Emergency readmission rates

Further analysis

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PURPOSE AND SUMMARY

1. This paper reviews an analysis by the National Centre for Health Outcomes Development (NCHOD) of the rising trend of emergency readmissions and carries out further analysis on an enhanced dataset. The original analysis used Hospital Episode Statistics (HES) data for England linked by NCHOD for the years 1998/9 – 2005/06. The new analysis extends this to include data for 2006/7. For the purpose of this paper, an "emergency readmission" is defined as any emergency admission into hospital within 28 days or less following discharge from a previous stay in hospital (not necessarily with the same diagnosis). Readmissions after maternity and readmissions for patients in mental health specialties or with a diagnosis of cancer are excluded, as are readmissions after day case procedures.[1]

Background

2. Data on emergency readmissions within 28 days after discharge, analysed and published by NCHOD since 1998/9, have consistently shown a rising annual trend. This remained after taking into account differences between the years in the age and gender of patients, method of admission of the original hospital stay, diagnoses within medical specialties, and operations within surgical specialties.

3. NCHOD was commissioned by the then Information Management Group of the Department of Health to undertake some preliminary analyses to explore potential reasons for this rising trend. These showed that while there was an association between individual aspects (age, gender, method of admission of the original hospital stay, diagnosis, operation, geography and socio-economic status) and emergency readmissions, none of these fully explained the rising trend. There was a small but weak correlation between length of stay of the original admission and emergency readmission, with longer lengths of stay associated with fewer emergency readmissions.

4. The NCHOD analysis suggested that the growth in the number of patients with multiple emergency readmissions in more recent years had made a substantial contribution to the overall rise. NCHOD recommended further work, firstly to look at the different possible drivers collectively rather than individually; and secondly, a more detailed examination of individual medical conditions and operations.

5. Starting out from the methods used in the NCHOD report, this analysis aims to examine the rise in readmission rates in recent years. It is often assumed that high readmission rates are an indicator of poor quality of care in the original hospital episode. Certainly *some* readmissions will reflect avoidable adverse events (missed or incorrect diagnosis, incomplete treatment, operating site infection etc). However, for most admissions to hospital, and especially in

[1] The NCHOD indicators exclude maternity patients and those with mental health problems or cancer, where emergency readmissions are more likely to be expected. The indicators also exclude day cases.

longer term conditions, there will be a finite probability of a further readmission within 28 days of the original discharge, whatever the quality of care in the original episode. It is extremely difficult to disentangle changes in the number or proportion of emergency readmissions that are potentially avoidable, from those that would occur irrespective of the quality of care. The proportion will depend on many other factors which are varying at the same time, including the quality of care in the community, changes in clinical practice, and changes in patient expectations.

6. The paper attempts to examine the underlying trends and break down the data to a sufficient level of detail to offer some tentative interpretations. The key issue is whether the observed increase in the rate of emergency readmissions could reflect deterioration in the quality of care, in general or for particular patient groups. .

Methods

7. NCHOD's preliminary analysis looked at readmission rates aggregated over all ages. However, when it comes to analysing the effect of case-mix, analyses need to be undertaken separately for different age bands. During our developmental work, it became clear that there were distinct patterns for the age bands 16-74 and 75+. This paper therefore presents results separately for these two age bands, focussing mainly on the younger age band where multiple unrelated admissions seem *a priori* to be less expected[2]. For the older, 75+ age group, the number of emergency readmissions is expected to be higher as older patients are more likely to have multiple long term conditions than younger patients and readmission rates for long term conditions are expected to include a significant proportion of unavoidable "readmissions" relating to separate disease episodes. We have also taken the opportunity to add a further years' data (2006/7) to NCHOD's previous analysis.

8. We presented our initial results at a workshop of clinicians drawn from primary care, hospital acute care and the emergency services (see Appendix A), and we have drawn on the outcome of this workshop in some of the interpretations offered below. We are extremely grateful to the clinicians who took part in this exercise.

Findings

9. The key analytical findings presented in this paper are:

- The readmission rate for the 16-74 age group increased from around 7% in 1998/9 to 9% in 2006/7. The equivalent figures for the 75+ age group are 10% and 14% respectively.

- The rate of increase in emergency readmissions rises particularly sharply from 2002/3 onwards, coinciding with an increase in the proportion and number of emergency readmissions coded to the specialty of A&E. The emergency readmission rate rose from 6.9% in 1998/9 to just 7.5% in

[2] Whenever age group is not specified, it is assumed that the analysis refers to the 16-74 age group.

2002/3 but then to 9.1% in 2006/7, whilst the proportion of total emergency readmissions with an A&E speciality increased from 8% in 1998/9 to 9% in 2002/3 and 12% in 2006/7. However, the trend appears to have stabilised in 2006/7.

- A quarter of the increase in readmission rates for the 16-74 age group since 2003/4 is explained by changes in the case-mix, i.e. an increase in emergency admissions in Health Resource Groups (HRGs) with higher than average readmission rates. The equivalent figure for the 75+ group is 8%.

- A large number of the HRGs of the *original* admission that led to most emergency readmissions are associated with long-term conditions and/or are broader, encompassing a variety of symptoms and conditions.

- There seems to be a shift in the specialty of the original admission from General Medicine to A&E, indicating that the admitting consultant is more likely to be an A&E specialist than an on-call General Medical consultant. This may well be due to a change in clinical practice over the period.

- NCHOD, using time series methods over the 8 years 1998/9-2005/6, observed an inverse but weak correlation between the overall raw readmission rates and the corresponding national average length of stay for each age and gender category. Our analysis has looked at similar data but using a more detailed, cross-sectional approach. We have looked at the relationship between length of stay and readmission rates for each HRG across all providers, thus adjusting for case-mix. We also looked at different ways of presenting length of stay and readmission rates (for example, as change in both variables since 1998/9). We consistently found extremely small correlations, providing no evidence for the hypothesis that decreases in the length of stay have led to a higher rate of (avoidable) readmissions.

- Over the period 1998/9-2006/7, there has been a shift towards readmissions with a shorter length of stay. The mean length of stay of an emergency readmission has decreased from 8.06 days and 15.94 days in 1998/9, for age groups 16-74 and 75+, to 6.38 days and 13.89 days respectively in 2006/7.

- Similarly, in the same period, there has been a considerable increase in the proportion of emergency readmissions occurring within 0 -1 days of the original admission (from 11.4% as a proportion of total in 1998/9 to 14.9% as a proportion of total in 2006/7).

- A preliminary analysis of the variability within HRGs across similar providers suggests that this approach might in the longer term, provide us with a better understanding of the reasons for the trends and of the circumstances in which emergency readmission rates could be reliably used as an indicator of the quality of care.

10. Discussion at the workshop suggested that there was no single explanation for the analytical findings, and in particular that equating the increasing rate of emergency readmissions to reductions in the quality of hospital care was far too simplistic. Some tentative and partial interpretations, which would need to be explored in more detailed analyses, include:

    - increased investment in Accident and Emergency services, together with the recognition that it is good patient care for those patients requiring more than four hours of clinical care to have access to the same standards of comfort and care as any other hospital patients, including developing short stay admission and assessment units for clinical tests or further observation;

    - changes in patient expectations, with an increasing tendency to seek further specialist care if symptoms persist after an initial spell in hospital or (for surgical cases) if the side effects of treatment are more severe than expected;

    - variations between healthcare communities in the quality of community and social care services, or in the coordination between hospital and community care, which could mask or distort the time series trends.

11. The relative importance of these and other factors will vary between the condition leading to the initial hospital episode. Further analysis is therefore more likely to be fruitful if it is carried out at a more disaggregated level, and if cross-sectional analysis is used to help interpret the time series trends.

BACKGROUND

12. An emergency readmission is any unplanned (non-elective) admission to hospital within 28 days of a previous discharge. The two hospital spells need not have the same diagnosis, HRG or specialty. It would require clinical judgement on individual cases to determine whether they are clinically related.

13. The National Centre for Health Outcome Development (NCHOD) conducted some preliminary analysis on emergency readmission rates over the eight year period 1998/9 to 2005/6 in England. They found that the raw emergency readmission rate (number of emergency readmissions divided by the number of original admissions) for patients over the age of 16 increased from around 7.7% in 1998/9 to around 10.1% in 2005/6. Comparable figures for the indirectly standardised rate (which removes the effect of differences in the age / sex / method of admission and case type variation between years) were 7.8% and 9.8% respectively.

14. In order to decompose this figure into key drivers, NCHOD conducted some univariate analysis on their eight-year data set. They considered:
    - Age
    - Gender
    - Method of admission
    - Diagnoses and procedures

- Geography
- Demography
- Deprivation
- Relationship between the emergency readmission rate and length of stay
- Impact of multiple emergency readmissions on the emergency readmission rate

This analysis is attached at Appendix B.

15. From their analysis, 20% of the annual growth in emergency readmission rates during this period could be explained by changes in case mix, in particular in the age and gender of patients, method of admission, diagnosis or procedure. They found the following:
    - Raw readmission rates increase with age.
    - Males have higher readmission rates than females.
    - A non-elective original method of admission has a higher chance of having an emergency readmission (11%-12%) than an elective one (5%).
    - A medical admission has a higher chance of having an emergency readmission (12%) than a surgical admission (7%). This is due in part to the previous finding, since non-elective admissions make up a much greater proportion of medical admissions than surgical ones.
    - There are regional variations in the rate, and rate of increase, of emergency readmissions with London standing out with above average annual growth rates.
    - There is an inverse but weak relationship between length of stay and emergency readmission rates (reducing length of stay is correlated with an increasing emergency readmission rate)[3].
    - Multiple readmissions (for the same patient within the same year) have made a significant contribution to the rise in the overall rate.

16. Following on from the NCHOD report, this paper extends the analysis by including a further year's data and discusses the following areas:
    i. The aggregate increase in emergency readmissions 1998/9 to 2006/7
    ii. The change in the case mix of the original admissions and emergency readmissions over time
    iii. The relationship between the HRGs of the original admission and of the emergency readmission
    iv. Analysis of HRGs/specialities that generate the most emergency readmissions
    v. Further analysis on the relationship between length of stay of the original admission and the rate of emergency readmissions
    vi. Analysis of the changing patterns in the length of stay of the emergency readmission
    vii. Analysis of the changing patterns in the period between the original discharge and the subsequent emergency readmission.
    viii. Preliminary analysis on the variability of emergency readmission rates by HRG across providers

[3] It is important to note that the correlation between length of stay and readmission rates is based on 8 data points (from 1998/9 and 2005/6) or 4 data points (2002/3 and 2005/6). We have repeated this analysis using the whole dataset and we discuss this topic in detail later in the paper.

17. Our analysis looks at the NCHOD data in various levels of detail. We look at **Speciality** level (broad speciality of the admitting consultant), **Healthcare Resource Group** (HRG) level (clinically similar conditions that use similar amounts of resources are grouped together), **Procedure** level and **Diagnosis** level. It is important to note is that we are using one source of data throughout but are cutting it at different levels to get a more complete picture.

(i) THE INCREASE IN EMERGENCY READMISSIONS 1998/9 TO 2006/7

18. The analysis presented in this paper differs from the initial NCHOD report in the following ways:
    - Figures in this analysis are up to 2006/7, while in the initial NCHOD report figures are up to 2005/6.
    - NCHOD's preliminary analyses looked at readmission rates aggregated over all ages. However, when it comes to analysing the effect of case-mix, analyses need to be undertaken separately for different age bands. During our developmental work, it became clear that there were distinct patterns for the age bands 16-74 and 75+. Separate sets of standards for diagnoses within medical specialties and procedures within surgical specialties are used for each band during the production of the indicators. We have split the population in two age groups 16-74 and 75+. Analysis in this paper mainly focuses on the 16-74 age group.

19. The following table shows the increase in the number and rate readmissions in total and for the different age groups.

Table 1: Raw count of emergency readmissions and the crude readmissions rate by age group, (thousands)

	Readmissions ('000)			Readmissions Rate		
	16+	16-74	75+	16+	16-74	75+
1998	282	194	88	7.7%	6.9%	10.0%
1999	291	199	92	8.0%	7.2%	10.4%
2000	298	203	95	8.2%	7.3%	10.8%
2001	303	205	98	8.4%	7.5%	11.0%
2002	315	210	105	8.5%	7.5%	11.5%
2003	356	236	120	9.0%	7.9%	12.3%
2004	395	261	134	9.7%	8.5%	13.2%
2005	431	284	147	10.1%	8.8%	13.8%
2006	442	294	149	10.3%	9.1%	13.9%

20. The number of readmissions increased since 1998/9 by around 160,000 cases. The majority of these additional readmissions (60%) were in the age group 16-74, although the increase in the rate of readmissions was more pronounced in the older age group.

