Health Policy 121 (2017) 923–928

Contents lists available at ScienceDirect

Health Policy

journal homepage: www.elsevier.com/locate/healthpol

The ageing society and emergency hospital admissions

Raphael Wittenberg*, Luke Sharpin, Barry McCormick, Jeremy Hurst

Centre for Health Service Economics and Organisation, Nuffield Department of Primary Care Health Sciences, Radcliffe Observatory Quarter, Woodstock Road, Oxford OX2 6GG, United Kingdom

ARTICLE INFO

Article history:
Received 7 October 2016
Received in revised form 4 May 2017
Accepted 15 May 2017

Keywords:
Emergency admissions
Older people
Ageing
Cohort effect

ABSTRACT

There is strong policy interest, in England as elsewhere, in slowing the growth in emergency hospital admissions, which for older people increased by 3.3% annually between 2001/2 and 2012/3. Resource constrains have increased the importance of understanding rising emergency admissions, which in policy discourse is often explained by population aging. This study examines how far the rise in emergency admissions of people over 65 was due to population ageing, how far to the changing likelihood of entering hospital at each age, and how far to other factors which might be more amenable to policy measures. It shows that: admission rates rose with age from age 40 upward but each successive birth cohort experienced lower emergency admission rates after standardising for age and other effects. This downward cohort effect largely offset the consequences of an older and larger population aged over 65. Other factors which could explain increasing admissions, such as new technologies or rising expectations, appear more important than the changing size and age structure of the population as drivers of rising emergency admissions in old age. These findings suggest that stemming the rate of increase in emergency admissions of older people may be feasible, if challenging, despite population ageing.

1. Introduction section

Emergency inpatient care of older people is an issue of considerable policy concern in England as in other countries. For example, recent Department of Health policy goals include "a measurable reduction in age standardised emergency admission rates and emergency inpatient bed-day rates" by 2020 [1], while the Department of Health 2016 Shared Delivery Plan [2] comments that "Improved care in out-of-hospital settings is expected to lead to reduced need for emergency admissions to hospital, and to shorter stays for those who are admitted, and hence a fall in the number of emergency bed days per head of population".

Inpatient hospital care can be highly effective; but it is also very costly and may not be in the interests of patients' quality of life if treatment elsewhere is feasible. Despite the concerns of policy makers, the numbers of emergency hospital admissions in England have been rising for at least the last 25 years, at times rapidly and at times more slowly. The National Beds Inquiry [3] reported that emergency admissions per head increased by 2.1% per year between 1989 and 1998 for the whole population and by 3.0% per year for the older population (age 65 and over). The Nuffield Trust [4] found that emergency admissions among the overall population rose by 2.8% per year between 1998/9 and 2008/9, implying a rate of 2.3% per head per year.

Increases in emergency hospital admissions are not peculiar to England. In the USA the numbers of emergency admissions via emergency departments involving at least one overnight stay rose by 3.2% per year between 1993 and 2006, which implies an average annual rise of some 2.2% in the rate per head [5].

The key question this article addresses is how far the rise in emergency admissions of older people (aged 65 and over) is due to population ageing and how far to other factors. This is very relevant for the future financing and planning of emergency care. If the rise is due mainly to population ageing, it will inevitably continue over the coming decades as the rise in numbers of older people accelerates. If it is due mainly to other factors, or if the impact of ageing is at least partially offset by other factors, there may be greater prospect of slowing the rise in emergency admissions.

The number of people aged 65 and over in England rose from 7.8 million in 2001 to 9.1 million in 2012, and is projected to reach 10.6 million in 2020 and 13.2 million in 2030. These rises are due partly to increasing life expectancy and partly to the baby boom cohorts of 1945 to 1964 reaching old age in increasing numbers. Larger cohorts, other factors equal, mean higher costs, but other factors may not be equal: the upward pressure from rising numbers could

* Corresponding author.
E-mail address: Raphael.wittenberg@phc.ox.ac.uk (R. Wittenberg).

http://dx.doi.org/10.1016/j.healthpol.2017.05.007
0168-8510/

be offset by factors such as better health among later cohorts or better care.

Past studies have found that less than half the increase in emergency admissions is due to the increase in numbers of older people [6,7]. Other drivers have been discussed in the literature, including changes in technology, medical practice, expectations, and policy incentives [6–9]. The latter, it has been suggested, could include an incentive to admit patients briefly arising from the payment by results system [9] or the 4 hour waiting time target for A&E attendances [7].

Various initiatives have been pursued to stem this increase in emergency admissions. These include measures which are being pursued internationally, such as better care co-ordination, as well as measures which relate specifically to the health and social care system in England and its financing arrangements, such as reimbursing additional admissions above a set level at a reduced rate [10]. The importance of such initiatives has been sharpened by constraints on public expenditure on health care in England and elsewhere.

Urgent and emergency services have been the subject of a wide range of policy discourse and policy decisions in recent years, including the Urgent and Emergency Care Review [11]. This has been prompted by a belief that the system is currently facing severe stress, at least in winter.

