

# **Emergency Admissions in the United Kingdom: Trend Upward or Fundamental Shift?**

by

Rodney P. Jones BSc (Hon) PhD

Directorate of Strategy and Service Development  
Royal Berkshire and Battle Hospitals NHS Trust  
London Road  
Reading RG1 5AN

## **Current contact details:**

Dr Rod Jones (ACMA)  
Statistical Advisor  
Healthcare Analysis & Forecasting  
Camberley, UK  
[hcaf\\_rod@yahoo.co.uk](mailto:hcaf_rod@yahoo.co.uk)  
+44 (0)1276 21061  
[www.hcaf.biz](http://www.hcaf.biz)

Footnote: Additional research conducted by the author has been subsequently added as Appendix 1-2.

Authors Comments: In hindsight there may have been a step change in GP referral associated with the event of March-93. The early 1990's saw the introduction of GP fundholding and considerable media attention which appears to have led to a widespread increase in GP referral during 1991. At this point joint replacement was becoming an increasing feature of Orthopaedic surgery and so a large increase in Orthopaedic referrals further complicates the picture. It is therefore possible that a further step increase occurred in early 1993. I am not sure that the original monthly data is available for re-analysis to clarify this point.

## **Emergency Admissions in the United Kingdom: Trend Upward or Fundamental Shift?**

### **Summary**

The recent increase in emergency admissions within the UK is examined and shown to be due to a fundamental shift rather than a long-term trend. This shift appeared to occur during the period April 1991 to March 1992 for Scotland and in late 1992 or early 1993 for England. Data for Berkshire shows a clear shift around the month of March 1993 while other locations throughout England appear to be clustered between December 1992 and December 1993. The shift resulted in a step upwards in General Medical admissions of around 10%. The increase is not the result of a reduction in the GP threshold for referral or a change in data capture methods. A tentative conclusion is reached for an apparent unique and ongoing shift in the health of the population. The onset of this shift appears to have co-incided with an outbreak of influenza-like illness.

### **Introduction**

There has been much recent speculation about the rise in General Medical emergency admissions within the UK. It is not disputed that a rise has occurred, but the reasons remain largely unexplained (1,2). Much of this debate has unfortunately centred around a short term analysis of the problem. To date only one long term study exists, namely, for the Scottish Health Service covering the years 1981 to 1994 (3).

This Scottish study concluded that the trends in emergency Medical Admissions were mainly part of long-term increases with different rates of increase applying to different diagnostic conditions (3). Not apparently noted in this study is the fact that the data shows that the year-on-year increase from April 1982 to March 1991 was largely linear and that a shift upward had occurred between April 1991 and March 1993, followed by what appeared to be a return to the former level of linear increase, i.e. same slope but higher intercept.

Such behaviour is characteristic of a shift upward or step increase in emergency activity. Such a step increase implies that emergency activity rises to a new higher level and does not return to the previous lower level of activity. This type of change is totally different to a spike increase where the activity rises and then falls to its previous level or to the emergence of a new trend where an increase in the slope of any established trend upward corresponds to a simultaneous reduction in the intercept.

This study proposes that there has been a fundamental shift in emergency admissions which is out of character with past experience. A possible linkage between the onset of this shift and an outbreak of influenza-like illness is explored.

### **Methods**

Data relating to the number of total and emergency admissions was derived from four sources, namely, National statistics (4), data relating to the Oxford Regional Health Authority (2), data from five hospitals throughout England (1) and local data held by

