusted mortality and non-compliance percentage.



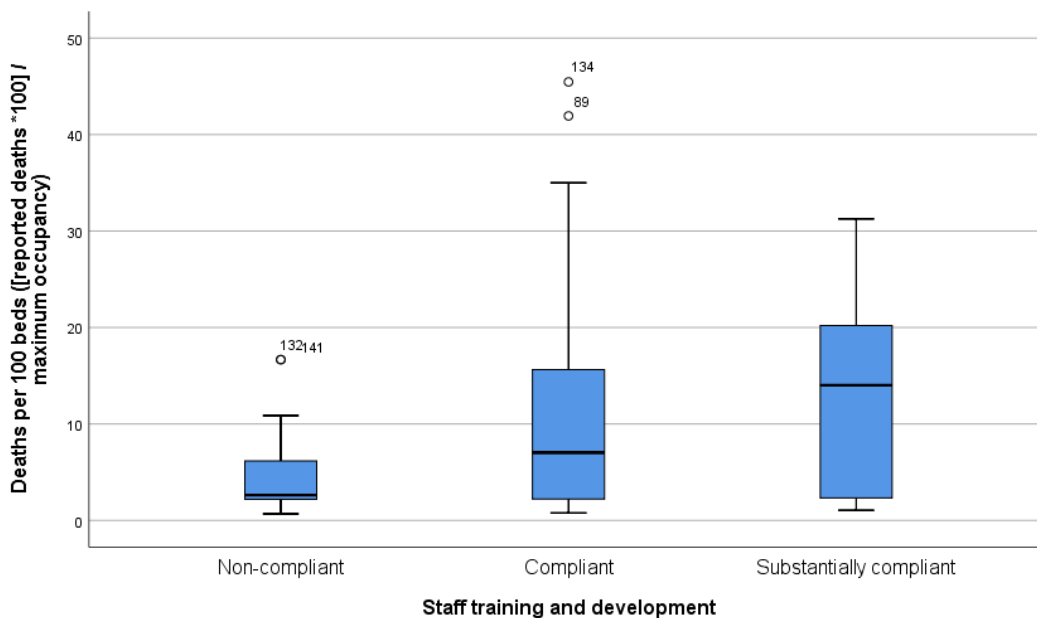
In terms of specific compliance with suitable staffing, data was specifically reported for 135 (96.4%) facilities. 17 were non-compliant, 94 compliant and 24 substantially compliant. There was no statistically significant association between this standard and occupancy-adjusted mortality (Spearman's rho = -0.05, p=0.548, Figure 5).

Figure 5. No statistically significant association between staffing compliance and occupancy-adjusted mortality (n=135).



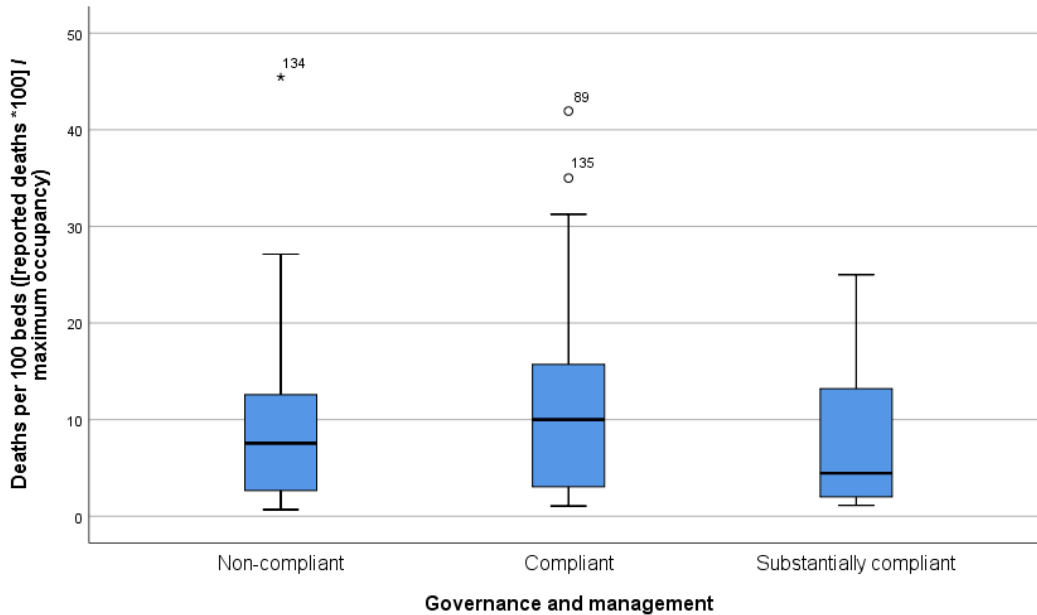
As regards specific compliance with staff training and development, data was specifically reported for 98 (70.0%) facilities. 15 were non-compliant, 65 compliant and 18 substantially compliant. There was a statistically significant association between this standard and occupancy-adjusted mortality, with higher compliance associated with higher mortality (Spearman’s rho = 0.22, p=0.032, Figure 6).

