Rising Emergency Admission and Readmission Rates—a Retrospective Study of Demographic and Socio-economic Factors

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INTRODUCTION

Emergency hospital admissions have been rising over time[1]; the precise reasons have been debated. A lowered threshold to admit, or changing demographic population structures have been proposed as explanations.[2] Our institution established an acute medical admission unit in 2002 and its performance in relation to clinical outcomes has been well described.[3] We have developed a risk score that is related exponentially to 30-day in-hospital mortality; this estimates acute illness severity and case complexity using both laboratory (multiple-variable fractional polynomial method[4]) and blood culture data supplemented by case complexity estimates calculated from discharge codes (ICD9/ICD10)—Charlson Comorbidity Index and the Chronic Disabling Score. From such determinants, we can assess temporal change in case acuity or complexity, and relate these to admission thresholds.[5] Our study's purpose was to examine16 years of acute medical admissions (2002–2017) at St. James' Hospital, Dublin, to investigate how the incidence rates for emergency medical admissions might have changed over time and to relate such to socio-economic and societal structural changes.

METHODS

St. James's Hospital, Dublin, serves as a secondary care centre for emergency admissions. This was a retrospective cohort study using anonymised, aggregated data collected between 2002 and 2017 for all acute unselected medical admissions (106,586 episodes in 54,928 patients). According to the Republic of Ireland census (Central Statistical Office), the catchment area population, measured in 2006, was 210,443 persons, with a median population per electoral division (the smallest reporting unit) of 2845 (IQR 2020–3399). Deprivation metrics, developed by the Small Areas Health Research Unit (SAHRU) of Trinity College Dublin, were used to derive a deprivation score.[6]

Descriptive statistics were calculated for background demographic data. Comparisons between categorical variables and mortality were made using chi-square. We employed a logistic multiple-variable model with robust estimate to allow for clustering; the correlation matrix thereby reflected the average dependence among the specified correlated observations. We included in the initial model, potential mortality predictors that were significant univariate predictors ($p < 0.1$ by Wald test). For admission and readmission incidence rate estimates (Poisson regression), we adjusted the data for local demographic constructs (deprivation index based on small area statistics of unemployment, social class, type of housing tenure and car ownership), proportion of population that were > 65 years (elderly dependency rates), family structures (lone parent) and level of education (primary, secondary or tertiary).

In the multi-variable model (Poisson), we adjusted univariate estimates of effect, using the previously described outcome predictor variables (Stata v.15, Stata Corporation, College Station, TX).

RESULTS

The average age at admission increased over time (≤ 2010) from 66.8 years to (≥2010) 68.7 years. Admission incidence rates between the two periods increased on average from 30.5/1000 population (95% CI 30.2–30.7) to 33.5 (95% CI 33.3–33.8) (Table 1 and Fig. 1). This represents a 9.8% increase on average over an approximate 8-year period, and together with population change, would increase emergency admissions on average from 7807 patients (95% CI 6727–9036) in 2009 to 8823 patients (95% CI 7610–10,236) in 2017. The illness acuity and case complexity for admissions during the two time periods appeared comparable (risk score identical at 11 (IQR 8–13) ($p = 0.12$)). Adjusting the data for the population, proportion between 75 and 80 years IRR 1.17 (95% CI 1.16–1.18) and 80–85 years IRR 1.06 (95%CI: 1.05–

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Table 1 Characteristics of Emergency Medical Admission Episodes by Time Split

Factor	Level	< 2010	> 2010	*p* value
Number		35,609	42,331	
Gender	Male	17,380 (48.8%)	20,321 (48.2%)	0.089
	Female	18,229 (51.2%)	21,842 (51.8%)	
Outcome	Alive	33,156 (93.1%)	39,912 (94.7%)	< 0.001
	Died	2453 (6.9%)	2251 (5.3%)	
Age, median (IQR)		66.8 (46.4–78.6)	68.7 (49.8–81.2)	< 0.001
Length of stay (days)		6.2 (2.7–13.8)	6.1 (2.7–13.8)	0.65
Admission incidence		30.5 (30.2–30.7)	33.5 (33.3–33.8)	< 0.001
Acute illness severity	1	746 (2.3%)	1034 (2.7%)	< 0.001
	2	1925 (5.9%)	2136 (5.5%)	
	3	3434 (10.5%)	3850 (9.9%)	
	4	5075 (15.5%)	5728 (14.7%)	
	5	6568 (20.0%)	7472 (19.2%)	
	6	15,040 (45.9%)	18,623 (47.9%)	
Charlson Index	0	13,766 (38.7%)	18,145 (43.2%)	< 0.001
	1	9315 (26.2%)	13,028 (31.0%)	
	2	12,528 (35.2%)	10,852 (25.8%)	
Disabling disease	0	3384 (9.5%)	3628 (8.6%)	< 0.001
	1	7631 (21.4%)	9234 (21.9%)	
	2	9828 (27.6%)	12,038 (28.6%)	
	3	8125 (22.8%)	10,204 (24.2%)	
	4	6641 (18.6%)	7059 (16.7%)	
Sepsis status	0	25,568 (71.8%)	31,636 (75.0%)	< 0.001
	1	8250 (23.2%)	8772 (20.8%)	
	2	1791 (5.0%)	1755 (4.2%)	

LOS length of stay, MDC major disease category, IQR inter-quartile range

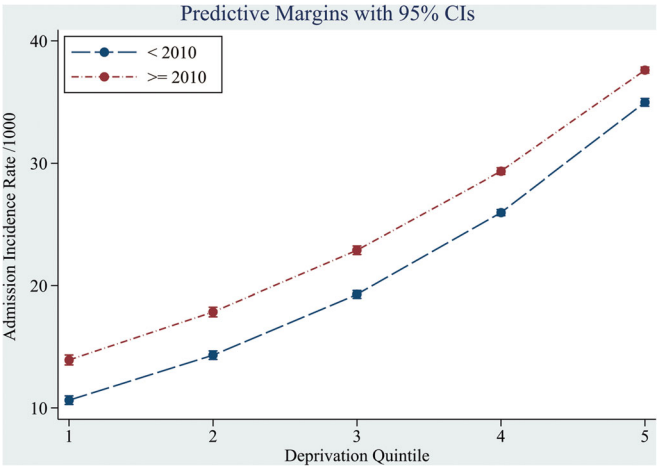

Figure 1 The hospital admission incidence (rate/1000 population) was strongly influenced by the deprivation status. The data is for catchment small areas (DED) ranked from low Q1 to high Q5 deprivation. The predicted probabilities were derived from the multiple-variable truncated Poisson model; the effect is plotted based on the latter prediction. The admission incidence rate was consistently higher in the second period after adjustment for socio-economics, elderly dependency, family structure and educational status.

1.08) did not materially alter the calculated incidence admission rates.

CONCLUSION

There has been a small but sustained increase in hospital emergency medical admission and readmission rates that is unrelated to admission thresholds, population age structure or socio-economic status. An increase in longevity with an expanded population 'at-risk' is the most likely explanation for these increases.

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Compliance with Ethical Standards:

Conflict of Interest: *The authors declare that they have no conflict of interest.*

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