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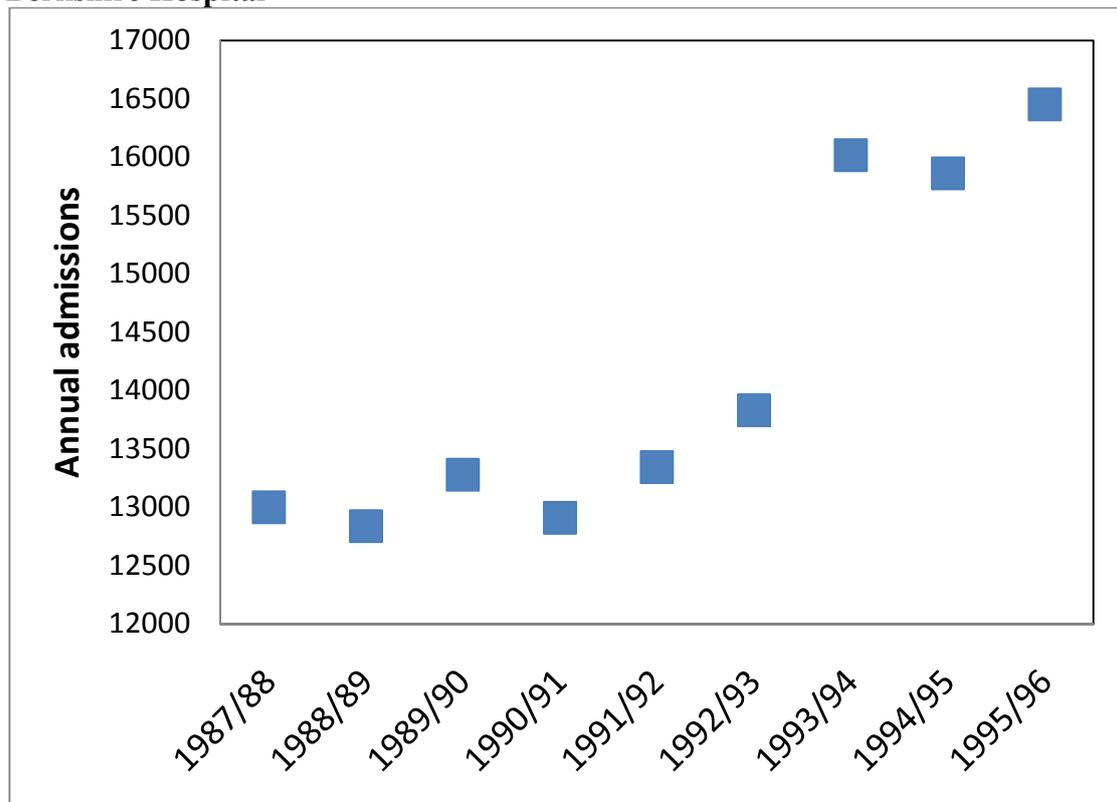
the Royal Berkshire and Battle Hospitals (5). Data for GP referrals comes from National Statistics (6) and local data (5). Data for the incidence of various conditions diagnosed by GP consultation comes from the Birmingham Research Unit of the Royal College of General Practitioners (7).

Data is presented as graphs and histograms. Statistical analysis was not performed due to the obvious magnitude of the difference and the fact that the rise in emergency admissions is already a well accepted. The aim of the study is to demonstrate the key mechanism rather than to establish the exact magnitude of the change.

## Results

To establish if there has been a fundamental shift in emergency admissions both National, Regional and Local data should be examined over a number of years and, if available, on a monthly basis. Due to the different ways of aggregating the numbers at Local, Regional and National levels analysis of local data is first used to establish what it is we are looking for and Regional and National numbers are then used to demonstrate the wider picture. This has been done in Figures 1 to 4 where different views of the same problem have been examined.

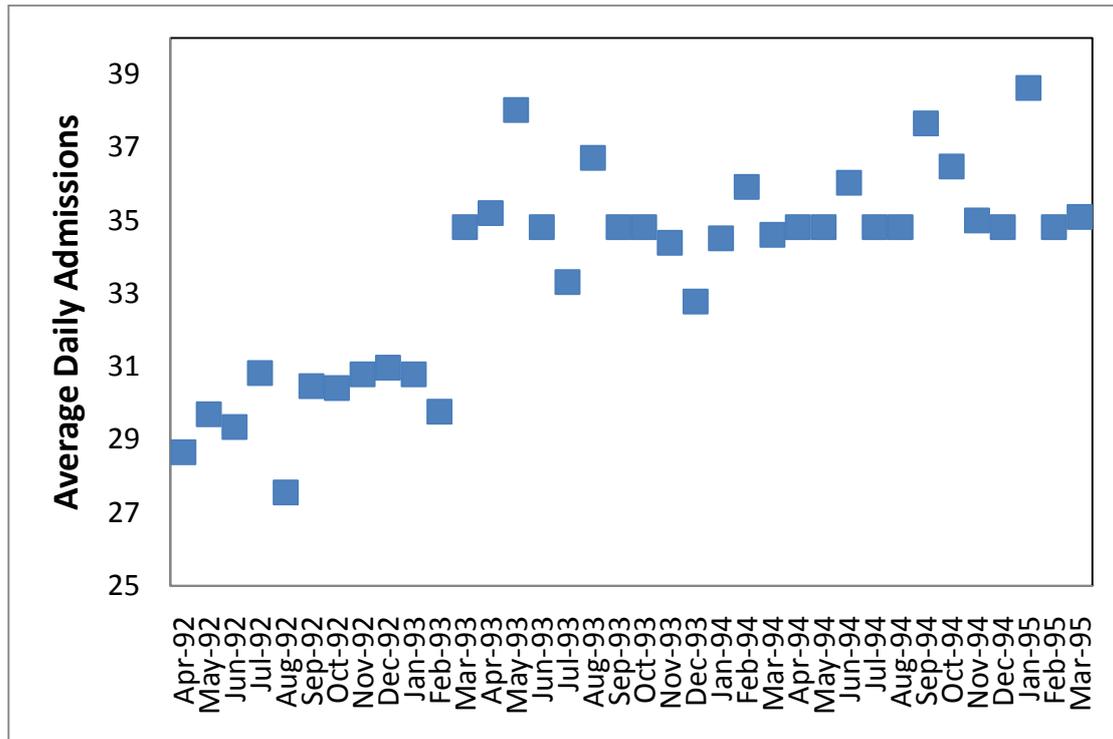
**Figure 1: Annual admissions to the medical group of specialties at the Royal Berkshire Hospital**