Figure 6. Mild statistically significant association between compliance with staff training/development and occupancy-adjusted mortality (n=98).



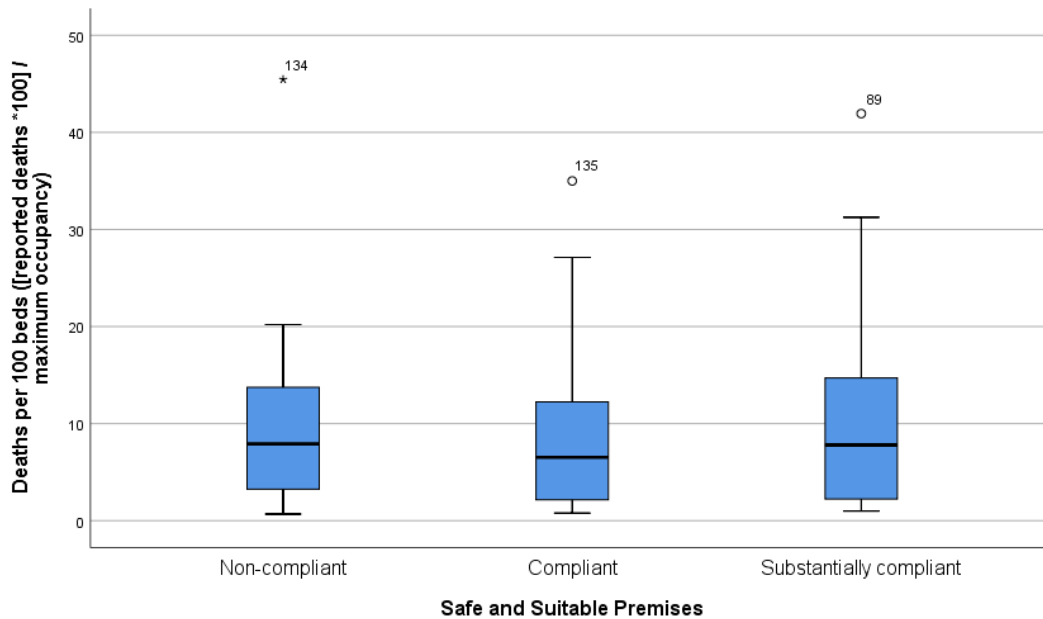
As regards specific compliance with governance/management, data was specifically reported for 116 (82.9%) facilities. 24 were non-compliant, 63 compliant and 29 substantially compliant. There was no statistically significant association between this standard and occupancy-adjusted mortality (Spearman's rho = -0.07, p=0.487, Figure 7).

Figure 7. Lack of association between compliance with governance/management and occupancy-adjusted mortality (n=116).