21. As we can see from the above table, older people (aged 75+) have higher readmission rates than younger people. This is because they are more likely to be frail and suffer adverse effects of treatment, or because they are more likely

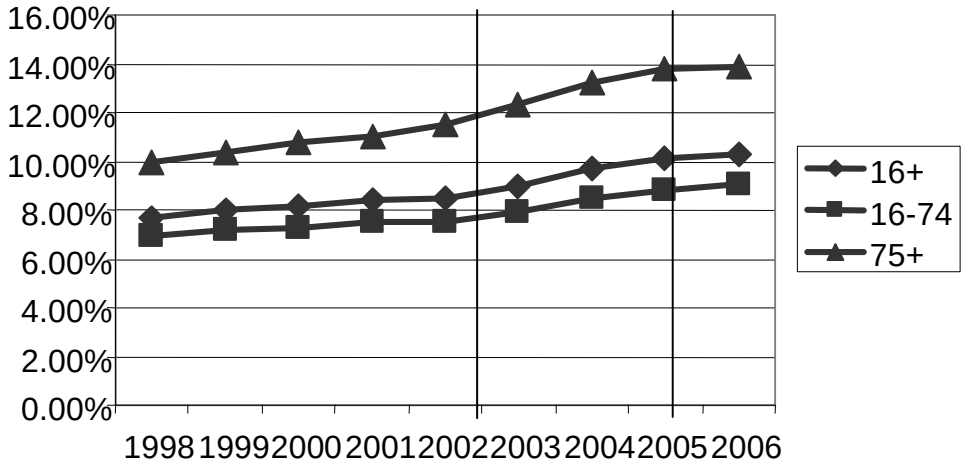
to suffer from those conditions associated with relatively high rates of readmission. It may be that for people who suffer from long-term conditions a sequence of readmissions is sometimes preferable to a longer stay in hospital.

22. The aim of this preliminary analysis is to try to explore the possible reasons for the increase and in particular to understand whether or not the rise in readmission rates is affected by the quality of the clinical care in the initial episode. In order to do this we analyse the two age groups separately.

23. The following chart shows the readmissions rate for each age group for individual years. It is very clear from the chart that there is a step change after 2002/3, and a stabilising of the rate between 2005/6 and 2006/7.

24. Chart 1 shows that the rate of emergency readmissions increases quickly after 2002/3, with the 16-74 and 75+ age groups increasing at an almost parallel rate. The growth of emergency readmissions seems to level off in 2006/7.

Chart 1: Emergency readmissions rate by age group



25. Clinicians at the workshop agreed that there was no single reason for the increase in emergency readmission rates. They felt that there were likely to be a number of factors contributing to the trend. Some tentative interpretations, which would need to be explored in more detailed analyses, include:

Demand Side

- *Change in expectations alter the perception and risk aversion of patients:* A number of clinicians suggested that patient expectations were now higher as a result of increased education and publicity on healthcare. This could lead to an increasing tendency to seek medical help – specifically, hospital care – rather than managing symptoms at home or waiting to see if symptoms persist. This could result in an increase in the number both of initial emergency admissions and in emergency readmissions following a previous spell in hospital.

- *Change in case-mix of admitted patients:* Changes in the case-mix of patients admitted in the initial hospital episode (over and above those already allowed for in the analysis described below) could also be contributing to the increase in the readmission rate. Firstly, an increasing proportion of the simpler cases are being handled as day cases (which as noted above are excluded from the definition of the readmissions rate). Secondly, with the increasing emphasis on prevention and extensive primary care, the less complex cases are increasingly, where possible, being treated in the community setting. For both reasons, an increasing proportion of patients admitted in the initial episode are likely to have relatively severe disease and an increase in the proportion needing an emergency readmission within 28 days would not be surprising.

- Looking to the future, the increasing emphasis on early intervention and delivering care in the community could in due course help reduce the rate of increase in the emergency readmissions rate, for example by enabling more people with longer term conditions to manage their symptoms without needing periodic admission to hospital. A commitment to organising local services in such a way as to assist people in preventing ill-health was outlined in Lord Darzi's Next Stage Review in June 2008, and steps are already been taken to improve the links further. For example, the Department of Health has funded 29 'Partnerships for Older People Projects' (POPP) pilots, aimed at creating a sustainable shift away from institutional and hospital based crisis care for older people towards earlier, targeted interventions within their own homes and communities. There are already early indications that POPP pilots are having significant effect on reducing hospital emergency bed day use.

<u>Supply Side</u>

- *Increased investment in A&E:*
  Over recent years there has been a major increase in investment in A&E facilities and in particular in the development of A&E as a consultant-led medical specialty. Clinicians have also increasingly recognised that it is good patient care for those patients requiring more than four hours of clinical care to have access to the same standards of comfort and care as any other hospital patient, including developing short stay admission and assessment units for clinical tests or further observation.

(ii) CASEMIX EFFECTS: HRGs OF ORIGINAL ADMISSION MOST LIKELY TO RESULT IN EMERGENCY READMISSIONS

26. Table 2 shows the 15 HRGs of original admissions that led to most emergency readmissions in 2006/7. They represent around 30% of all readmissions.

27. Many of these HRGs are associated with long-term conditions and/or broader groupings encompassing many conditions with varying severity and uncertain prognosis. For example, Ischaemic Heart Disease (E23), Acute Myocardial Infarction (E12)[4]; Chronic Obstructive Pulmonary Disease (D39/D40), and Asthma (D22) are all generally considered long-term conditions. Chest Pain (E35/E36) and Unspecified Acute Lower Respiratory Infection (D41) less specific in terms of diagnosis and future course of illness.

28. The table also shows changes between 2003/04 and 2006/07 in the number and rate of emergency readmissions. It can be seen from the table that the increases in the number of emergency readmissions by HRG is not necessarily the result of an increase in the rate of readmissions. For example, the HRG with the most emergency readmissions in 2006/7, E36 (Chest Pain), actually saw a decrease in its emergency readmission rate between 2003/4 and 2006/7. In spite of this, the number of emergency readmissions rose. The table shows that it is the increased prevalence of this HRG (the increase in the number of original admissions) that is increasing the number of emergency readmissions.

29. The third highest HRG is Poisoning, Toxic, Environmental and Unspecified Effects with a high readmission rate (13%). The Scottish Morbidity Record scheme (SMR1) studied emergency readmissions in the 1990s in Scotland and attributed 8.5% of total emergency readmissions to self-harm.[5] This HRG encompasses incidents that may be related to self-harm such as drug overdoses. It was noted above that the data analysed excludes patients within mental health specialties. Thus, this HRG could potentially be reflecting patients with undiagnosed mental health issues, which could be contributing to the relatively high emergency readmission rate for this HRG.

[4] E23 and E12 encompass Coronary Heart Disease

[5] http://qshc.bmj.com/cgi/reprint/8/4/234

Table 2: Original Admission HRG with Most Emergency Readmissions , adults aged 16-74, 2003/4 and 2006/7

HRG Code	HRG Description[6]	Number of original (index) admissions		Number of emergency readmissions		Emergency readmission rate (%)	
		2003/4	2006/7	2003/4	2006/7	2003/4	2006/7
E36	Chest Pain <70 w/o cc	109,741	144,088	9,389	11,871	8.6	8.2
F47	General Abdominal Disorders <70 w/o cc	88,242	106,722	8,080	11,366	9.2	10.7
S16	Poisoning, Toxic, Environmental and Unspecified Effects	63,176	83,637	6,721	10,720	10.6	12.8
D40	Chronic Obstructive Pulmonary Disease or Bronchitis w/o cc	37,783	34,421	7,747	7,540	20.5	21.9
F46	General Abdominal Disorders >69 or w cc	28,553	40,048	3,750	6,041	13.1	15.1
E23	Ischaemic Heart Disease without intervention <70 w/o cc	40,566	33,580	5,359	4,288	13.2	12.8
E35	Chest Pain >69 or w cc	22,591	30,466	2,753	3,719	12.2	12.2
D39	Chronic Obstructive Pulmonary Disease or Bronchitis w cc	11,621	14,147	2,687	3,600	23.1	25.5
E30	Arrhythmia or Conduction Disorders <70 w/o cc	32,448	36,917	2,963	3,587	9.1	9.7
H42	Sprains, Strains, or Minor Open Wounds <70 w/o cc	23,914	38,169	1,639	3,491	6.9	9.2
S19	Complications of Procedures	22,148	25,852	2,688	3,461	12.1	13.4
A30	Epilepsy <70 w/o cc	23,168	26,614	2,602	3,370	11.2	12.7
D41	Unspecified Acute Lower Respiratory Infection	24,774	26,476	2,599	2,926	10.5	11.1
E12	Acute Myocardial Infarction w/o cc	29,364	24,145	3,730	2,921	12.7	12.1
D22	Asthma w/o cc	27,328	27,324	2,748	2,773	10.1	10.2

30. Looking at the 75+ group, we get a similar story – the most common HRGs of readmissions are Kidney and Urinary Tract Infections (LO9) and Complex Elderly with a Respiratory System Primary Diagnosis (D99), representing around 8% of all readmissions. Both HRGs are associated with long-term conditions.

31. Because of the definition of an emergency readmission (any emergency admission within 28 days of discharge) some of these "readmissions" may represent entirely separate spells of illness unrelated to the original admission. However there may be a proportion of the readmissions that reflect potentially avoidable adverse events – complications, missed / incorrect diagnosis, incomplete treatment etc – and this proportion is likely to vary by HRG.

[6] "w/o cc" stands for without complications, "w cc" stands for with complications. "<70" stands for patients of age less than 70 years.

Case Mix Effects

32. The conditions listed in table 2 tend to have higher than average readmission rates. If the growth in initial admissions is skewed to those with higher than average readmission rates then the average readmission rate will go up.

33. In order to test the effect of changing casemix on overall readmission rates, we recalculated what the overall readmission rates would have been in 2006/7 if the readmission rate for each individual HRG had not changed since 2003/4 – the result was 8.2%, compared with actual readmission rates of 7.9% in 2003/4 and 9.1% in 2006/7. This implies that some 25% of the increase is explained by the change in casemix.

34. Repeating the same analysis for the 75+ age group, we found that only 8% of the increase is explained by the change in casemix. This may suggest that trends in readmissions for this age group may be more related to changes in the treatment of chronic conditions rather than changes in case mix.

35. The data from NCHOD that we have used for this in patient analysis excludes day cases. However, it is the less complex conditions that are now carried out as day cases. As a result, the simpler cases, with lower readmission rates, are included in the data for the earlier years but excluded once they are performed as day cases. That is to say that the data may be skewed with a more complex case mix for in-patients in the more recent years. Looking at this possibility in more detail could explain a further proportion of the increasing trend in emergency readmissions.

HRG of the readmission

36. The most common HRG of emergency readmissions are complication of procedures (S19) [7] and chest pain <70 (E36) – they represent around 9.2% of all emergency readmissions in 2006/7. Results remain fairly stable for most HRGs between years. However, readmissions for Poisoning, Toxic, Environmental and Unspecified Effects (S16) have increased slightly while Chronic Obstructive Pulmonary Disease or Bronchitis (D40) and Ischaemic Heart Disease without intervention <70 (E23) have reduced between 2003/4 and 2006/7.

(iii) LINK BETWEEN HRG OF ORIGINAL ADMISSION AND EMERGENCY READMISSION

37. We next look at the relationship between the HRG of the original admission and that of the emergency readmission. (As already noted, the definition of an emergency readmission does not necessarily imply any connection between the first and second admission – for example, a person leaving hospital after a minor surgical procedure who is re-admitted following, say, a road traffic

[7] HRG S19- complications of procedures does not distinguish between the avoidable and unavoidable. That is to say that there are some complications which will occur naturally regardless of quality of care, and there will be others that are potentially avoidable. This HRG encompasses both.

accident within four weeks of discharge is still counted as an emergency readmission).

38. It is difficult to deduce whether the original admission and subsequent emergency readmission are clinically related. In a high-level attempt to assess the possibility of clinical links, we looked at the instances where HRGs of the original admission and readmission were the same and whether these had changed over time. However, although Health Resource Groups (HRGs) are groups of clinically-related conditions, the clinical relationship describes a broad similarity in the resource inputs, not necessarily a similarity of patient outcomes. In addition, this analysis looks at continuous inpatient spells, for which there could be more than one condition and HRG, though only the most resource intensive HRG is assigned to the spell.

39. As the table below shows, just above a quarter of the readmissions had the same HRG as the original admission. This is fairly stable across all years.

Table 3: Emergency Readmissions with the same HRG as the Original Admission

Year	Count of readmissions with same HRG as original Admission	Readmissions with the same HRG as the original admission as a % of total readmissions
2003/4	67,720	28.7%
2004/5	73,948	28.4%
2005/6	78,307	27.6%
2006/7	79,294	27.0%

40. Table 4 shows the most common combination between the HRG of original admission and emergency readmission in 2006/7.Over the four years, the most common combinations between original admission HRG and the subsequent emergency readmission remained stable.

41. The most common combination between the HRG of original admission and emergency readmission is for “Poisoning, Toxic, Environmental and Unspecified Effects” representing around 2% of all readmissions.