Figures 1 and 2 give the numbers of all Medical admissions (emergency and elective) to a single hospital covering nine year and thirty six month time frames respectively. Data comes from records held by the Royal Berkshire and Battle Hospitals NHS (RBBH) Trust (5). Medical admissions cover all specialties General Medicine, Neurology, Rheumatology, Elderly, Dermatology, Cardiology, Respiratory Medicine

and Haematology. The reason all these specialties have been grouped is to avoid the possibility of lost admissions due to substitution between specialties. Such substitution could occur by virtue of the fact that almost all Medical Consultants fulfil dual roles in their own Medical specialty (i.e. Rheumatology, Neurology, Cardiology, etc) and in General Medicine.

**Figure 2: Seasonally adjusted medical admissions at the Royal Berkshire Hospital (monthly).**



In contrast to many other studies this work includes both emergency and elective medical admissions. The reason for this is that within the context of these specialties much of the so-called 'elective' workload comprises patients who are in the grey area between emergency and elective, i.e. the NHS definition of elective is any person waiting over 24 hours for admission. Any bias introduced by the inclusion of the 'elective' component should be very small since the 'elective' patients only account for around 15% of the total Medical admissions.

Figure 1 shows evidence of a fundamental shift in admissions between the end of the 1992/93 year (March 1993) and the end of the 1993/94 year (March 1994) while Figure 2 isolates this shift to the month of March 1993. More detailed analysis of this transition using the method of activity multipliers appears to suggest that the onset of the increase began in late February and continued through into early April (8).

Since the number of admissions per month is influenced by total days in the month and the seasonal nature of some disease conditions the best method for demonstrating the exact magnitude of the change is to do a paired comparison between months before and after the change (8). This has been done in Table 1 where it can be seen that there has been an overall change of around 13% in Medical admissions. Note that the method of paired comparison removes the appearance of overlap in the number of

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admissions seen in Figure Two and shows a clear 13% difference. The 3.5% difference in admissions between 1993/94 and 1994/95 of 37 admissions represents the usual level of growth expected for medical admissions.

**Table One: Monthly Medical admissions before and after March 1993.**

Month	Admissions per month			Ratio (Before/After)	
	1992/93	1993/94	1994/95	92/93	92/94
July	903	976	1020	93%	89%
August	816	1087	1031	75%	79%
September	902	1031	1115	87%	81%
October	898	1028	1077	87%	83%
November	965	1078	1097	90%	88%
December	990	1048	1113	94%	89%
January	935	1048	1173	89%	80%
February	896	1081	1048	83%	85%
<b>Average</b>	<b>913</b>	<b>1047</b>	<b>1084</b>	<b>87%</b>	<b>84%</b>

That such a dramatic change could occur so rapidly has some support from the work of Harrison et al (1) who compared quarterly data for all emergency admissions (i.e. General Medicine and Surgical specialties combined) from six English hospitals. They identified the period September 1993 to February 1994 as the period when the highest levels of admissions seemed to occur. This conclusion is however complicated by the fact that both Influenza A (H<sub>3</sub>N<sub>2</sub> subtype) and respiratory syncytial virus (RSV) activity had reached its peak in England and Wales by mid-November of 1993 (11) and that these four months account for above average General Medical admissions due to seasonal effects (8).

The correct method of analysis would normally be to do a paired analysis of their data (i.e. Q1-1993 vs Q1-1994, etc), however, as indicated this will be complicated by the particular impact of Influenza in late 1993. Such an analysis does however yield a result which appears to indicate that a step upward of around 10% occurred in one hospital (from the Trent RHA) commencing in December of 1993 and continuing up to November 1994. Lack of data beyond this point limits any further analysis.

The next method of analysis is to compare the period around March 1993 and this reveals a 6% and 7% shift upward respectively in two hospitals (West Midlands and Wessex RHA respectively) - recall that the data from this particular study included all admissions and hence the impact of General Medical admissions will be diluted. This leaves two other hospitals (Mersey and South Western RHA), where had any shift occurred, it would have been either before or in the interval December 1992 to February 1993. Once again lack of data before December 1992 and the absence of monthly data within the quarters prevents any further analysis.

Such analysis of the results of other studies lend some support to the conclusions derived from the analysis of monthly admissions for the Royal Berkshire and Battle Hospitals. Another method for defining any step increase would be to look at Regional and National numbers.