The House of Commons Health Committee conducted a study of urgent and emergency care and published a report in July 2013 [12]. They noted that 'whilst growth in attendances at emergency departments has been limited, admissions have grown substantially placing more pressures on hospitals and restricting the ability of emergency departments to manage the flow of patients'.

The English National Health Service (NHS) is funded mainly from general taxation and is almost entirely free at point of use. Decisions on the level of spending on the NHS are largely at the discretion of the government of the day. Since the middle of the last decade, providers have been paid for secondary health care, including inpatient stays, through a national 'payment by results' (PbR) system which is a form of prospective, fixed price, case based payment system. Payments are linked to activity and adjusted case-mix.

This article focuses on the question of how far the rise in emergency admissions of older people over the period 2001/02 to 2012/13 was due to the rise in the numbers of older people and how far to other factors such as trends in health status among successive cohorts, advances in technology or policy changes. It extends the scope of earlier studies through: a focus on older people; inclusion of more recent trends; and an analysis of age, cohort and period effects to examine the increase in admissions of older people. Section 2 presents the data and methods, Section 3 sets out our key findings, Section 4 discusses the findings and Section 5 concludes.

2. Data and methods

Our study comprised analyses of Hospital Episode Statistics (HES) inpatient data for England together with Office for National Statistics population estimates [13]. HES contain details of all admissions, outpatient appointments and accident and emergency (A&E) attendances at NHS hospitals in England [14]. The data is collected during a patient's time at hospital and is submitted to allow hospitals to be paid under the case-based system for the care they deliver.

HES include a range of data for each hospital episode and a facility to link episodes into spells, where a spell is the period from admission to death or discharge. Our analyses use data on the patient's age, type of admission (emergency or elective), diagnoses, procedure, duration of spell and financial year of admission. We used descriptive statistics to present trends in emergency admissions by age band, health condition and procedure. Further details are presented in Wittenberg et al. [15].

We used a regression-based methodology to partition past trends in emergency admissions between age, period and cohort (APC) effects. The APC method, which is discussed in Yang and Land [16], is a valuable way to examine factors underlying time trends. APC analyses have been conducted in studies of trends in mortality rates and in prevalence rates of diseases. They have rarely, if ever, to our knowledge been used to examine trends in hospital admissions in England.

APC analysis is a form of multivariate regression analysis. The dependent variable is counts by age and year of the variable to be analysed or, as in our analysis, those counts by age and year expressed as rates e.g. per 1,000 population. The independent variables are dummy variables for each age, year of birth and year of admission. The model specification is as follows:

$$M_{ij} = D_{ij}/P_{ij} = \mu + \alpha_i + \beta_j + \gamma_k + \varepsilon_{ij}$$

- M_{ij} denotes the observed occurrence/exposure rate of admissions for the *i-th* age group for $i = 1,\ldots,a$ age groups at the *j-th* time period for $j = 1,\ldots, p$ time periods of observed data
- D_{ij} denotes the number of admissions in the *ij*-th group, P_{ij} denotes the size of the estimated population in the *ij-th* group
- μ denotes the intercept or adjusted mean
- α_i denotes the *i-th* row age effect or the coefficient for the *i-th* age group
- β_j denotes the *j-th* column period effect or the coefficient for the *j-th* time period
- γ_k denotes the *k-th* cohort effect or the coefficient for the *k-th* cohort for $k = 1,\ldots, (a+p-1)$ cohorts, with $k = a-i+j$
- ε_{ij} denotes the random errors with expectation $E(\varepsilon_{ij}) = 0$.

A problem arises however when attempting to apply the APC method econometrically, in that age, period and cohort are perfectly multi-collinear: period = age plus cohort, e.g. if a person was born in 1960 (cohort) and was aged 50 (age) this identifies the year as 2010 (period). One way to handle this multicollinearity issue is to impose a restriction on the regression parameters. We have however adopted the Intrinsic Estimator (IE) approach, which avoids the need to impose potentially arbitrary constraints on the regression parameters. It instead restricts the impact of the design matrix (the data entered in the model) on the coefficient estimates. In practice, this implies that the constraint is determined by the number of age and period groups modelled [17]. The method is discussed in more detail in a technical annex which also includes charts showing the regression coefficients.

We calculated separate rates of emergency admission for each single year of age for each year of admission from 2001/02 to 2012/13. The dependent variable comprises these rates with a separate observation for each combination of year of age and year of admission. We included three independent variables: patients' age, year of birth and year of emergency admission. We used Stata version 12.

We ran two versions of the APC regression, for people of all ages and for older people only. The reason is to check that the age effect turns upward from a much younger age than 65 and that the period and cohort effects do not differ substantially between older people and the whole population. We present here the results of the regression for older people.

Age effects relate to differences in emergency admission rates by age after controlling for any differences in the other two factors. They are ascertained by examining admission rates at each age averaged across each birth cohort and each time period. The age effect is likely to reflect the way in which the underlying need