Table 4: Top 5 HRG Relationships between Original Admissions and Emergency Readmission 2006/7

Original HRG	Readmission HRG	% of Year Total
S16	S16	2.3%
E36	E36	1.7%
F47	F47	1.5%
D40	D40	1.4%
E30	E30	0.6%
U01	U01	1.2%

S16	Poisoning, Toxic, Environmental and Unspecified Effects
E36	Chest Pain <70 w/o cc
F47	General Abdominal Disorders <70 w/o cc
D40	Chronic Obstructive Pulmonary Disease or Bronchitis w/o cc
E30	Arrhythmia or Conduction Disorders <70 w/o cc
U01	Invalid Primary Diagnosis

42. The aim of assessing the clinical relationship between an original admission and the subsequent emergency readmission is to identify potentially avoidable readmissions. Clinicians at the workshop agreed that the emergency readmission rate would be a better indicator of poor quality care in the original hospital episode for some conditions – for instance, readmissions after elective surgery – than for others. Further analysis might therefore helpfully focus on an agreed list of specific conditions, rather than on the overall emergency readmission rate.

43. Clinicians did also make the point that the emergency readmission rate of some conditions may be an indicator of the quality of care in the community after discharge, or of the coordination between community health services, social care and hospital services. They referred to long term conditions in particular, e.g. coronary heart disease.

44. Clinicians also agreed that HRGs were very broad and to assess emergency readmissions as an indicator of quality of care, procedure and diagnoses level may be more appropriate.

(iv) FURTHER ANALYSIS OF CASE-MIX EFFECTS BY PRIMARY DIAGNOSIS, PROCEDURE AND SPECIALTY OF ORIGINAL ADMISSION

45. The next section includes some further analyses of the changes in the case-mix of emergency readmissions analysed by primary diagnosis, procedure and specialty of admitting consultant.

Primary diagnoses of original admissions

46. Table 5 shows the five diagnoses that generated the most emergency readmissions in 2006/7. The number of admissions and readmissions with diagnosis “pain in throat and chest” has almost doubled between the two years. The emergency readmissions rate on the other hand has almost stayed the same. Conversely, the number of readmissions with diagnosis “angina pectoris” has decreased in the same period and the re-admission rate has gone down slightly. The readmission rate for “Other chronic obstructive pulmonary disease” has increased from around 19% to 24% between these years. Overall, the table appears to reinforce our previous point that increases in the number of emergency readmissions are particularly associated with original admissions linked to long-term conditions and/or less specific diagnoses,. However, it is important to note here that the ICD codes have changed since 1998/9 and some of the apparent changes in emergency readmission diagnoses could be attributable to this.

Table 5: Number of readmissions and readmissions rate for top 5 Primary Diagnoses, 1998/9-2006/7

ICD Code	Diagnosis Description	Number of original (index) admissions		Number of emergency readmissions		Emergency readmission rate (%)	
		1998/9	2006/7	1998/9	2006/7	1998/9	2006/7
R07	Pain in throat and chest	88,889	151,798	7,297	13,909	8.2	9.2
J44	Other chronic obstructive pulmonary disease	43,790	46,173	8,206	10,859	18.7	23.5
I20	Angina pectoris	67,546	44,201	8,983	5,691	13.3	12.9
I48	Atrial fibrillation and flutter	25,113	33,187	2,388	3,691	9.5	11.1
I21	Acute myocardial infarction	37,453	29,607	4,229	3,457	11.3	11.7

Procedures of the original admissions

47. Table 6 shows the first (main) procedures of original admissions that lead to the most emergency readmissions.

Table 6: Number of readmissions and readmissions rate for 5 most common first procedures of original admission, 1998/9-2006/7

OPCS Codes	Procedure description	Number of original (index) admissions		Number of emergency readmissions		Emergency readmission rate (%)	
		1998/9	2006/7	1998/9	2006/7	1998/9	2006/7
J18	Excision of gall bladder	31,759	42,279	1,471	2,752	4.6	6.5
W40	Total prosthetic replacement of knee joint using cement	14,867	31,748	709	1,760	4.8	5.5
F34	Excision of tonsil	22,530	17,096	1,927	1,736	8.6	10.2
H01	Emergency excision of appendix	24,277	23,033	1,078	1,625	4.4	7.1
U08	Poorly coded dominant procedure[8]		13,979		1,621		11.6

[8] No information on U08 in 1998/9

48. The main feature of the table is the large increase in the number of readmissions since 1998/9 following an initial admission for J18 (excision of gall bladder) or W40 (knee replacement) although they still represent a very small proportion of the overall increase in readmissions over that period. Much of this increase is due to the increase in the number of the initial admissions (case-mix effect); there has been some increase in the readmission rate, but in both cases it is still well below the average overall admissions. Again, it is important to note that between 1998/9 and 2006/7 that the OPCS codes have been revised and updated and this may have contributed to some of the changes seen in the table.

Speciality of the original admission

49. Table 7 shows the number of readmissions and readmission rate for the specialties of original admission resulting in the largest number of emergency readmissions. These were General Medicine, General Surgery, A&E, Trauma and Orthopaedics and Cardiology. They represent around 78% of all readmissions. (The speciality denotes the speciality of the admitting consultant – it does not does not mean that this was the only consultant to attend the patient during the inpatient spell.)

Table 7: Number of emergency readmissions for 5 most common specialties of original admission, 1998/9-2006/7

		Number of readmissions								
		1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
300	**General Medicine**	80,944	84,016	85,572	85,274	85,546	95,137	98,612	101,108	96,642
100	**General Surgery**	31,702	33,290	35,125	34,963	36,034	40,845	45,331	48,342	49,873
180	**A&E**	4,826	4,613	4,715	5,241	5,055	10,275	18,338	30,556	36,001
110	**Trauma & Orthopaedics**	13,822	14,720	14,801	14,947	15,499	17,759	19,372	20,414	21,201
320	**Cardiology**	6,431	6,297	6,767	7,254	8,332	8,783	10,122	11,140	12,325

50. There has been a significant increase in the number of readmissions with an original admission speciality of A&E, from just below 5,000 in 1998/9 to more than 36,000 in 2006/7 (as a proportion of the total, from 3% in 1998/9 to 15% in 2006/7). The most common specialty is General Medicine for which the number of readmissions increased from around 81,000 in 1998/9 to around 97,000 in 2006/7. However, as a proportion of total readmissions this represents a decrease from 51% to 38% over the same period. These results indicate a shift from General Medicine to A&E, perhaps reflecting a change in clinical practice. We understand that, in many hospitals, A&E consultants now have direct admitting rights, where appropriate, as a means of providing patients who require admission to hospital with timely care.

51. Table 8 shows the readmission rates for the five most common specialties of original admission. As we can see from the table, the rate for each specialty has increased since 1998/9; however, the increase is not as great as the one for the raw number of readmissions as shown in Table 7 (especially in the second half of the period). This implies that the large increase in the number of emergency readmissions is at least partly driven by the increase in the number

of original admissions, in particular in specialties such as A&E which are associated with relatively high readmission rates.

52. In NCHOD's original analysis they found that a non-elective (emergency) original method of admission has a higher chance of having an emergency readmission (11%-12%) than an elective one (5%). This supports the suggestion above, ie that a relative increase in the proportion of non-elective original admissions will increase the rate of increase in the number of emergency readmissions.

Table 8: Emergency readmissions rate for 5 most common specialties of original admission, 1998/9-2006/7

		Readmission rate								
		1998	1999	2000	2001	2002	2003	2004	2005	2006
300	General Medicine	10%	11%	11%	11%	11%	11%	12%	12%	12%
100	General Surgery	6%	6%	7%	7%	7%	7%	8%	9%	9%
180	A&E	8%	8%	9%	9%	9%	10%	11%	11%	12%
110	Trauma & Orthopaedics	4%	4%	4%	4%	4%	4%	5%	5%	5%
320	Cardiology	8%	8%	8%	8%	8%	8%	9%	9%	10%

53. Table 9 shows the most common readmissions categorised by the specialty of readmission. These were again General Medicine, General Surgery, A&E, Cardiology and Trauma and Orthopaedics. There has been an increase in the number of emergency readmissions with an A&E speciality, whilst at the same time a reduction of similar magnitude in the number of emergency readmissions with a General Medicine speciality. These results reinforce the indication above that there has been a possible shift of admitting consultant from General Medicine to A&E.

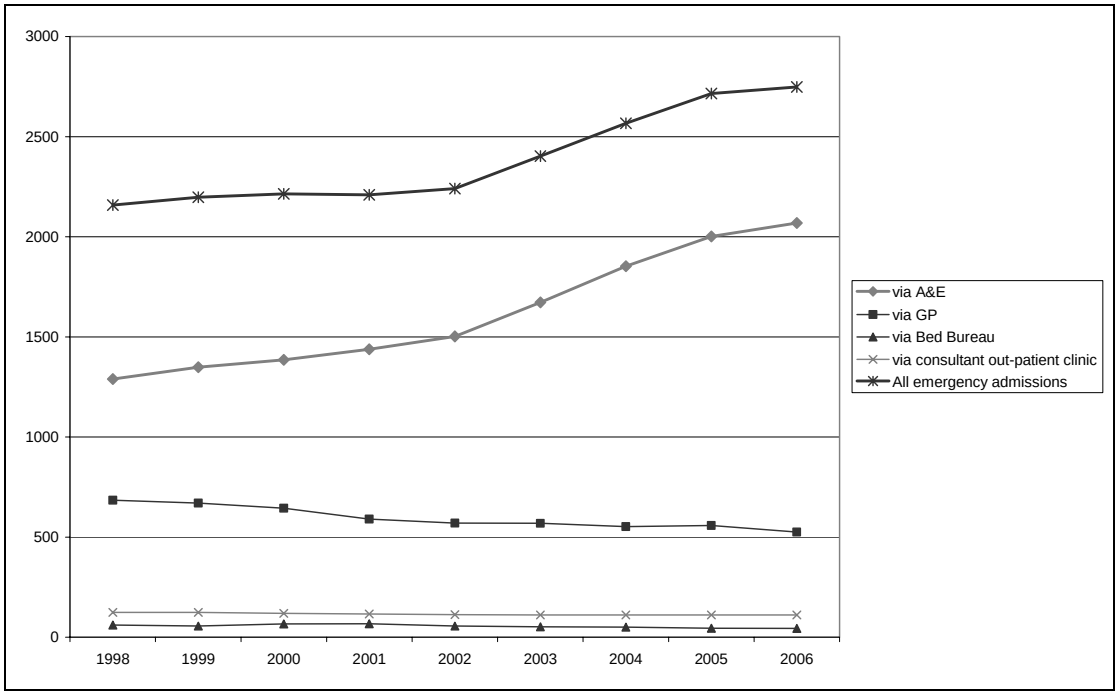
Table 9: Proportion of emergency readmissions by emergency readmission speciality, 1998/9-2006/7

	Readmission Speciality	1998/9	1999/0	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7
300	General Medicine	45.6%	45.9%	45.8%	45.3%	44.8%	44.2%	41.5%	38.9%	36.3%
100	General Surgery	15.8%	16.3%	16.8%	16.4%	16.6%	17.0%	17.1%	16.8%	16.9%
180	Accident & Emergency (A&E)	2.3%	2.1%	2.2%	2.4%	2.3%	4.0%	6.3%	9.7%	10.8%
110	Trauma & Orthopaedics	5.8%	5.9%	5.7%	5.8%	5.7%	5.8%	5.7%	5.6%	5.5%
320	Cardiology	2.9%	2.8%	3.0%	3.3%	3.6%	3.3%	3.4%	3.5%	3.7%

54. To put these trends into perspective, the chart below shows graphically the trend in total finished **emergency admissions** (not just readmissions) for each data year. From the chart, it can be seen that the increase in total emergency admissions has been driven solely by the increase in emergency admission through A&E. In addition, a step change can be seen around 2002/3 where the rate of increase in emergency admissions rises. NCHOD found that those who

had an emergency original admission were more likely to have an emergency readmission than those who had had an elective (planned) original admission. As a result, this increasing trend of emergency admissions could potentially explain part of the increasing trend in emergency readmissions over the same period.

Chart 5: Emergency admissions by admission source in England (thousands)



(v) RELATIONSHIP BETWEEN EMERGENCY READMISSIONS AND LENGTH OF STAY

55. The increase in the rate of emergency readmissions coincides broadly with a progressive fall in the length of stay in hospital. It might therefore be supposed that there is some causal link, ie that the decreasing length of stay is contributing to the rise in the readmission rate..

56. NCHOD, using longitudinal (time-series) methods, observed a correlation between the overall raw readmission rate and the corresponding national average length of stay for each age and gender category at a national level. They looked at eight data points for the period 1998/9 and 2005/6 and, separately, four data points for the period 2002/3 and 2005/6. They found that across the full eight-year period there was only a weak and statistically insignificant relationship between emergency readmissions rates and length of stay. However, they noted that the relationship was stronger and statistically significant if the analysis was limited to the latter half of the period, but this only applies to 4 data points; they advise that any attempt to infer a causal link from the correlation to be treated with caution until further analysis or data is available. They also recommended analyses using multiple rather than single variables.

57. We used a different approach, using cross-sectional rather than time series analysis, and found only very weak and statistically insignificant correlations. In the first instance, we looked at the correlation between readmission rates for each individual HRG and provider and the corresponding length of stay.