**Figure 3: Emergency admissions in various regional health authorities**

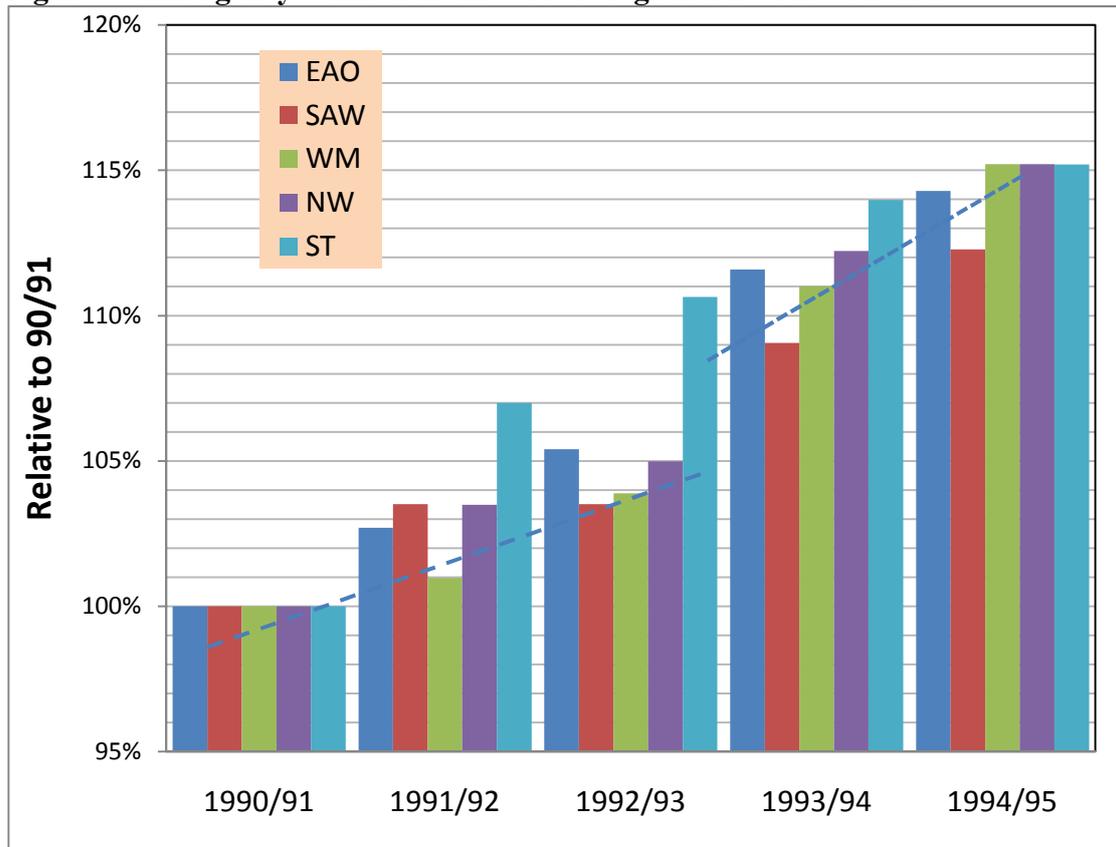


Figure 3 presents similar results for the Oxford Region where emergency admissions to General Medicine are considered (i.e. excludes elective admissions and does not include other 'medical' specialties such as Neurology, etc). Data in this figure comes from a study commissioned by the former Oxford Regional Health Authority (2). The data unfortunately ceases at March 1994 due to the amalgamation of the Oxford and Anglian Regions at that point. Seen is the same step change in admissions for the period April 1993 to March 1994, i.e. the annual difference between 1992/93 and 1993/94, namely a 14% increase, is twice that previously encountered, namely 6% to 7%.

When viewing all figures (except Figure 2) it is important to recall that the numbers are annual totals. As such, a shift upward in admissions at a particular time in a year, i.e. from an average of 100 per month to 120 per month, will be concealed within the annual total. The apparent difference between the two annual totals will therefore depend on when such a shift occurred within the year. For example, a shift upward early or late in the year will lead to a clear difference in annual totals while any shift in the middle of a year will give an intermediate result which may otherwise hide the fact that a step change has occurred.

As examples of the widespread nature of this shift in activity Figure Five gives the non-surgical acute admissions for three Regional Health Authorities (covering the period April 1990 to March 1995). Data comes from the Department of Health publication 'Ordinary and day case admissions for England' (4). By way of

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comparison there is no corresponding shift in the national position for any of the following categories - Surgical, Elderly Care, Mental Illness or Mental Handicap.

The term 'non-surgical acute' encompasses mainly General Medical (General Medicine, Gastroenterology, Endocrinology, Haematology, Cardiology, Dermatology, Oncology, Neurology, etc - NHS specialty codes 300 through to 410)) and Paediatrics (NHS specialty codes 420 and 421) admissions. Elderly Care admissions are specifically excluded (although the definition of Elderly Care does vary between hospitals and so in some cases these may be reported under the category of General Medicine). The term also encompasses emergency and 'elective' admissions which, as has already been discussed, is a relevant grouping for the Medical Specialties.

As can be seen there has been a fundamental shift in the number of admissions which has its onset either in late 1992/93 (i.e. January to March 1993) or early in 1993/94 (i.e. April to June 1993). The slope of the line before and after this shift appears to be relatively constant although absolute comparison is difficult due to the possibility of a step change occurring at different points in the year in the different Regions. The net effect is however a shift in the intercept rather than the slope, i.e. the effect is a step upward in admissions.