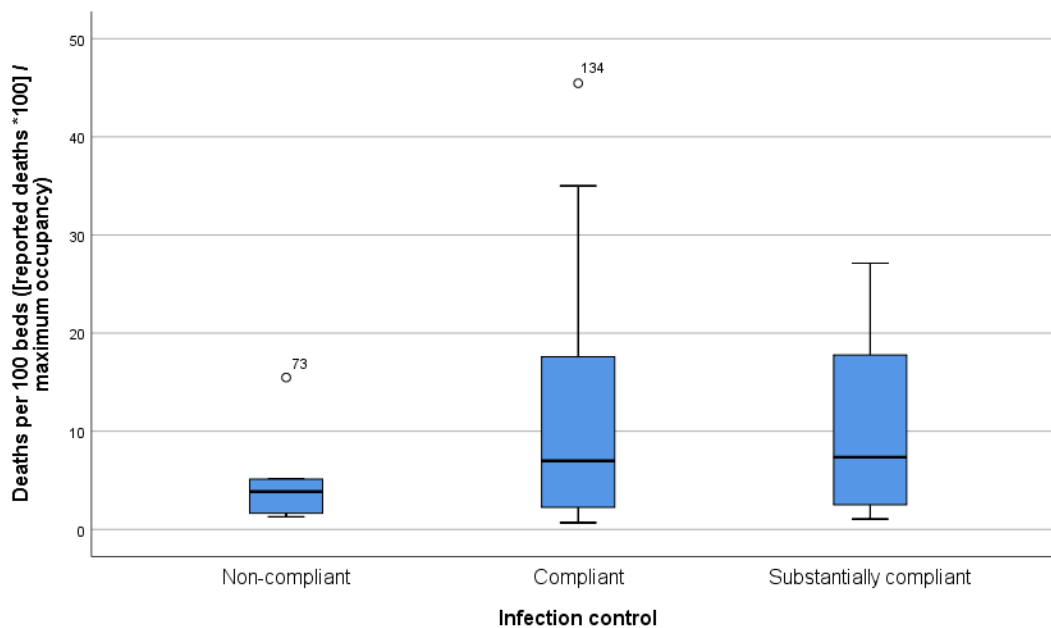
As regards specific compliance with safe and suitable premises, data was specifically reported for 129 (92.1%) facilities. 32 were non-compliant, 53 compliant and 44 substantially compliant. There was no statistically significant association between this standard and occupancy-adjusted mortality (Spearman's rho = 0.02, p=0.826, Figure 8).

Figure 8. Lack of association between compliance with safe/suitable premises and occupancy-adjusted mortality (n=129).



Finally, as regards specific compliance with infection control, data was only available for 56 (40.0%) facilities. 5 were non-compliant, 40 compliant and 11 substantially compliant. There was no statistically significant association between this standard and occupancy-adjusted mortality (Spearman's rho = 0.09, p=0.527, Figure 9).

Figure 9. Lack of association between compliance with infection control and occupancy-adjusted mortality (n=56).



57 out of 146 facilities had at least 10 deaths per 100 beds. A multivariate logistic regression analysis aimed to predict this outcome in n=140 with the following: facility type (dummed) and percentage non-compliance. The results of this model are shown in Table 1 below, and suggest that higher non-

compliance with standards was marginally associated with lower mortality ($p=0.019$), adjusting by centre type.

Table 1. Multivariate binary logistic regression model predicting at least 10 deaths per 100 beds (n=140).

	Odds Ratio (OR)	95% confidence interval for OR		p
		Lower	Upper	
Nursing Home	1.14	0.20	6.63	0.888
Community Hospital/Long Stay Unit	1.58	0.19	12.90	0.669
Percentage non-compliance	0.97	0.94	0.99	0.019

A more detailed model including the predictors in Table 2 could only include n=86, and in this model no significant predictors were found.

Table 2. Multivariate binary logistic regression model predicting at least 10 deaths per 100 beds (n=86).

	Odds Ratio (OR)	95% confidence interval for OR		p
		Lower	Upper	
Nursing Home	2.30	0.20	26.32	0.504
Community Hospital/Long Stay Unit	3.18	0.18	55.95	0.430
Percentage non-compliance	0.94	0.86	1.02	0.136
Non-compliant with staffing	2.12	0.21	21.44	0.526
Non-compliant with staff training and development	0.49	0.08	2.87	0.429
Non-compliance with governance and management	1.61	0.30	8.73	0.584
Non-compliant with premises	1.82	0.42	7.94	0.429

5. Discussion

This secondary analysis of publicly available data has shown that the association between the number of deaths reported in each facility by the Irish Times and their maximum occupancy was significant and of moderate strength. The reporting of occupancy-adjusted rather than crude mortality figures could avoid potentially inappropriate “naming and shaming”.