Table 10a: Correlation between Length of Stay and Emergency Readmission Rates for each HRG within each provider across all years-16-74

1998/9	1999/0	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7
0.03	0.12	-0.02	0.01	0.11	0.03/0.08	0.04/0.03	0.03/0.03	0.03/0.04

1998/9-2002/3 the data was by provider only. 2003/4-2006/7 the data was by provider and original admission HRG, as a result the datasets were large and split across two files, hence the two figures shown for these years

Table 10b: Correlation between Length of Stay and Emergency Readmission Rates for each HRG within each provider across all years-75+

1998/9	1999/0	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7
-0.08	0.03	-0.27	-0.03	-0.1	0.04	0.04	0.03	0.05

58. The above tables show that there is no strong correlation between length of stay and emergency readmission rates.

59. The NCHOD analysis on the relationship between readmission rates and length of stay did not take into account the differences in the case-mix across providers. In order to explore this further, we looked at the correlation between length of stay and readmission rates within a number of individual HRGs. Table 11 shows the correlation figure for the five HRGs with the highest readmission rates.

Table 11: Correlations between Length of Stay and Emergency Readmission Rates for 5 HRGs

HRG	2003/4	2004/5	2005/6	2006/7
E23 Ischaemic Heart Disease without intervention <70 w/o cc	-0.11	0.03	-0.37	0.19
E36 Chest Pain <70 w/o	-0.18	-0.02	0.14	-0.19
F47 General Abdominal Disorders	-0.01	-0.17	-0.01	-0.08
S16 Poisoning, Toxic and Unspecified Effects	-0.41	-0.14	-0.1	-0.11
D40 Chronic Obstructive Pulmonary Disease	0.06	-0.12	0.13	-0.03

60. We also looked at the correlation across providers between the *change* in length of stay since 1998/9 (around 13% reduction on average) against the readmission rate in 2006/7 and against the change in readmission rate since 1998/9 (around a 43% increase). The correlation coefficients were 0.03 and 0.08 respectively, therefore revealing that the relationship between length of stay and readmission rates is very weak.

61. Finally we looked at changes in length of stay and readmission rates for across providers for a single HRG (chest pains<70) but results remained insignificant. The correlation across providers between the change in length of stay since 1998/9 and the readmission rate in 2006/7 was 0.09; the correlation between the change in length of stay and the change in readmission rate since 1998/9 was -0.02.

62. Clinicians at the workshop accepted that the data shows no evidence to support the idea that reducing length of stay, in general, is leading to increases in the rate of readmission. They did however note that variations between health communities in access to high quality community health and social care could be masking an effect. Thus in PCTs with good care in the community, and good coordination between hospital and community services, hospital discharge managers might be able to discharge patients earlier in the confidence that they could be appropriately managed in the community. In this case, low length of stay (relative to other PCTs) might be associated with *low* readmission rates. The workshop suggested that it might be worth looking in detail at some individual PCTs with combinations of low length of stay/low readmission rate or high length of stay/high readmission rate in order to understand better how the various factors interact.

(vi) LENGTH OF STAY OF EMERGENCY READMISSIONS

63. The next section analyses emergency readmissions in relation to the length of stay of the readmission episode. As Tables 12a and 12b show, over the period 1998/9-2006/7 there has been an increase in the raw count of emergency readmissions in all length of stay groups. However, the increase in the proportion of emergency readmissions with a length of stay of 0 or 1 days stay has been much more significant. As a percentage of the annual total, emergency readmissions with lengths of stay of 0 and 1 day have increased whilst at the same time emergency readmissions with lengths of stay of 2-5, 6-10 and 11+ have decreased. Clinicians at the workshop suggested that there had been a change in clinical practice in more recent years where patients who because of their presenting condition required more than four hours of care – perhaps to undergo specific tests or observation before a final diagnosis could be made – could be admitted to assessment units or specialist wards for short periods. Previously, they may have been managed in A&E regardless of the time period.

Table 12a: Emergency Readmission Length of Stay, 16-74

Year	Proportion of total emergency readmissions					Number of total emergency readmissions				
	0 days	1 day	2 - 5 days	6 - 10 days	11 days+	0 days	1 day	2 - 5 days	6 - 10 days	11 days+
1998/9	11.6%	15.1%	34.6%	19.3%	19.5%	22,441	29,215	67,113	37,514	37,764
1999/0	12.1%	15.4%	34.5%	18.8%	19.2%	24,049	30,701	68,678	37,339	38,259
2000/1	12.0%	15.5%	34.0%	18.56%	19.9%	24,408	31,537	68,949	37,690	40,461
2001/2	13.1%	15.56%	33.1%	18.3%	20.0%	26,878	31,921	67,898	37,494	41,093
2002/3	13.5%	15.8%	33.0%	17.7%	20.0%	28,420	33,150	69,358	37,166	42,004
2003/4	14.9%	16.5%	32.2%	17.1%	19.3%	35,208	39,081	76,095	40,333	45,502
2004/5	17.3%	17.7%	31.2%	16.1%	17.7%	44,963	46,231	81,364	42,054	46,099
2005/6	19.9%	18.3%	30.34%	15.2%	16.2%	56,635	52,013	86,331	43,063	46,075
2006/7	21.7%	19.1%	30.0%	14.3%	15.0%	63,537	56,097	87,974	41,859	44,049

Chart 6a: Comparison of Proportion of Readmissions by Length of Stay for 1998/9 and 2006/7, age group 16-74.

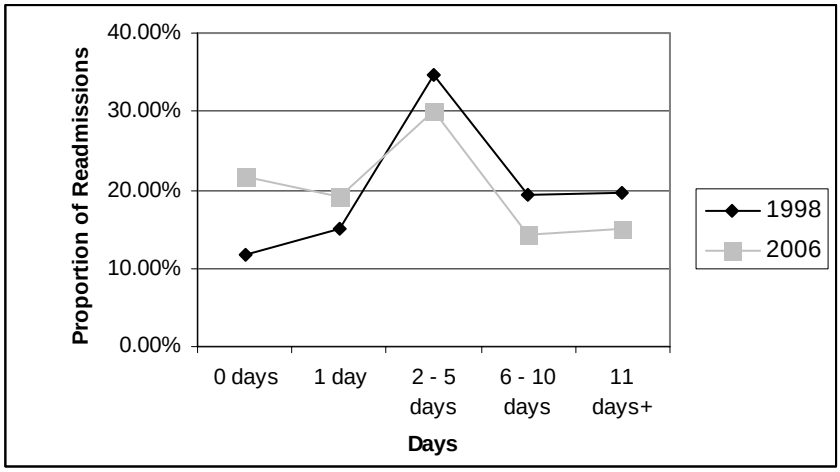
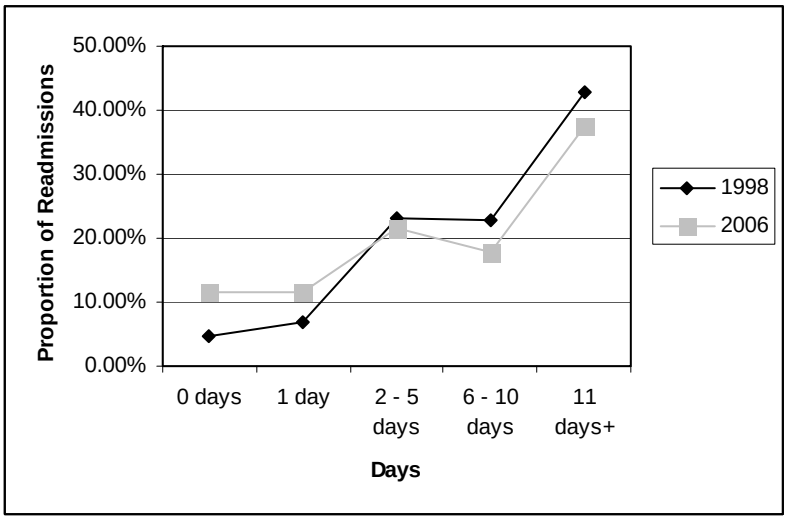


Table 12b: Emergency Readmission Length of Stay, 75+

Year	Proportion of total emergency readmissions					Number of total emergency readmissions				
	0 days	1 day	2 - 5 days	6 - 10 days	11 days+	0 days	1 day	2 - 5 days	6 - 10 days	11 days+
1998/9	4.6%	6.9%	23.1%	22.7%	42.8%	4,043	6,061	20,321	19,984	37,698
1999/0	4.9%	7.3%	22.8%	22.2%	42.8%	4,459	6,749	20,921	20,405	39,375
2000/1	4.9%	7.6%	22.7%	21.3%	43.5%	4,693	7,190	21,624	20,252	41,442
2001/2	5.2%	7.9%	22.1%	20.8%	43.9%	5,130	7,730	21,648	20,424	43,057
2002/3	5.6%	8.1%	21.8%	20.1%	44.4%	5,867	8,541	22,811	21,126	46,549
2003/4	6.7%	8.9%	21.6%	19.6%	43.3%	8,006	10,617	25,803	23,420	51,772
2004/5	8.4%	10.0%	21.3%	18.8%	41.3%	11,357	13,470	28,624	25,534	55,588
2005/6	10.5%	10.7%	21.3%	18.3%	39.3%	15,447	15,813	31,339	26,887	57,827
2006/7	11.6%	11.6%	21.6%	17.7%	37.4%	17,279	17,331	32,186	26,420	55,691

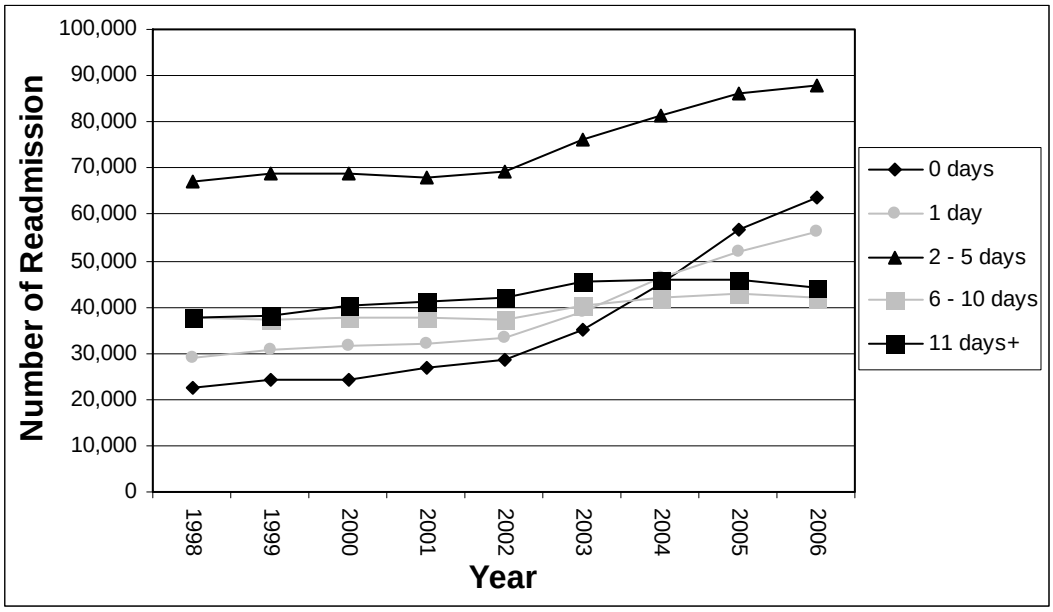
Chart 6b: Comparison of Proportion of Readmissions by Length of Stay for 1998/9 and 2006/7, age group 75+.



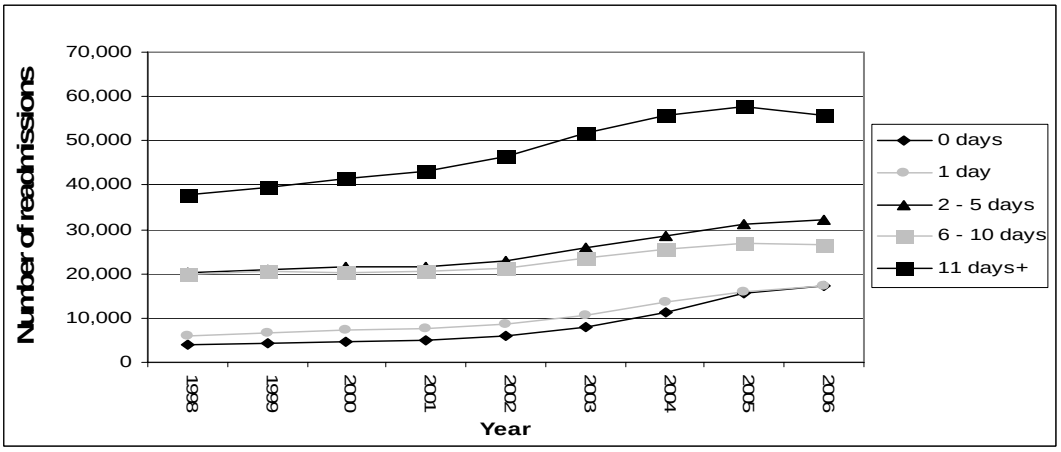
64. The length of stay for older people is longer than for younger people. In 2006/7, episodes of 11 days and above account for around 37% of all readmissions for the 75+ age group compared to 15% for the 16-74 age group. However, the trend towards short lengths of stay can be seen in both groups.