When looking at the National figures a step increase appears to apply over a different time frame in two regions (N.E. Thames and Trent), namely, late-1993/94. Of great interest is the fact that the one hospital in the study of Harrison et al (2) showing a late onset in the step increase, around December 1993, comes from the Trent RHA.

This behaviour cannot be demonstrated in all regions and the exceptions are as follows: N.W. Thames (wild fluctuations in total numbers from year to year), S.W. Thames (large annual increases every year since 1990/91 obscure any step increase), S.E. Thames (very large increase in 1991/92 over 1990/91 hides a possible step increase if 1991/92 is excluded), Wessex (wild fluctuation from year to year), Northern (no apparent trend). The situation for the Thames regions is not surprising as all include part of metropolitan London with its highly mobile population.

Of interest is the fact that both the South Western and Mersey regions show a clear shift in emergency admissions indicating that any step increase will have occurred earlier or before the commencement of the 1993/94 financial year, i.e. April 1993. The two hospitals from the study of Harrison et al (2) where an early shift in emergency admissions was presumed (due to lack of data) also came from each of these regions.

## **Discussion**

There are two possible explanations for the above shift in admissions, either, the method of counting has changed or a fundamental change in health has occurred. That the method of counting has changed is considered unlikely for several reasons:

- i. There were no national data initiatives during the year 1993/94 and as such there is no compelling reason for a change in 'counting method' to occur in all English hospitals at around the same point in time

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- ii. The introduction of contracting, GP Fundholding, etc into the NHS occurred in 1990/91 and so any change due to these pressures should be expressed as gradual change over time rather than a large step increase in a particular year.
- iii. It has been disproved that there has been a change in the recording of consultant episodes per admission (1,2)
- iv. In terms of local data for the Royal Berkshire and Battle Hospitals there was not any fundamental change in the data recording methods for this time period.
- v. The change in both the local and National data is confined to Medical admissions and does not occur for any of the Surgical specialties.
- vi. A change in the way patients are counted cannot explain the obvious pressure on general medical bed availability now experienced by the majority of hospitals.

We are therefore left with the conclusion of a fundamental shift. Such a fundamental shift could come from three sources:

1. A reduction in GP referral threshold
2. An increase in the expectations of the general public
3. A fundamental change in the health of the population

The effect of factors 1 and 2 should be expressed in the volume of GP referrals for a hospital outpatient appointment. The position for GP referrals to a specialties (all NHS specialty codes 100 through to 832) is given in Figure 5 where it can be seen that such a shift has not occurred in National or Oxford Regional numbers. Indeed Figure 5 shows the classic picture of the emergence of a new trend. As in the example given in Figure One the slope of the line changes at around the end of 1991, however, there is no evidence for a step change in demand at any time and specifically in the period April 1993 to March 1994.

Local data for GP referrals covering this period likewise agrees with the national and regional picture, namely, a change in slope at the end of 1991 but no step increase in 1993/94. Analysis of both local and national data shows that the change in the slope, at the end of 1991 reflecting increased levels of GP referrals to the acute sector, is due mainly to increased referrals to several of the Surgical specialties and in particular Orthopaedics (9), i.e. medical conditions are not implicated.

Having established that a step change in the threshold for GP referral or from public expectation did not occur in 93/94 one is left with the conclusion of some basic biological or natural change.

In this respect spike events such as sunspot activity, an unusually hot summer, etc must be discounted since the effect appears to be permanent, i.e. a one-off or spike event will only cause admissions to increase temporarily. There appears to be evidence for a permanent change in the health of the population.

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Why such a fundamental shift should occur earlier for Scotland, i.e. 92/93 rather than 93/94 for England could suggest a North to South movement of the 'condition'. In this respect the effect of the 'condition' was expressed in Berkshire during March of 1993 and between December 1992 and December 1993 for other locations throughout England. Although the latter date may be due to the confounding effect of the winter months.

In order to determine a possible cause or trigger for this step change in emergency admissions two sources of public health data were utilized, namely, the Royal College of General Practitioner's Monitoring Unit (RCGP) (7) and the PHLS Communicable Diseases Surveillance Centre (PHLS) (10).

National data from the RCGP (7) indicates that commencing in late December of 1992 there was an outbreak of influenza and influenza-like illness which continued to week 3 of 1994. This was then followed by a second peak whose maximum occurred in week 11 (i.e. toward the end of March 1993). Interpretation of these two peaks would be that the first smaller peak was probably due to a local outbreak in a particular region followed by more widespread outbreak across the whole country (second larger peak).

It is of interest to note that the incidence of flu-like illness in weeks 10 to 14 of 1993 was the highest recorded for the period 1991 to 1996. An aggregated basket of 'respiratory diseases' likewise follows the same trend with weeks 10 to 14 in 1993 being the highest of any year from 1991 to 1996. By way of comparison acute tonsillitis or infectious mononucleosis do not appear to show abnormal incidence over this period.