A review of the available HIQA inspection reports suggests that most centres were running at near maximum occupancy and there was a good level of compliance with standards across the board. We found no significant association between occupancy-adjusted mortality and overall percentage of non-

compliance with standards. Specifically, there seemed to be no significant association between compliance with staffing, governance and management, safe and suitable premises and infection control, although for some of the latter associations the numbers were significantly smaller (especially for infection control).

On bivariate analyses, there seemed to be a mildly significant association between higher compliance with staff training/development and higher occupancy-adjusted mortality. The regression analysis on n=140 also suggested a mild effect of higher overall non-compliance in predicting lower adjusted mortality. This might seem counterintuitive, but a hypothesis is that perhaps centres that cater for the most complex and vulnerable residents may invest more in staff education. It is important to emphasise that the data from which this report is based is not nuanced enough to test this hypothesis and a better understanding would require detailed case-mix information.

This report doesn't capture some key information which may be specific to this pandemic, and may have influenced site-specific mortality rates. It is likely that nursing homes who recorded their first cases earlier in the pandemic had poorer outcomes than those who did it later due to issues regarding knowledge of the virus including potential for asymptomatic spread and atypical symptoms; and also, higher community transmission rates in the areas surrounding nursing homes likely meant higher staff infection rates despite best efforts. Issues regarding access to testing and personal protection equipment were all more pronounced early in the pandemic, as the entire health service struggled to adjust. Furthermore, as result of many nursing homes (especially private) existing outside the traditional community/primary care/acute hospital national health service model, there were limited communication channels to escalate issues at local and national level to address these unprecedented needs.

This report does suggest that even when in compliance with the regulations, this model of care is inherently flawed and exposed in the context of a brutal viral pandemic. This pandemic must result in a detailed review of the current model of care provision for older people who require support to maintain their daily living activities. Most people would like this to be provided in their own homes, and if that becomes no longer possible, they wish it to be provided in their own communities with as much autonomy preserved as is possible. Early epidemiological studies have suggested that long-term care facilities with supportive living "own-door" model have fared much better compared to traditional multi-occupancy buildings.¹⁰

There are important limitations to this report. The deaths data were extracted from the Irish Times map and this source cannot be regarded as official, although they were reported as having been retrieved from the national Health Service Executive. The Irish Times acknowledged that data include those who died with both suspected and confirmed cases, and that the final figures on deaths and confirmed cases are produced by the State's Health Protection Surveillance Centre.¹¹ Additional limitations of this report include its observational nature and some significant proportions of missing data. Therefore, any causal conclusions from this report would be inappropriate.

A further possible conclusion of this analysis is that the here-to-fore HIQA standards which nursing homes are largely adhering to, need reflection and revision in light of the learnings we can take forward from this first wave of the pandemic. In response to the disproportionate impact of COVID-19 related mortality in Irish long-term care settings, the minister for health announced the establishment of an

¹⁰ <https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2766448>

¹¹ <https://www.irishtimes.com/news/ireland/irish-news/the-human-cost-of-covid-19-ireland-s-care-homes-with-the-most-deaths-revealed-1.4264170>

expert panel to examine national and international measures. One would hope an important focus would be in identifying the necessary regulation modifications required to ensure nursing homes have guidance to put in place the best possible mitigation practices to support and protect their residents in the context of this pandemic and the annual flu-season outbreaks which also result in hundreds of deaths each year in nursing homes.

In conclusion, league tables with crude COVID-19-related nursing home deaths are likely to be unhelpful and data should at least be adjusted for the size of the facilities. Even in the latter case, extrapolation to quality of care according to the current HIQA guidance is likely to be inappropriate. Much more research is needed to shed light into this complex topic and for this we urgently need a minimum dataset for care homes in Ireland.