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Hospital Deaths - The Missing Link : Measuring Outcome in Hospital Activity Data

by PAUL KIND

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Measuring Outcome in Hospital Activity Data

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Paul Kind

The Author

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Abstract

Although fairly detailed information on NHS inputs can be identified, little or no corresponding data on outcomes are available to those concerned with the management and delivery of health care. The absence of any significant outcome data is a longstanding problem which has so far largely been by-passed. Non-financial systems in hospitals are directed mainly at the task of logging and tracking patients. They are designed to generate the routine administrative data which is demanded of local Health Authorities, and to enable the construction of various performance indicators. Despite this apparent restriction, it has proved possible to extract information on one health outcome - death.

This Discussion Paper describes the analysis of mortality data embedded in the 1985 HIPE sample. Death rates by consultant specialty and diagnostic category are presented for 14 Regional Health Authorities. Standardised mortality rates are also listed for 192 local Health Authorities. Crude rates vary from 2.5 to 14.3 deaths per 100 admissions with a national average of 5.5. There is wide variation too in standardised mortality rates - ranging from 50% below the national average to 50% above.

Proper monitoring and control of hospital services requires the measurement of outcomes. Without such measures decision makers will continue to rely on imperfect indicators of activity and performance. The potential already exists to redress this information deficit. This paper may help to encourage such a process.

HOSPITAL DEATHS - THE MISSING LINK:

Measuring Outcome in Hospital Activity Data

The National Health Service after 4 decades characterised by occasional periods of crisis is once again the subject of much speculation. The present debate has focused on funding and organisational issues. Given the background concern with effectiveness and efficiency, it is perhaps surprising that little attention has been directed so far towards the more central problem of identifying and measuring health outcomes. There can be few organisations of such a scale which possess such limited capacity to quantify their output. The emphasis on improved management skills which enable a more vigorous pursuit of the goals of value for money and effective use of resources, masks a fundamental deficiency in the information which is available to those charged with the task. The current efforts aimed at enhancing the gathering and processing of information in the NHS are of course to be welcomed. However, though much can be learned about the relative performance of some NHS activities, through interrogation of financial and administrative information systems, there remains one basic blind spot. Other than in specific research studies there is little or no information on the impact of health care services on the health of individual patients or the community at large. Indeed such is the design of hospital information systems that no real distinction is made between patients who leave hospital alive and those who die there. Both outcomes are to all intents and purposes identical.

Until 1985, Hospital Activity Analysis (HAA) was the principal source of information on patients admitted to NHS general hospital. Two separate systems recorded information on maternity and psychiatric admissions. HAA had been introduced in 1969 to as to avoid anticipated problems if the piecemeal development of NHS computing at that time was allowed to continue unchecked. Although other information systems existed previously, HAA represented the first attempt to coordinate the computerised collection of hospital activity data through the development of national-standard software. A laissez-faire approach to its implementation by health authorities meant that nearly 10 years later some areas of the country were still not fully integrated with HAA (Kind and Prowle, 1978). The sheer mechanics of ensuring that all patients were logged by the system and that records were complete at the year-end, posed immense organisational problems for some Authorities. These difficulties were further compounded by the vexed question of data quality. The HAA data are usually generated by coding clerks working from the patients' notes, referring to a discharge summary or interpreting a summary letter to a GP. The coding clerk's experience and judgement very often guides the interpretation of clinical information which once it is encoded on the Regional computer, becomes part of a definitive database. Occasional vetting of the coding clerks' performance ensured a modicum of control over this flow of information. However the purpose of collecting HAA data was never very clear and the work lacked any real importance - save for one activity. The HAA records formed the basis of the computations of cross-boundary flows and as such plays a vital role in determining the adjustments to the RAWP formula. Whilst Health Authority Treasurers might be impressed by the need for high quality data, it fails to register with the Consultants whose patients' records formed the basis of this information system. Since it has low status for them, by and large, it never attracts sufficient attention to ensure that quality control is exercised where it counts - with the doctors responsible for recording the initial information.

Hospital In-Patient Enquiry (HIPE) was an earlier information system based on a 1 in 10 sample of hospital admissions, although originally set up to record information on <u>all</u> patient admissions. The sampling process was initially carried out in a highly variable fashion which attracted some criticism. It was recognised that the physical availability of the medical records might be influenced by individual Consultants who had perhaps inadvertently retained the notes for one reason or another. The composition of the sample might also be affected if Medical Records staff selected thin (uncomplicated) sets of notes rather than more bulky (complicated) sets. The advent of HAA provided an ideal opportunity to replace the manual selection of the HIPE sample with an automatic process. The need for 2 systems, one a subset of the other, might well be questioned. However, the practicalities of collecting, validating and processing some 6 million records are considerable. In order to ensure a reasonably rapid turn round (i.e. within 18 months of the year end), the HIPE sample continued to be processed. Ultimately, the changing requirements for information have brought about its replacement with other systems which it is expected will provide more accurate and timely flow of results.