Data from the PHLS states that 'All indices of influenza virus activity in England and Wales remained low until the beginning of March' (10) although they concluded that much of the influenza and influenza-like illness reported during the period may have been due to respiratory syncytial virus (10). Of interest was the fact that influenza and influenza-like illness had its onset earlier in Scotland than England (10) which corresponds to the earlier shift to higher levels of emergency admissions demonstrated for Scotland.

Overall we therefore have a picture of an early rise in both emergency admissions and influenza and influenza-like illness for Scotland. This is followed in December 1992 of the incidence of influenza and influenza-like illness in England followed by a very large peak in this illness for mid-November of 1993. This period December 1992 to December 1993 appears to likewise co-incide with the period over which various hospitals throughout England experience a step increase in emergency admissions.

Why the effect of this influenza and influenza-like illness should be permanent, i.e. the step increase in emergency admissions will obviously require further investigation. A review of the sero-type of all viruses reported in various regions over this interval may be of use in locating the exact effector.

The monthly admission statistics for different hospitals could potentially locate the time frame over which the 'condition' spread from one location to another. The inclusion of Paediatric emergency admissions in any such studies would be wise since

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local data (5) and Oxford regional data (2) suggests that a similar step increase in emergency admissions had also occurred in children.

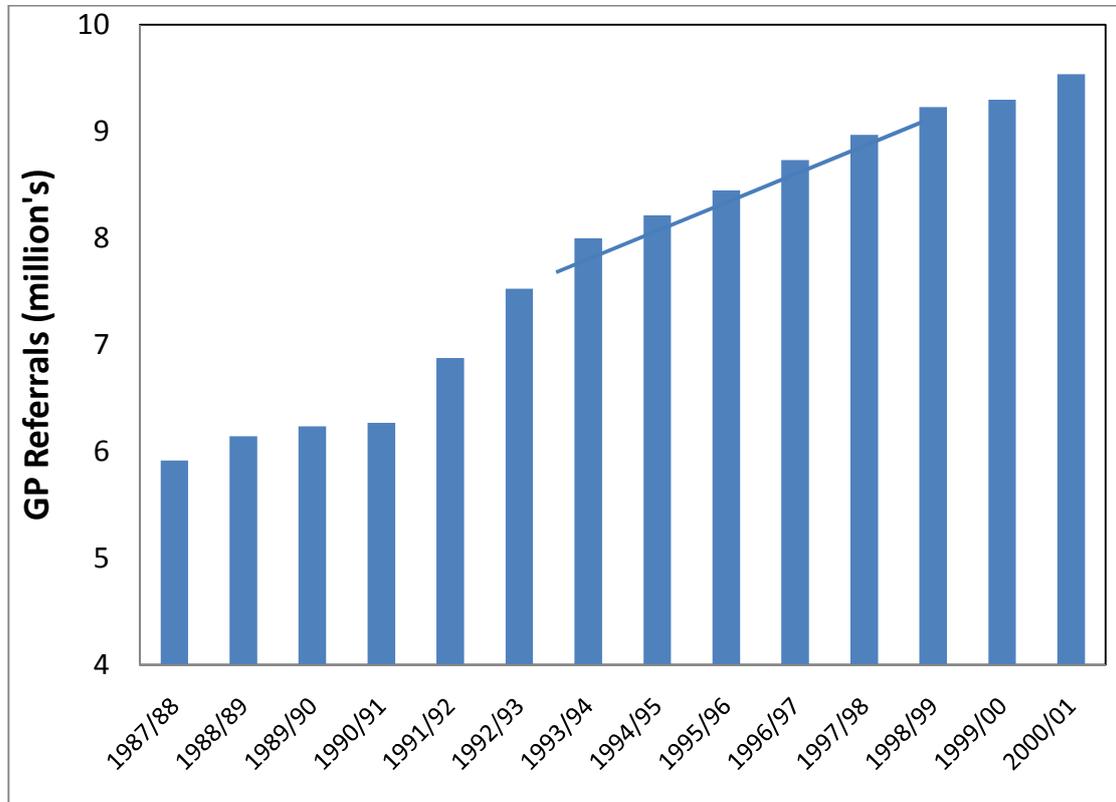
If we are dealing with a previously unknown factor the analysis of local data by diagnosis may reveal a large increase in non-specific diagnoses which will be reflected in the use of non-specific ICD codes in the hospital patient data set. This view appears to be supported by other studies (1,2). Unfortunately the change from ICD-9 to ICD-10 in April 1995 may make a longer term comparison more difficult to undertake.