65. Charts 7 and 8 below demonstrate that the rate of growth in short-stay readmissions has been particularly marked after 2002/3. For instance, taking the 16-74 age group, the total number of readmissions rose by around 16,000 between 1998/9 and 2002/3. Around 37% of this change is due to an increase in readmissions with length of stay 0 days and around 26% is due to readmissions with length of stay of more than 11 days. Since 2002/3, there have been around 83,000 more readmissions, of which 42% is due to an increase in readmissions with length of stay 0 days and only 2% due to readmissions with length of stay of more than 11 days. The increase in emergency readmissions after 2002/3, is mainly concentrated in emergency readmissions with short length of stay. The trends for the 75+ age group are similar although as already noted they tend to have longer lengths of stay.

Chart 7: Emergency Readmission Length of Stay, 16-74. Number of Readmissions 1998/9 to 2006/7.

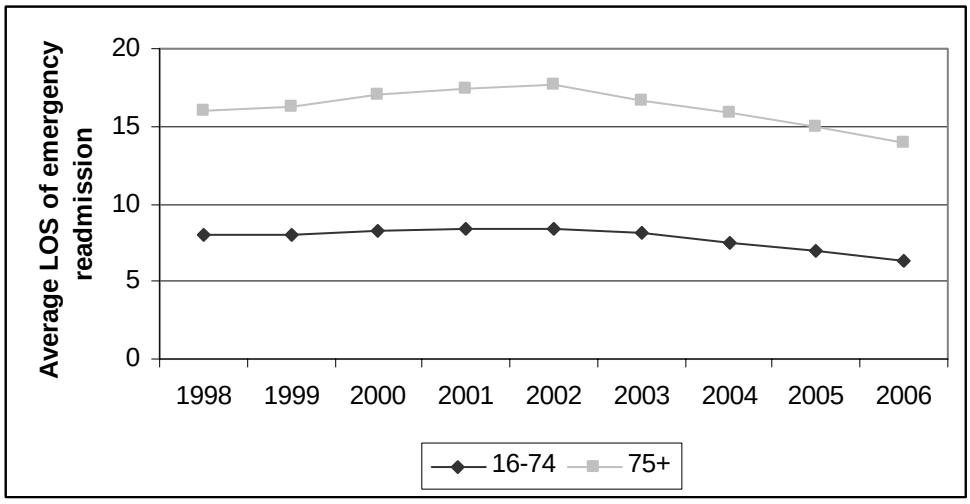


.**Chart 8: Emergency Readmission Length of Stay, +75. Number of Readmissions 1998/9 to 2006/7.**



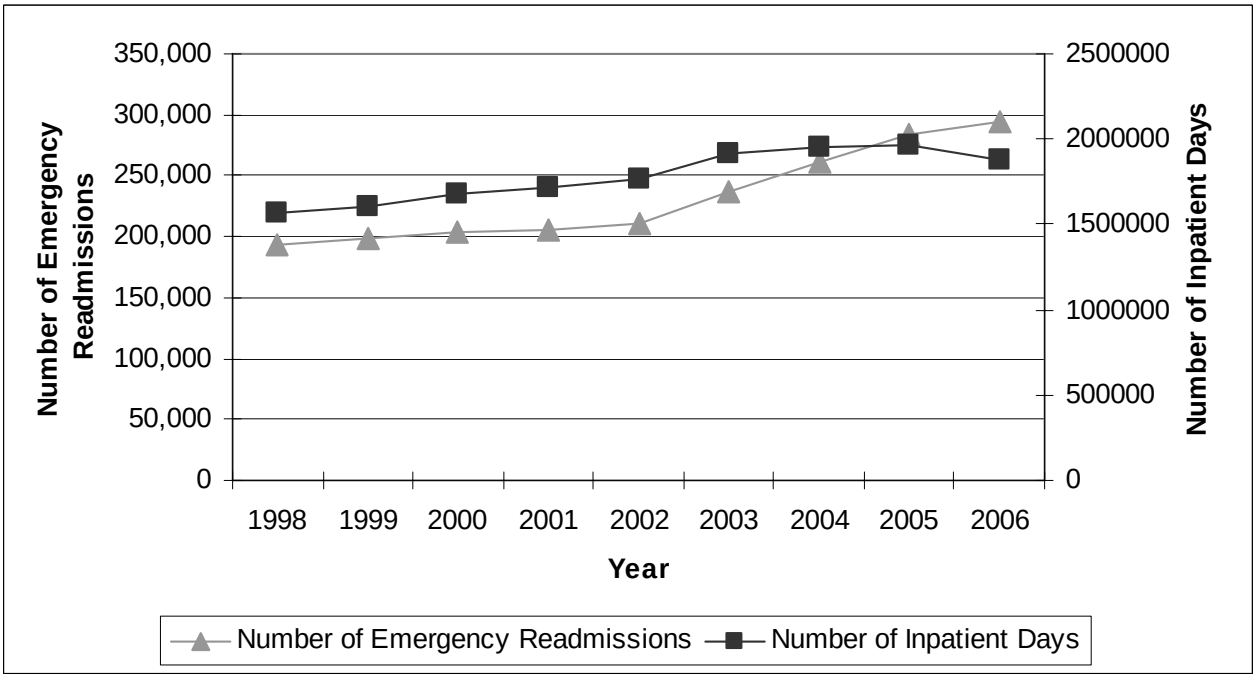
66. The above results can be supported by the changes in the mean length of stay of emergency readmissions, shown in the following chart. For both age groups there is a change in trend around 2002/3, which is consistent with previous results from our analysis. From 2002/3 to 2006/7 the mean length of stay of the emergency readmission decreases – from 8.06 to 6.38 days in the 16-74 age group and from 15.94 to 13.89 days in the 75+ age group.

Chart 9: Mean LOS of the emergency readmission, 1998/9 to 2006/7



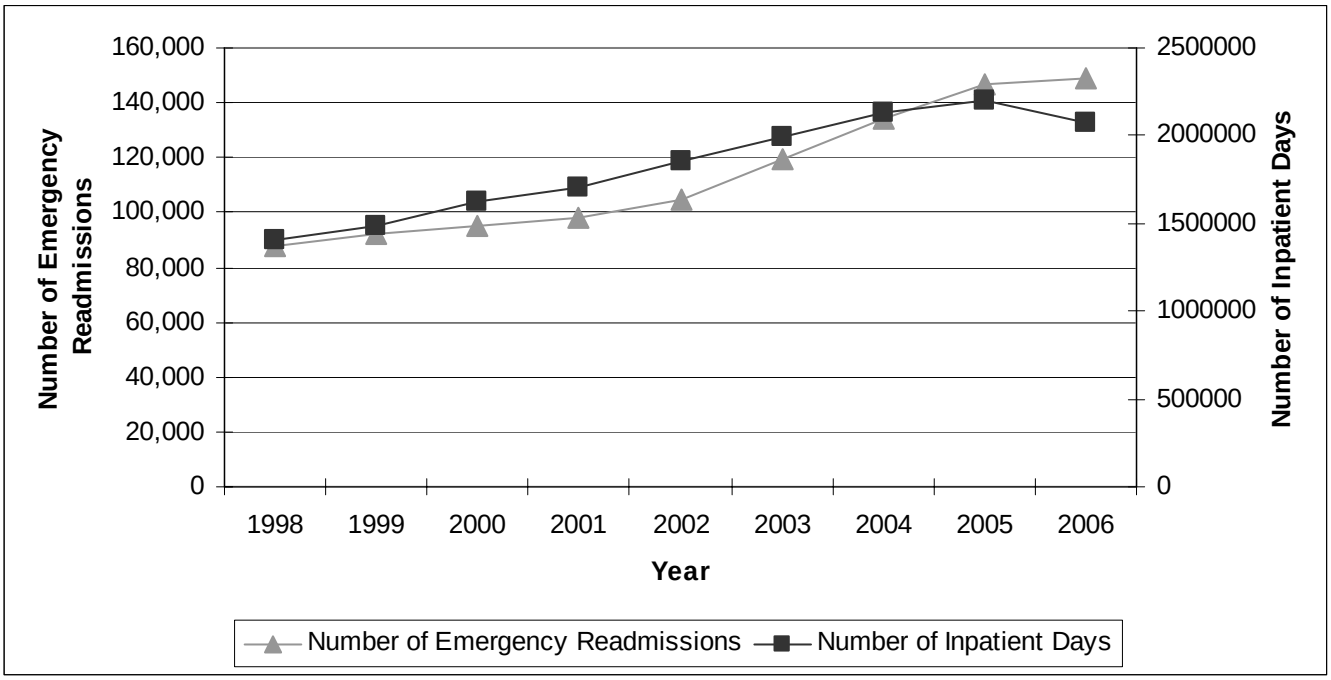
67. From the chart below we can see the effect of the reduction in the mean length of stay on the total number of inpatient days accounted for by emergency readmissions. The trend in inpatient days due to emergency readmissions does not mirror the trend in the total number of readmissions – indeed it levels out in 2004 and appears to decline in 2006/7.

Chart 10: Trends in number of emergency readmissions and associated number of inpatient days, 1998/9-2006/7, 16-74.



68. The chart below shows the equivalent analysis for the 75+ age group. For the 75+ the two trends seem more similar. However, from 2004/5 onwards the trend in the number of inpatient days seems to stabilise and the decrease, whilst the total number of emergency readmissions continues to increase.

Chart 11: Trend in Emergency Readmissions by Raw Count and Patient Bed Days, 1998/9-2006/7, 75+



(vii) TIME BETWEEN DISCHARGE FROM ORIGINAL INPATIENT EPISODE AND EMERGENCY READMISSION

69. This section looks at changes in the number and proportion of emergency readmissions analysed by the time elapsing between discharge from the original inpatient episode and the emergency readmission. The data are shown in table 13 below.

70. Over the period 1998/9-2006/7 there has been an increase in the number of emergency readmissions occurring in all bands of elapsed days (0-1, 2-7, 8-14 and 15-27 days). However, the increase in the proportion of emergency readmissions occurring within 0 -1 days of the original discharge has been particularly marked. As a percentage of the annual total, emergency readmissions occurring within 0-1 and 2-7 days have increased whilst at the same time emergency readmissions occurring within 8-14 and 15-27 days have decreased.

Table 13: Time between original admission discharge and emergency readmission

	Proportion of total readmissions				Number of readmissions			
Year	0 to 1 days	2 to 7 days	8 to 14 days	15 to 27 days	0 to 1 days	2 to 7 days	8 to 14 days	15 to 27 days
1998/9	11.4%	34.9%	24.7%	28.9%	22,109	67,458	47,770	55,801
1999/0	12.0%	35.0%	24.6%	28.3%	23,795	69,179	48,621	56,025
2000/1	11.6%	35.1%	24.8%	28.5%	23,404	70,800	49,899	57,405
2001/2	11.9%	34.8%	24.6%	28.7%	24,146	70,919	50,098	58,369
2002/3	11.9%	35.2%	24.5%	28.4%	24,911	73,714	51,268	59,351
2003/4	12.5%	35.3%	24.2%	27.9%	29,488	83,190	56,927	65,758
2004/5	13.3%	35.1%	23.7%	27.9%	34,521	91,135	61,569	72,331
2005/6	14.2%	35.3%	23.4%	27.0%	40,356	99,966	66,358	76,588
2006/7	14.9%	35.6%	23.1%	26.4%	43,560	104,255	67,644	77,141

71. Table 14 below shows the mean number of days between discharge and emergency readmission. There has been a small reduction (7% for the 16-74 age group and 5% for 75+ age group) in the time between admission and readmission over the period analysed. As with other analyses, there appears to be a clear change in the trends around 2002/03 – for instance, for the 16-74 age group there was only a 1% reduction between 1998/9 and 2002/3 followed by a 6% reduction between 2002/3 and 2006/7.[9]

Table 14: Mean number of days between original admission discharge and emergency readmission.

Year	1998/9	1999/0	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7
16-74	10.2	10.1	10.1	10.1	10.1	10.0	9.9	9.7	9.5
75+	10.9	10.8	11.0	11.0	11.0	10.8	10.6	10.6	10.4

72. Clinicians at the workshop suggested that these patterns could be due to a combination of the factors discussed above – an increasing tendency for patients to seek further specialist help shortly after the discharge from the original admission, perhaps because of an increasing unwillingness to tolerate the delayed side effects of treatment, combined with an increasing availability (especially after 2002/3) of appropriate facilities for short-term follow-up and observation. In this connection, it would be interesting to analyse the length of stay of emergency readmissions stay alongside the period between discharge and emergency readmission, as on the explanation suggested by the clinicians

[9] For the 75+ age group there was a 1% increase between 1998/9 and 2002/3 followed by a 6% reduction between 2002/3 and 2006/7.

the two would be expected to be correlated. Unfortunately it was not possible to analyse this from the data available at the time, but could be a possible area for further detailed analysis.

(viii) VARIABILITY OF HRG EMERGENCY READMISSION RATES ACROSS CLUSTERS

73. The aim of this paper is to understand the trend behind the increase in emergency readmission rates in recent years and provide some insight into whether this has been affected by the quality of clinical care.