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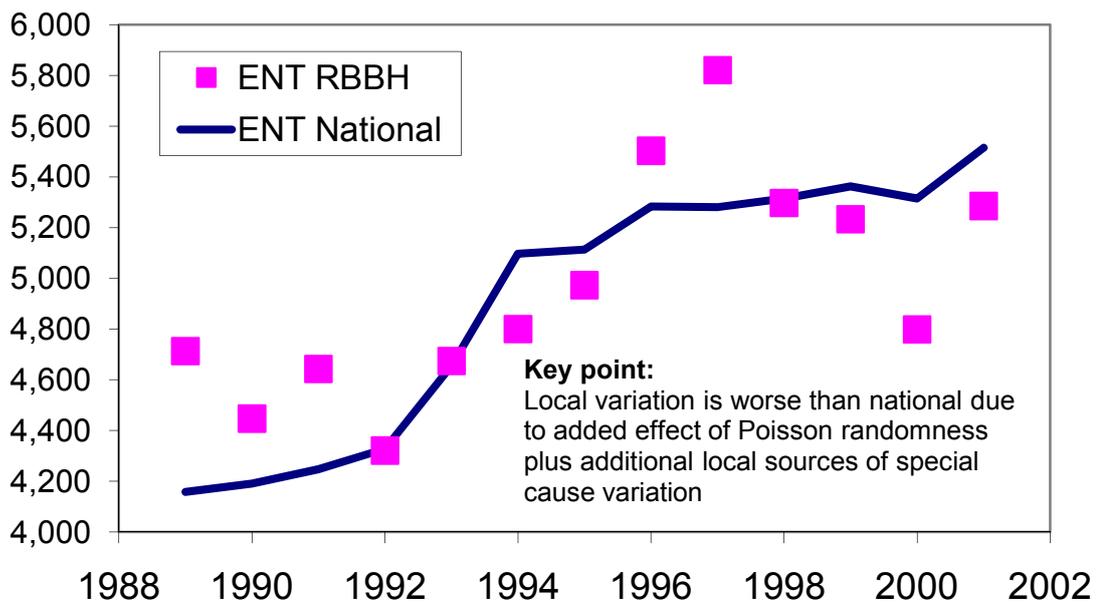
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## Appendix One: Figures relating to GP referral

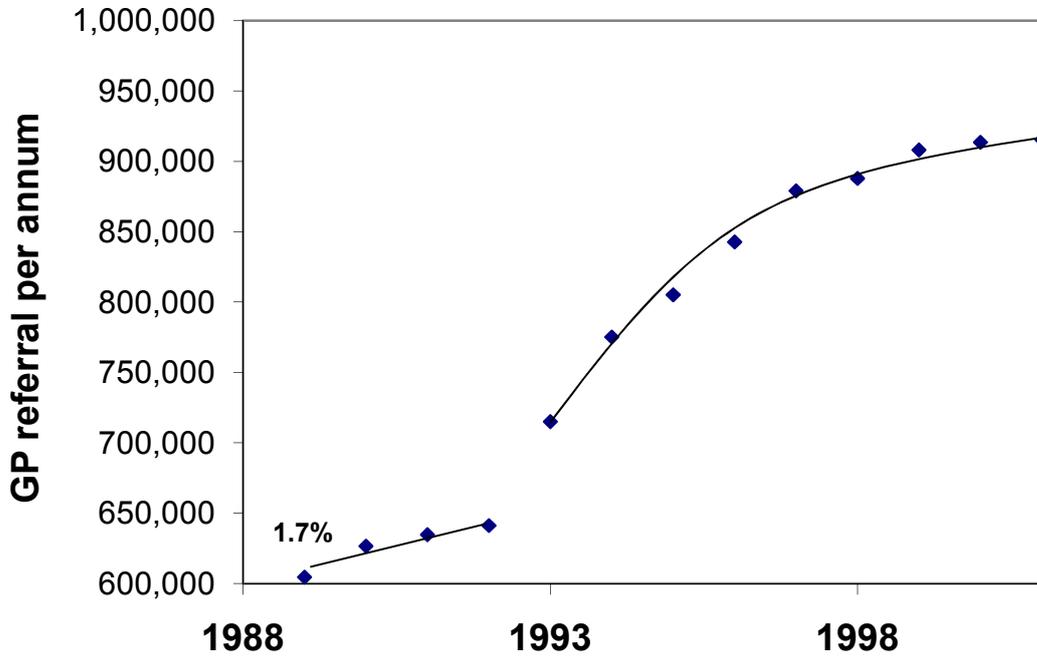
### Total GP referrals (all specialties) England



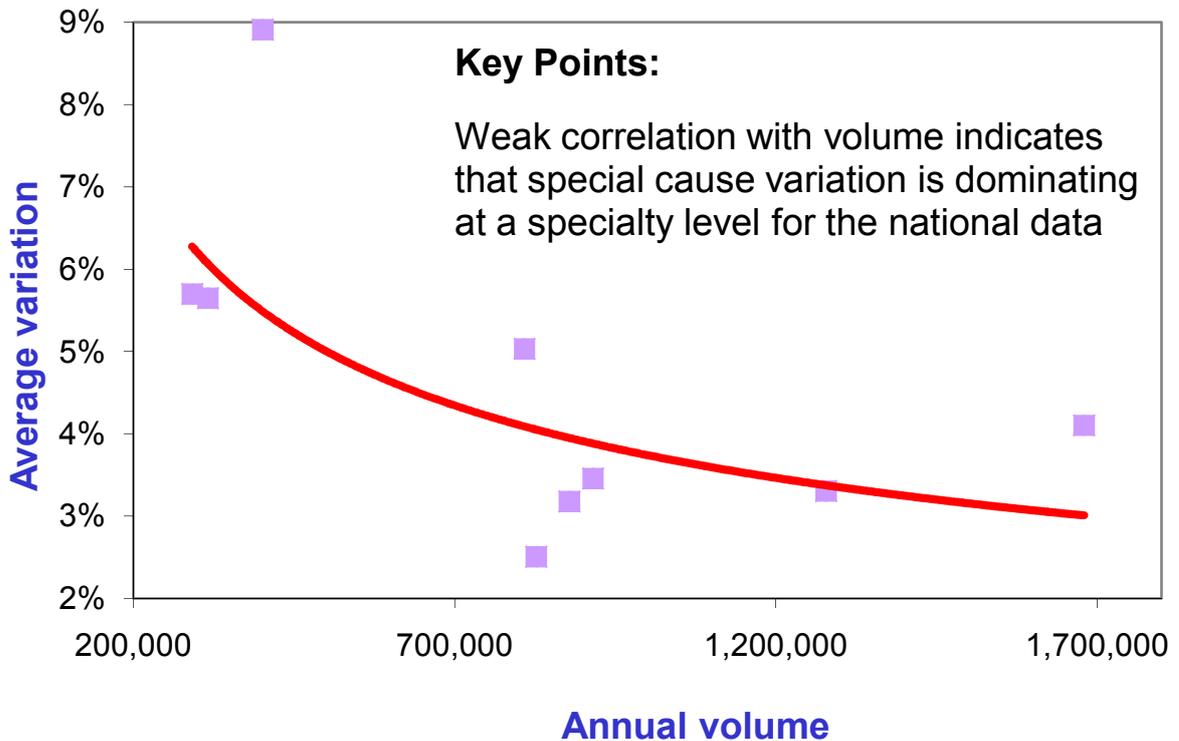
### GP referral to ENT



### GP referral to Orthopaedics (England)



### Average variation between years for GP referral in England



## Appendix Two: Shifts in the pattern of disease

Diagnosis	Northampton	Kettering	W. Berkshire	E. Berkshire	Average
Stroke	0.9	0.7	1.1	0.8	0.9
Trauma	1.2	1.0	1.2	1.3	1.2
Respiratory	1.1	1.6	1.2	1.0	1.2
Poisoning	1.3	2.5	0.7	0.7	1.3
Endocrine	0.9	1.4	1.1	2.1	1.4
Diabetes	1.4	1.4	1.6	1.4	1.5
Bacterial & Viral	2.7	1.3	1.0	1.2	1.5
Mental Health	1.1	1.3	2.4	1.5	1.6
Haematology	2.1	2.2	1.4	0.8	1.6
Renal & urinary	1.0	1.8	2.4	1.6	1.7
Ischaemic heart disease	1.3	0.7	2.1	2.9	1.7
Cancers	1.8	2.2	3.0	1.1	2.0
<b>Gynaecology</b>	<b>3.3</b>	<b>2.1</b>	<b>2.9</b>	<b>1.3</b>	<b>2.4</b>
<b>Other heart &amp; circulatory</b>	<b>1.5</b>	<b>3.3</b>	<b>2.5</b>	<b>3.1</b>	<b>2.6</b>
<b>Gastroenterology</b>	<b>1.4</b>	<b>2.4</b>	<b>4.1</b>	<b>2.5</b>	<b>2.6</b>
<b>General symptoms</b>	<b>5.2</b>	<b>6.0</b>	<b>2.2</b>	<b>1.5</b>	<b>3.7</b>
<b>Other Diagnoses</b>	<b>5.1</b>	<b>4.9</b>	<b>3.5</b>	<b>2.0</b>	<b>3.9</b>
<b>All Diagnoses</b>	<b>3.8</b>	<b>7.2</b>	<b>5.3</b>	<b>3.5</b>	<b>4.9</b>

This table gives the index of variation in four different locations for a variety of diagnoses during the course of the 1993 step change.

An index of variation value close to 1.0 indicates simple random variation around an average while higher values indicate the possible involvement of special cause variation. As a general rule values between 1.0 and 2.0 can occur due to small number sampling effects.

Hence diagnoses at the top of the table show no significant change while those toward the bottom of the table showed a possible linkage with the 1993 'outbreak'. Those in **red bold** are most likely to have shown a statistically significant change.

This table came from a re-analysis by the author of data collected by the former Oxford Regional Health Authority. Unfortunately the author no longer holds the original data and only this table remains.

At the time the author also conducted analysis of the change in age and sex of admitted patients arising from the March 1993 shift at the Royal Berkshire Hospital. From memory, there was a shift to higher medical admissions in women in around the 50-60 age group.