74. As we have seen up to now, emergency readmission rates across HRG vary and a high rate in one HRG compared to another does not necessarily indicate poor quality of care. Some HRGs, due to their nature, will have higher emergency readmission rate than others. However, if we observe large variations between hospitals in the emergency readmission rates within individual HRGs, this may be a sign of different clinical processes and patient pathways or even of variations in quality.

75. NCHOD group individual hospital providers into clusters based on their size and the type of care they provide. Using NCHOD's grouping, this section presents some preliminary findings regarding variation between providers and calls for further detailed analysis in the emergency readmission rate within HRGs. We have used as a measure of variability the interquartile range, which is equal to the difference between the first and third quartiles in the distribution.

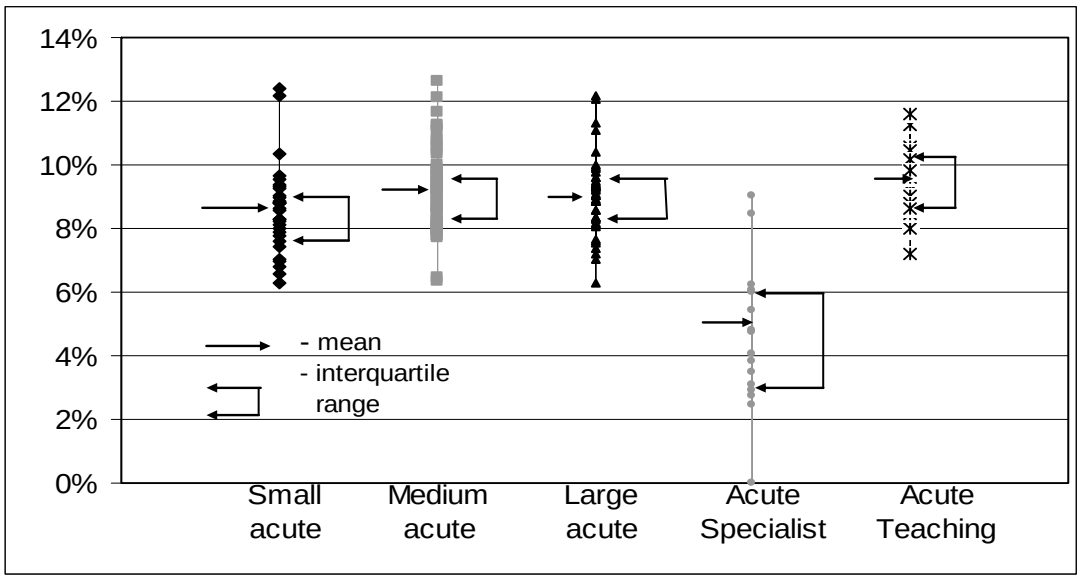
76. The table below shows the mean and interquartile range of emergency readmission rates for people aged 16-74, across all clusters and HRGs. Variability across providers increases until 2004/5, with a bigger increase after 2001/2, and then drops.

Table 15: Mean and interquartile range of emergency readmission rates, 16-74

	Mean	Interquartile range
1998	6.9%	2.2%
1999	7.2%	2.4%
2000	7.3%	2.4%
2001	7.5%	2.5%
2002	7.5%	3.5%
2003	7.9%	4.1%
2004	8.5%	5.5%
2005	8.8%	4.1%
2006	9.1%	3.7%

77. Some of the variation in table 15 will be due to variations in case mix and other factors between providers of different types. The following chart presents results using NCHOD's grouping into clusters based on the size and the type of care providers offer. The graph shows how the emergency readmission rates have varied across clusters for all providers in 2006/7, for the age group 16 -74.

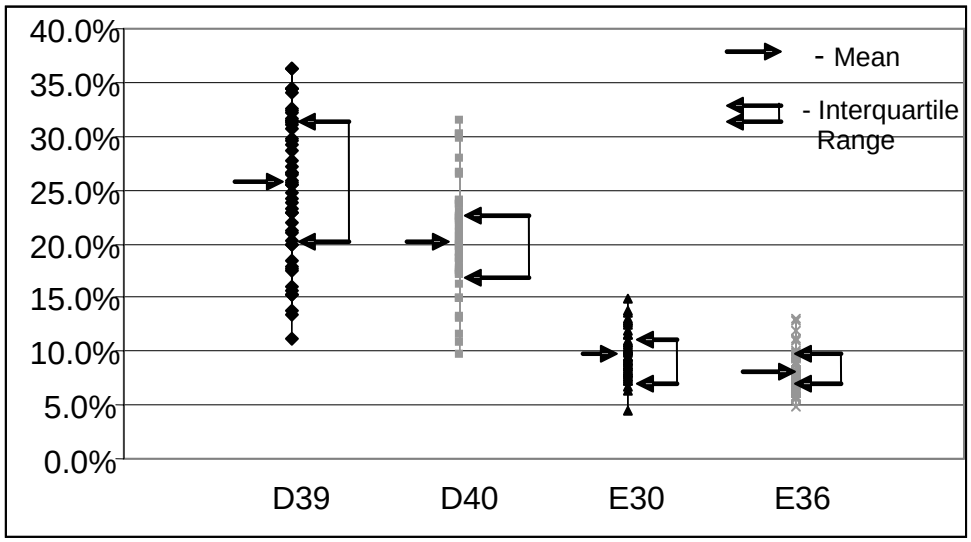
Chart 12: Variation in Emergency Readmission Rates for Clusters across Providers, Age Group 16 -74, 2006/7.



78. The above chart shows considerable variation in emergency readmission rates both between and within clusters. As we can see, acute specialist providers have lower emergency readmission rate than the rest of the cluster of providers and much higher interquartile range than the other. This may reflect their very different case mix compared to non-specialist hospitals and between themselves. However, it is difficult to draw firm conclusions without adjusting more systematically for variations in case mix.

79. In the following chart, we present results on emergency readmission rates within the medium acute cluster for four HRG's in 2006/7, age group 16-74. The four HRG's are: Chronic Obstructive Pulmonary Disease or Bronchitis with complications (D39); Chronic Obstructive Pulmonary Disease or Bronchitis without complications (D40); Arrhythmia or Conduction Disorders <70 (E30); and Chest Pain <70 (E36).

Chart 13: Variation in Emergency Readmission Rates for Medium Acute Cluster across 4 HRG's, Age Group 16 -74, 2006/7.



80. As we can see from the above chart the average emergency readmission rate varies greatly between HRGs; for example, the emergency readmission rate for Chronic Obstructive Pulmonary Disease or Bronchitis with complications (D39) is around 25% while for Chest Pain for people less than 70 years old (E36) is around 8%. At the same time, the variation within D39 is much higher than E36.

81. The above analysis suggests that, in order to be able to understand better the reasons for variations in emergency readmission rates both over time and between providers, we need to examine the rates of individuals HRGs in similar type of providers (in order to compare like with like). We should not only look at the mean rate but the variation between providers as well, and the possible factors which might explain this variation. A further detailed analysis of this form might throw further light on the question of whether – and for which conditions or procedures – emergency readmission rates can be taken as a reliable indicator of quality of care.

(ix) FURTHER ANALYSIS

82. This basic analysis showed some interesting results and highlighted some possible areas for further analysis. These include:

    i. Further analysis of the relationship between the original admission and the subsequent emergency readmission at procedure and diagnosis level. It would be particularly interesting to look at the relationship in procedure/diagnoses codes of emergency readmissions following particular elective surgery procedures, as this may be the area in which the emergency readmissions rate is most likely to be an indicate of the quality of care in the original hospital episode. Conversely, in some longer term conditions (especially where the diagnosis/procedure is the same or closely related for the original and subsequent admission) the rate of readmissions within a short period of discharge may be an indicator of the quality or accessibility of community services.

ii. Related to the previous suggestion, choosing a number of specific conditions/procedures (eg some elective surgery procedures compared with some acute episodes associated with long term conditions such as CPOD) and analysing the rate of specific causes of readmission to assess which could be due to adverse consequences of the original admission and which are more likely to be separate episodes

iii. Analysis of the correlation between the length of time between discharge and emergency readmission and the length of stay of the subsequent readmission, by HRG.

iv. Multiple regression analysis of emergency readmission rates by HRG by provider to identify possible casual factors and to assess whether the residual variation could be used as a marker of quality (either of the quality of hospital care or of the quality/accessibility of community care).

v. Detailed analysis, perhaps looking at suitably anonymised medical records, of the reasons behind variability within HRGs among providers with similar characteristics.

Department of Health

Finance and Investment Directorate
NHS Medical Directorate

October 2008

Appendix A – Emergency readmissions: Clinicians Workshop

In order to fully understand the results of our analysis, the Department organised a consultation workshop to investigate and discuss causal factors. At the workshop a number of questions were posed relating to the general increase in emergency readmissions and specifically, the step-change in 2002-3. Consideration was paid to individual conditions and whether the data indicates poor quality care in certain areas. Attention was also given to the increase in readmissions under the care of A&E professionals and to the rise in readmissions within 24 hours of initial discharge.

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Woollard, Malcolm	Professor in Pre-hospital and Emergency care, Coventry University

Appendix B – Paper by the National Centre for Health Outcomes Development

Interim report to the Information Management Committee, Department of Health: Preliminary analyses of the growth in emergency readmission rates over the eight year period 1998-9 to 2005-6, National Health Service, England

Introduction

Data on emergency readmissions within 28 days after discharge, analysed / published by the National Centre for Health Outcomes Development (NCHOD) since 1998, have consistently shown a rising annual trend at national level in England. This remained after taking into account differences between the years in the age and gender of patients, method of admission of the original hospital stay, diagnoses within medical specialties, and operations within surgical specialties. The basic assumption behind these indicators is that emergency readmissions are likely to reflect unplanned care and that a proportion may reflect potentially avoidable adverse events. The indicators exclude maternity patients and those with mental health problems or cancer, where emergency readmissions are more likely to be expected. The indicators also exclude day cases. These indicators were first developed to compare hospitals. As there are more day cases than inpatient stays, the ratio varies between hospitals, and day cases have fewer readmissions, it was felt at the time that inclusion of day cases would make comparisons difficult to interpret. NCHOD was commissioned by the then Information Management Group of the Department of Health to undertake preliminary analyses of more detailed data to explore potential reasons for the rising trend.

Results of the analyses

During the period 1998-9 to 2005-6, emergency readmissions to hospital within 28 days of a previous live discharge rose considerably (see Compendium of Clinical and Health Indicators, May 2007 (www.nchod.nhs.uk)). Table 1 below provides the basic data together with the percentage readmission rate.

Table 1: Growth in emergency readmissions between 1998/9 and 2005/6

ENGLAND: All adults aged 16+				
	Number of discharges to 31st March	**Number of emergency readmissions**	**Raw readmission rate(%)**	**Indirectly age, sex, method of admission, diagnosis, procedure standardised rate (%) #**
98-99	3,681,793	282,132	7.66	7.84
99-00	3,650,763	290,927	7.97	8.05
00-01	3,654,202	298,214	8.16	8.21
01-02	3,625,436	303,224	8.36	8.33
02-03	3,708,764	314,946	8.49	8.49
03-04	3,954,980	355,805	9.00	8.89
04-05	4,091,547	395,020	9.65	9.41
05-06	4,278,394	431,020	10.07	9.83

Indirect standardisation involves the calculation of the ratio of the observed number of events in a particular year and the number of events that would be expected if the NHS had experienced the same event rates as those in the year used as standard (2002/03), given the mix of patients' age, sex, method of admission, diagnoses, and operations. This standardised ratio is then converted into a rate by multiplying it by the overall event rate of patients in England. This enables comparison between years on a 'like' for 'like' basis.

The increase in the raw emergency readmission rate during this time has been 31.5%, occasioned by an average annual growth of 3.86%. However, average annual growth in the first four years of the period was 2.57%, while in the last four growth ran at an average rate of 5.13% per annum. Comparable figures for the indirectly standardised rate were a 25.4% increase and an average annual growth of 3.17% over the eight years. Average annual growth figures for this statistic were 1.95% in the first four years and 4.44% in the last four.

We have undertaken analyses across a wide range of variables, examining each variable on its own (univariate) and a summary of results is provided in the table in Annex 1. A brief description of our findings to date is provided in the next section.

Univariate analyses

1. Age

Table 2 shows the raw emergency readmission rate for each of the eight years, by age and gender across all acute conditions. This clearly shows that, unsurprisingly, readmissions increase with age. The results summarised in Annex 1 suggest that some of this increase may be related to specific diagnoses and procedures. For example, chronic conditions typically have more frequent admissions and are more common among older people. While the relationship between age and readmissions is statistically significant (i.e. a statistical test shows that this relationship is unlikely to be a chance occurrence), removing its effect by standardisation has a limited impact on the growth in readmissions that has been previously noted.

Table 2: Variation in emergency readmission rate by age and gender

		Raw readmission rate(%)							
Sex and age:		**98-99**	**99-00**	**00-01**	**01-02**	**02-03**	**03-04**	**04-05**	**05-06**
M	**16-64**	6.78	6.99	7.05	7.31	7.33	7.86	8.47	8.93
	65-74	9.20	9.57	9.71	9.86	9.67	10.16	10.68	11.01
	75-84	10.74	10.96	11.24	11.28	11.72	12.34	13.03	13.44
	85+	11.69	12.28	12.89	12.88	13.57	14.70	15.70	16.36
F	**16-64**	6.09	6.33	6.53	6.70	6.71	7.05	7.59	7.91
	65-74	8.04	8.37	8.61	8.50	8.69	9.03	9.46	9.69
	75-84	9.07	9.55	9.82	10.09	10.51	11.17	12.08	12.65
	85+	9.94	10.51	10.95	11.55	12.19	13.04	14.48	15.15

2. Gender

Table 2 also shows that the raw emergency readmission rate differs somewhat between the sexes. Typically males have a higher readmission rate than females (allowing for age) and this is shown to be highly consistent over time. As with age, some of this difference can be related to specific diagnoses and procedures e.g. chronic respiratory conditions. Again this relationship has been found to be statistically significant but removing its effect by standardisation also has little impact.

3. Method of admission

The method of admission of the patient's index admission i.e. the initial admission which may lead to subsequent readmissions, has a significant impact on the chances of that patient being readmitted as an emergency within 28 days. Readmissions following a non-elective (emergency admissions,

emergency transfers and other urgent cases) index admission generally occur at a rate of between 11 and 12 per 100 while those following an elective admission typically occur at about 5 per 100. Like age and gender, this variable has been included within the standardisation approach we have adopted and its effect has been removed in deriving the indirectly standardised figures shown in Table 1 and Tables 3 to 5.

4. Diagnoses and procedures

A previous study[10] of emergency readmission rates by diagnosis, and separately by procedure, showed that there were different rates for different clinical conditions. This is not at all surprising but unless acknowledged could impact on the interpretation of readmission rates over time, should the balance of care between conditions shift during the period under study. Readmissions following a medical admission run at about 5 percentage points higher than those following surgery (approximately 12% compared to 7%) but a large proportion of this is due to the proportional difference in type of admission between these two groups - medical specialties have a higher proportion of non-elective conditions than surgical specialties. The indirectly standardised figures in Tables 1 and Tables 3 to 5 have been standardised using approximately 200 diagnosis and procedure groups.

As identified previously, age, gender and method of admission interact together with the diagnosis and/or procedure and may impact on readmission rates depending on the mix of patients under consideration. The use of indirect standardisation for all these variables (as shown in Table 1), when used across organisations or over time, should reduce this effect. However, in this case, it explains just less than 20% of the noted growth in raw readmission rates over the eight year period (annual growth rate is reduced from 3.86 to 3.17 (18%)) implying that other additional factors are also having an effect.

> **Summary: Variations in age, gender, method of admission and case-mix over the eight year period explain approximately 20% of the overall increase in raw emergency readmission rates over that time. More detailed analyses, looking at specific individual diagnosis and procedure groups are recommended. Discussions with clinicians on changes in case-mix and care practices over time, as well as the proportion of emergency readmissions likely to be due to potentially avoidable adverse events, are also recommended.**

Having examined individual patient variables, the analysis next looks at variables related to geography, demography and deprivation. This section of the analysis removes the impact of the patient variables by only looking at standardised emergency readmission rates.

5. Geography (defined by Strategic Health Authorities (July 2006))

Table 3 overleaf shows the level of variation between Strategic Health Authorities both in terms of the indirectly standardised emergency readmission rate (standardised by variables 1 to 4 above) and in terms of the average annual growth in this figure. Inevitably there is variation in these figures but the range* has reduced somewhat across the eight years (1.42% cf 1.72%) despite the growth in the absolute rate. Individual Strategic Health Authorities have grown at different rates, most notably London and the South East Coast which have had the highest growth rates, although the latter started from the lowest base figure in 1998/9. London's readmission rate rose by 35.3% in the eight year period and also showed an above average growth in the number of index admissions during this time.

[Note: * The 'Others' category has been excluded from this analysis. It includes patients whose initial (index) admission took place in another part of the United Kingdom or, where this is known, in the independent sector or overseas. These account for relatively few patients (1.2% in 1998/9) and the results are somewhat anomalous across years.]

[10] Lakhani A, Coles J, Spence C. *Review and Refinement of the Readmissions Clinical Indicators (for selected specialties excluding diagnoses of cancer) Phase 2.* NCHOD, London. January 2004.

Table 3: Variation in indirectly standardised (by age, gender, method of initial admission and selected diagnostic and procedure groups) emergency readmission rate by Strategic Health Authority

	Indirectly standardised readmission rate (%)							
Strategic Health Authority of residence:	**98-99**	**99-00**	**00-01**	**01-02**	**02-03**	**03-04**	**04-05**	**05-06**
NORTH EAST STHA	8.51	8.88	9.20	9.34	9.37	9.77	10.18	10.67
NORTH WEST STHA	8.21	8.46	8.58	8.68	8.91	9.40	9.95	10.37
YORKSHIRE AND THE HUMBER STHA	8.72	8.85	9.01	9.01	9.13	9.30	9.57	9.98
EAST MIDLANDS STHA	7.96	8.21	8.68	8.89	9.16	9.13	9.62	10.14
WEST MIDLANDS STHA	7.76	7.84	8.06	8.13	8.55	8.63	8.94	9.47
EAST OF ENGLAND STHA	7.71	7.71	7.78	7.95	7.93	8.50	9.04	9.25
LONDON STHA	7.50	7.49	7.60	7.69	7.89	8.64	9.38	9.96
SOUTH EAST COAST STHA	7.00	7.14	7.46	7.63	7.98	8.42	9.00	9.47
SOUTH CENTRAL STHA	7.62	7.82	8.41	8.74	8.26	9.00	9.66	9.77
SOUTH WEST STHA	7.51	8.23	7.73	7.82	8.06	8.42	9.06	9.39
Other	3.65	4.34	4.52	4.77	5.05	6.34	7.05	8.08

Average annual growth rate %

NORTH EAST STHA	2.96
NORTH WEST STHA	3.32
YORKSHIRE AND THE HUMBER STHA	1.74
EAST MIDLANDS STHA	3.23
WEST MIDLANDS STHA	2.78
EAST OF ENGLAND STHA	2.81
LONDON STHA	4.28
SOUTH EAST COAST STHA	4.49
SOUTH CENTRAL STHA	3.56
SOUTH WEST STHA	2.81
Other	11.39

Table 4: Variation in indirectly standardised (by age, gender, method of initial admission and selected diagnostic and procedure groups) emergency readmission rate by ONS Area classification

ONS Area classification:		Indirectly standardised readmission rate (%)							
		98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06
ONS1.1	REGIONAL CENTRES	8.63	8.72	8.86	9.10	9.21	9.61	10.15	10.71
ONS1.2	CENTRES WITH INDUSTRY	8.31	8.36	8.62	8.87	9.20	9.35	9.89	10.27
ONS1.3	THRIVING LONDON PERIPHERY	7.36	7.35	7.91	8.03	7.99	8.81	9.31	10.22
ONS2.4	LONDON SUBURBS	7.26	7.13	7.56	7.35	7.62	8.32	9.31	9.80
ONS3.5	LONDON CENTRE	7.61	7.90	7.72	7.73	8.34	9.00	9.85	10.42
ONS4.6	LONDON COSMOPOLITAN	8.13	8.16	8.12	8.60	8.46	9.36	9.90	10.10
ONS5.7	PROSPERING SMALLER TOWNS	7.45	7.90	7.96	8.02	8.18	8.50	8.99	9.46
ONS5.8	NEW AND GROWING TOWNS	7.65	7.67	7.89	7.99	7.96	8.56	9.26	9.71
ONS5.9	PROSPERING SOUTHERN ENGLAND	7.02	7.16	7.32	7.54	7.62	8.37	9.03	9.10
ONS6.10	COASTAL AND COUNTRYSIDE	7.46	7.82	7.96	8.07	8.37	8.45	8.77	9.04
ONS7.11	INDUSTRIAL HINTERLANDS	8.56	8.82	8.97	9.09	9.19	9.86	10.16	10.45
ONS7.12	MANUFACTURING TOWNS	8.48	8.69	8.88	8.85	8.91	8.95	9.36	9.91

Average annual growth rate %

REGIONAL CENTRES	3.06%
CENTRES WITH INDUSTRY	3.15%
THRIVING LONDON PERIPHERY	4.63%
LONDON SUBURBS	4.58%
LONDON CENTRE	4.68%
LONDON COSMOPOLITAN	3.51%
PROSPERING SMALLER TOWNS	3.06%
NEW AND GROWING TOWNS	3.46%
PROSPERING SOUTHERN ENGLAND	4.11%
COASTAL AND COUNTRYSIDE	2.57%
INDUSTRIAL HINTERLANDS	2.89%
MANUFACTURING TOWNS	1.79%

6. Demography (defined by Office for National Statistics (ONS) Area classification (April 2004))

Table 4 provides similar information by ONS Area classification. This classification groups similar types of areas across the country, variously describing them as 'Prospering Smaller Town' and Coastal and Countryside'. The table shows a similar scale of variation to that seen across Strategic Health Authorities.

The range (1.61% in 1998/9) of the standardised rate has remained almost static over the eight years (1.67% in 2005/6) despite the growth in the absolute rate. The rates within individual areas have again grown at different rates, with those defining London (ONS Areas 1.3, 2.4 and 3.5) showing the highest growth rates, thus reinforcing the findings of the previous section. The growth in Area 4.6 - London Cosmopolitan is somewhat less, having started from a higher base in 1998/9. The importance of London's contribution to the overall rise in emergency readmissions is again emphasised.

7. Deprivation (defined by the Index of Multiple Deprivation (IMD) groups)

Table 5 overleaf shows standardised emergency readmission rates by IMD group. Individual patients are assigned to a group based on the deprivation level of their postcode, and in this way it is relatively more sensitive in this respect than other groupings. The most noteworthy feature of table 4 is the consistency with which more deprived populations have a higher rate of readmission than those with less deprivation. There is a consistent gradient through the groups that is maintained across all eight years.

The growth rate throughout the period is also more consistent across groups than in tables 3 and 4, therefore the only way that deprivation could make a significant contribution to the increase in readmission rates between 1998/9 and 2005/6 would be if the number of admissions in those groups with the highest readmission rates (Groups 1 and 2) increased disproportionately compared to the other groups. This is not the case; in 1998/9 groups 1 and 2 accounted for 46.5% of admissions while in 2005/6 they accounted for 45.9%.

Geography, demography and deprivation provide some indication of factors that have had an impact on emergency readmission rates although, in the case of deprivation, there is no evidence that this has contributed to the growth in the rate over the eight year period. Additionally while deprivation may explain variation in readmission rates, it does not necessarily justify it.

Variations in the rate by geography and demography are inevitable (the national figure being a composite of those of the areas). This part of the analysis therefore only highlights areas that make an 'above average' contribution to the national figure. Emergency readmissions may reflect patient factors that are not amenable to NHS interventions (e.g. lack of social support) as well as the NHS' response to poor patients and the quality of care. The latter are amenable to change by the NHS. The reasons behind the increased contributions from areas such as London therefore require further detailed analysis.

> **Summary: There is no evidence that deprivation has contributed to the growth in readmission rate over the eight year period. Different geographic and demographic areas have different rates of readmission and some make a greater than average contribution to the rise in the national rate. These three measures overlap to some extent, for example deprivation is more prevalent in some inner city areas and in some rural communities, which also define to some degree some of the ONS areas.**

The final part of this paper looks at some additional analyses that have been undertaken to try to inform discussion as to whether specific aspects of patient management might have contributed to the rise in emergency readmission rates. These analyses have been undertaken on the raw data since they either use sub-populations of readmitted patients and/or additional variables making standardisation inappropriate. We have shown that approximately 80% of the rise in emergency readmission rates remains unexplained after standardisation, thus leaving plenty of scope for further analyses to address this issue.

Table 5: Variation in indirectly standardised (by age, gender, method of initial admission and selected diagnostic and procedure groups) emergency readmission rate by Index of Multiple Deprivation (IMD) groups

	Indirectly standardised readmission rate (%)							
Index of Multiple Deprivation:	**98-99**	**99-00**	**00-01**	**01-02**	**02-03**	**03-04**	**04-05**	**05-06**
IMD Group 1 (Most Deprived)	8.95	9.07	9.30	9.42	9.60	10.04	10.58	11.05
IMD Group 2	8.07	8.30	8.49	8.56	8.74	9.16	9.73	10.16
IMD Group 3	7.59	7.79	7.92	8.11	8.26	8.61	9.07	9.52
IMD Group 4	7.21	7.56	7.66	7.69	7.91	8.19	8.71	9.10
IMD Group 5 (Least Deprived)	6.85	7.07	7.20	7.41	7.44	7.87	8.40	8.71

Average annual growth rate %

IMD Group 1 (Most Deprived)	3.01%
IMD Group 2	3.21%
IMD Group 3	3.17%
IMD Group 4	3.10%
IMD Group 5 (Least Deprived)	3.40%

This next section addresses questions relating to organisational and clinical practice such as:

- is the increased emergency readmission rate related to reductions in length of stay?
- is the increase due to
    - more readmissions per patient
    - an increasing proportion of patients with multiple readmissions?

8. The relationship between raw emergency readmission rate and length of stay

Table 6 sets out the raw emergency readmission rates for each age and gender category (previously presented in Table 2) alongside the corresponding national average length of stay for that sub-population, for each of the eight years. It is clear that length of stay increases as the age of the patient increases, and among the older age groups women stay in hospital longer than men, although some of this may be due to the case-types admitted or to the severity of the condition.

Across the eight year period, there is an inverse but weak relationship between length of stay and readmission rate. Up to 2002-03, the readmission rate grows relatively slowly and length of stay *increases*. After 2002-03 the readmission rate grows faster and length of stay *decreases.* This is true for all combinations of age group and sex. There is a statistically significant correlation between readmission rate and length of stay over this latter period, suggesting that there may be some connection between the two variables. However, with such a difference between the two time periods (1998/9 to 2001/2 and 2002/3 to 2005/6) this possibility should be treated with caution until either an explanatory cause can be proposed for the change that occurred around 2001/2, or the finding is reinforced by a continuation of the trend in future years.

At this stage, looking across the eight year period, it is difficult to suggest that the reduction in the length of stay from 1998/9 (which is quite modest in some age bands) is responsible for the rise in the readmission rate. A statistical relationship does not automatically mean that one caused the other – there may be other explanatory factors. However, the possibility that it may have contributed to the increase, particularly over the latter years, can not be discounted either.

Summary: Across the eight year period, there is an inverse but weak relationship between length of stay and readmission rate, with different distinct patterns over two time periods. More detailed analyses, looking at specific individual diagnosis and procedure groups across clusters of providers are recommended. Discussions with clinicians on possible explanations for the observed relationships are also recommended.

9. The impact of multiple readmissions on the readmission rate

Tables 7 and 8 look at the relationship between the average number of emergency readmissions per patient and the number of different patients being readmitted. In this analysis, we are trying to see whether the growth in the readmission rate can be explained by any movement in the number of patients with multiple readmissions.

Table 7 shows that the average annual growth rate in emergency readmissions per patient is relatively low when compared to the growth rate in the readmission rate itself. However, Table 8 shows that the growth rate in patients with more than three emergency readmissions in the year has been considerable. Similarly the growth in the proportion of readmitted patients that have had more than three emergency readmissions has also exceeded the overall growth in emergency readmissions. Taken together, these results would suggest that multiple readmissions have made a sizeable contribution to the growth in the national readmission rate over the eight year period. Looking at the detailed figures, this finding would appear to be consistent across all age and gender bands although, perhaps not surprisingly growth has been greatest in the older age groups. It can also be seen that the growth in the proportion of patients with multiple readmissions has accelerated towards the end of the period under study.

Summary: There is quite strong evidence that changes in practice have contributed to the increase in the emergency readmission rate. Recent reductions in the average length of stay may have had some effect but across the eight year period, the relationship with emergency readmission rates is weak. There does appear to be evidence that multiple readmissions have made a considerable contribution to the rise in the overall rate.

Table 6: The relationship between raw emergency readmission rate(%) and length of stay (LoS) in days

		Age: 16-64		65-74		75-84		85+	
		Readm rate	LoS	Readm rate	LoS	Readm rate	LoS	Readm rate	LoS
Male	**98-99**	6.78	4.4	9.2	7.77	10.74	10.29	11.69	13.47
	99-00	6.99	4.41	9.57	7.9	10.96	10.36	12.28	13.64
	00-01	7.05	4.51	9.71	7.99	11.24	10.64	12.89	14.11
	01-02	7.31	4.59	9.86	8.18	11.28	11.18	12.88	14.72
	02-03	7.33	4.59	9.67	8.07	11.72	11.03	13.57	15.02
	03-04	7.86	4.44	10.16	7.84	12.34	10.85	14.7	14.61
	04-05	8.47	4.19	10.68	7.5	13.03	10.43	15.7	13.75
	05-06	8.93	3.88	11.01	7.05	13.44	9.81	16.36	13.04
		Age: 16-64		**65-74**		**75-84**		**85+**	
		Readm rate	**LoS**	**Readm rate**	**LoS**	**Readm rate**	**LoS**	**Readm rate**	**LoS**
Female	**98-99**	6.09	4.03	8.04	8.58	9.07	12.7	9.94	16.8
	99-00	6.33	4.03	8.37	8.66	9.55	12.9	10.51	17.23
	00-01	6.53	4.1	8.61	8.77	9.82	13.21	10.95	18.01
	01-02	6.7	4.17	8.5	8.88	10.09	13.66	11.55	18.95
	02-03	6.71	4.05	8.69	8.65	10.51	13.77	12.19	19.1
	03-04	7.05	3.94	9.03	8.37	11.17	13.29	13.04	18.29
	04-05	7.59	3.72	9.46	7.92	12.08	12.63	14.48	16.88
	05-06	7.91	3.45	9.69	7.36	12.65	11.74	15.15	15.58

		Correlation between LoS and Readm. Rate (8 readings '98 to'05)	Correlation between LoS and Readm. Rate (4 readings '02 to '05)
Male	16-64	-0.82	-0.98
	65-74	-0.77	-0.97
	75-84	-0.38	-0.95
	85+	-0.21	-0.98

		Correlation between LoS and Readm. Rate (8 readings '98	Correlation between LoS and Readm. Rate (4 readings '02
Female	16-64	-0.87	-0.98
	65-74	-0.87	-0.97
	75-84	-0.52	-0.98
	85+	-0.38	-0.99

Table 7: Analysis of emergency readmissions per patient over time

Age and sex:		Readmissions per patient							
		98-99	**99-00**	**00-01**	**01-02**	**02-03**	**03-04**	**04-05**	**05-06**
Male	**16-64**	1.38	1.38	1.38	1.41	1.40	1.43	1.46	1.49
	65-74	1.33	1.34	1.36	1.37	1.37	1.37	1.41	1.42
	75-84	1.29	1.29	1.30	1.30	1.32	1.33	1.35	1.37
	85+	1.23	1.24	1.24	1.25	1.25	1.27	1.28	1.32
Female	**16-64**	1.33	1.33	1.34	1.35	1.34	1.36	1.38	1.39
	65-74	1.31	1.30	1.31	1.31	1.32	1.34	1.35	1.37
	75-84	1.24	1.25	1.26	1.27	1.28	1.29	1.32	1.34
	85+	1.19	1.20	1.21	1.21	1.22	1.24	1.26	1.28

Average annual growth rate %

Male	16-64	1.1%
	65-74	0.9%
	75-84	0.9%
	85+	0.9%
Female	16-64	0.6%
	65-74	0.7%
	75-84	1.0%
	85+	1.1%

Table 8: Growth in the proportion of patients with multiple (>3) emergency readmissions in the year over time

		98-99		99-00		00-01		01-02		02-03		03-04		04-05		05-06	
Age and sex:		**No of patients with more than 3 readmns. in year**	**Prop'n of readmitted patients who have had more than 3 readmns. in year**	**No of patients with more than 3 readmns. in year**	**Prop'n of readmitted patients who have had more than 3 readmns. in year**	**No of patients with more than 3 readmns. in year**	**Prop'n of readmitted patients who have had more than 3 readmns. in year**	**No of patients with more than 3 readmns. in year**	**Prop'n of readmitted patients who have had more than 3 readmns. in year**	**No of patients with more than 3 readmns. in year**	**Prop'n of readmitted patients who have had more than 3 readmns. in year**	**No of patients with more than 3 readmns. in year**	**Prop'n of readmitted patients who have had more than 3 readmns. in year**	**No of patients with more than 3 readmns. in year**	**Prop'n of readmitted patients who have had more than 3 readmns. in year**	**No of patients with more than 3 readmns. in year**	**Prop'n of readmitted patients who have had more than 3 readmns. in year**
Male	**16-64**	1818	3.50%	1886	3.53%	1929	3.57%	2041	3.73%	2072	3.68%	2534	4.02%	3120	4.51%	3613	4.80%
	65-74	605	2.62%	652	2.78%	703	3.02%	746	3.23%	747	3.24%	830	3.28%	968	3.69%	1074	3.95%
	75-84	437	2.02%	446	2.02%	482	2.15%	496	2.20%	577	2.40%	675	2.50%	840	2.90%	903	3.01%
	85+	104	1.36%	121	1.49%	120	1.39%	135	1.55%	139	1.50%	174	1.67%	225	1.95%	323	2.43%
Female	**16-64**	1429	2.83%	1445	2.79%	1603	3.01%	1593	2.98%	1643	2.98%	1894	3.10%	2337	3.50%	2640	3.60%
	65-74	455	2.45%	472	2.46%	488	2.51%	485	2.57%	557	2.86%	609	2.87%	654	2.93%	756	3.28%
	75-84	381	1.51%	429	1.65%	450	1.70%	516	1.91%	558	1.95%	712	2.18%	891	2.47%	1002	2.66%
	85+	167	1.01%	205	1.17%	196	1.07%	201	1.03%	215	1.04%	338	1.47%	391	1.50%	536	1.81%

Average annual growth rate %

		No of patients with more than 3 readmns. in year	Prop'n of readmitted patients who have had more than 3 readmns. in year
Male	16-64	10.2%	4.6%
	65-74	8.0%	5.5%
	75-84	11.9%	6.3%
	85+	15.6%	7.3%
Female	16-64	9.0%	3.5%
	65-74	7.4%	4.2%
	75-84	15.2%	8.4%
	85+	16.9%	7.7%

Conclusion

The analysis to date has looked at individual variables and their impact on the emergency readmission rate. It has found some areas that may have contributed to the rise in the rate and which may be worthy of further investigation. These include;

- a more detailed examination of the contribution of multiple readmissions to the rise in the rate (including an analysis of the types of patients that have been readmitted twice or three times during the year, by diagnoses etc.);
- an analysis of the relationship between length of stay and readmissions, using a multivariate approach to examine the impact of case-type and other variables on this relationship, particularly examining the last 4 to 5 years of the period;
- a more detailed examination of the contribution of specific diagnosis and procedure groups / chapters to determine which clinical areas have made the greatest contribution to the rise in readmission rates.

NCHOD
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ANNEX A.1

Summary Table of analyses and findings to date

Variable	Is there a relationship between this variable and other variables?	Is there a statistically significant relationship between this variable and emergency readmissions in univariate analyses in-year?	Does this variable explain growth in emergency readmission rates over time in univariate analyses (and by sub-groups e.g. age, gender)?	Is this relevant / meaningful?
Age	See diagnosis / procedure	Yes	No	Indicator has been age-standardised
Gender	See diagnosis / procedure	Yes	No	Indicator has been gender-standardised
Method of admission of index spell		Yes	No	Indicator has been standardised by method of admission of index spell
Diagnosis	Some are age-gender related	Yes, variation across diagnosis groupings	No	Indicator has been standardised by diagnosis groupings
Procedure	Some are age-gender related	Yes, variation across procedure groupings	No	Indicator has been standardised by procedure groupings
Geography (StHA)	Demography, deprivation	Yes (also shown elsewhere at Government Office Region, Primary Care Organisation and Local Authority levels)	Possibly, broadly similar growth rates are seen across HAs, although London makes an above average contribution to the overall figure. More variation noted in 0-15 age group.	Possible focus on reasons underlying high rates by StHAs

Variable	Is there a relationship between this variable and other variables?	Is there a statistically significant relationship between this variable and emergency readmissions in univariate analyses in-year?	Does this variable explain growth in emergency readmission rates over time in univariate analyses (and by sub-groups e.g. age, gender)?	Is this relevant / meaningful?
Demography (ONS area group)	Geography, deprivation	Yes	Possibly, broadly similar growth rates are seen across areas, although London makes an above average contribution to the overall figure. More variation noted in 0-15 age group.	Possible focus on reasons underlying high rates by type of area
Deprivation (Index of Multiple Deprivation)	Geography, demography	Yes (also seen in age/sex/method of admission/diagnosis/procedure standardised rates)	No	May explain variation but does not justify it. May be a reflection of quality i.e. NHS is not sufficiently responsive to needs of poor people.
Length of stay	Age, and weakly with gender	Weak evidence in acute specialties	There would appear to be an inverse relationship over the last four years of the period but this relationship is much weaker across the complete eight year period.	If there is a causal relationship it may be due to poor quality e.g. patients being discharged too early, but may also be due to appropriate clinical decision-making where early discharge (and rehabilitation) for many patients is balanced against the potential risk of readmission of a few. It is important to elicit views of clinicians on these and other possibilities.
Readmissions per person	Proportion of readmitted patients with >3 readmissions per person	Yes	Partially	Reducing readmissions per patient would have an impact on overall readmission rates.

Variable	Is there a relationship between this variable and other variables?	Is there a statistically significant relationship between this variable and emergency readmissions in univariate analyses in-year?	Does this variable explain growth in emergency readmission rates over time in univariate analyses (and by sub-groups e.g. age, gender)?	Is this relevant / meaningful?
Proportion of readmitted patients with >3 readmissions per person	Readmissions per person	Yes	Possibly. There has been a sizeable growth in the proportion of readmitted patient who have had multiple (>3) readmissions in the year.	Reducing readmissions per patient would have an impact on overall readmission rates. Need to examine patients readmitted 2 and 3 times in year as these are likely to account for a much larger proportion of patients than those studied to date.


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