Although HIPE data represents only 10% of the total HAA dataset it is sufficiently large (in excess of half a million records), to provide a test-bed on which to examine variations at a national level or intra-Regional level. The use of HIPE data might be considered more questionable, however, at the level of individual health authorities where sample size may be small. The number of patient records in the HIPE sample for a single health authority varies considerably (between 280 and 8300). It is not possible to disaggregate these records and to attribute cases to specific hospitals within an Authority. The number and type of hospitals does of course vary across authorities, and the provision of specialist units or other local factors such as above average numbers of long-stay beds will influence the mix and lengths of stay of patients. A further problem with HIPE/HAA data has also to be acknowledged. The records relate to patient episodes, and not to individual patients. They cannot normally be linked to provide a longitudinal account of a period of illness which may have necessitated multiple admissions in the course of a single year. Ten admissions for one patient are equivalent to single episodes for 10 patients. Without patient record linkage factors such as previous hospitalisation, length of stay or the effects of earlier treatments cannot be related to current outcome. Although the HAA patient record provides space for information of research interest, no data on patient health status are routinely collected. Thus HAA is unable to supply even the simple form of outcome classification which Florence Nightingale had introduced in the 19th. Century. Patients in her care were categorised as 'relieved', 'unrelieved' or 'dead' (Rosser 1983).

The need for outcome measurement in hospitals is clear in that it provides essential intelligence on the impact of treatments and generates relevant information which might improve the quality of decision-making and radically alter the basis on which resources are allocated. During the early 1970s there were researchers in both North America and UK who sought to generate measures of health status that could be applied in precisely these circumstances. In this country, for example, Rosser and Watts published a paper which specifically addressed the question of hospital output measurement (Rosser and Watts, 1972). There was, and still remains, some scepticism about the possibilities of constructing a universal system of outcome measurement that is applicable in all disease settings. Whilst such reservations might be entertained in respect of innovative research, they cannot be legitimately directed towards those outcome data which are currently available within existing information systems. HAA/HIPE records contain the details of patients' discharge (alive), or death. Here then is an unambiguous outcome which has not, it appears, been the subject of much systematic enquiry. The purpose of this paper is to flag the potential use of this information and to demonstrate the variability in death rates by health authority, specialty and diagnostic category across the 14 Regional Health Authorities.

Data

A copy of the 1985 HIPE data on magnetic tape was purchased from OPCS. The tape contained over half a million records relating to patient admissions in the 14 English Regional Health Authorities, and 9 directly administered hospitals (e.g. Hospitals for Sick Children and Moorfield Eye Hospital). The information for the directly administered hospitals was excluded for the purposes of this paper. This reduced the total number of records by 8,695. Each patient record is made up of fixed data items as shown in Figure 1, and these provide information on the admission and discharge of patients, their length of stay, the specialty in which they were treated, a diagnostic code and limited data on any operation they might have had. The HIPE information for certain items was reclassified so as to reduce the frequency of redundant codes and avoid empty cells in

Figure 1 : Contents of HIPE Record

Regional Health Authority of treatment

District Health Authority of treatment

Regional Health Authority of residence

District Health Authority of residence

Sex

Marital Status

Age

Accident indicator

Source of admission

Category of patient

Department on admission

Department of discharge

Disposal

Length of stay

Days on waiting list

Main/secondary diagnoses

Main operation/procedure performed

summary tables. In particular the information on patient 'disposal' was recoded as follows - all patients discharged home or sent for convalescence were grouped together ; patients transferred to any other hospital (psychiatric or non-psychiatric were grouped together ; all deaths, whether subject to a post-mortem or not, were grouped together. The remaining disposal options were recoded as 'other' forms of outcome. The information for the main diagnosis in the patient record had been originally coded to 4 digits according to the ICD (9th. Revision). This information was truncated to 3 digits, although the capacity for more detailed examination of these data was retained. Secondary diagnosis was sometimes recorded for patients but was excluded from all forms of analysis reported here.

Although a great deal of complex statistical analysis might be performed on such a data set, it was considered more useful at this stage to treat the data conservatively and to take a broadly descriptive view of the information which could be recovered. The analysis focuses on both local and Regional Health Authorities, as well as presenting national figures based on the sample data as a single entity.

Results

Table 1 gives details of the patient outcomes in the 14 Regional Health Authorities covered by the HIPE data. Patients who were discharged (home or for convalescence) account for just under 90% of hospital episodes; the remaining 10% being almost equally divided between those transferred to other hospitals and those who died. The death rates are expressed as a proportion per 100 hospital admissions. There is very little variation across the 14 Regions. East Anglia and Mersey RHA's rates (highest) are only slightly above the national average of 5.5%. Oxford RHA's rate (lowest) is some 1% lower. It appears that the majority of these

Table 1

Outcomes*(disposal) of Patients by Regional Health Authority

Region	Discharged Home	Transfers	Death	Other	TOTAL
Northern	29494 (89.6)	1175 (3.6)	1914 (5.8)	339 (1.0)	32922
Yorkshire	37412 (87.8)	2127 (5.0)	2426 (5.7)	645 (1.5)	42610
Trent	41429 (88.3)	2086 (4.4)	2663 (5.7)	737 (1.6)	46915
East Anglia	17616 (87.3)	1062 (5.3)	1188 (5.9)	299 (1.5)	20165
N.W. Thames	31169 (90.0)	1309 (3.8)	1829 (5.3)	324 (0.9)	34631
N.E. Thames	37498 (89.4)	1626 (3.9)	2365 (5.6)	463 (1.1)	41952
S.E. Thames	36451 (87.8)	2159 (5.2)	2303 (5.6)	593 (1.4)	41506
S.W. Thames	21237 (87.9)	1002 (4.1)	1367 (5.7)	545 (2.3)	24151
Wessex	22864 (88.4)	1232 (4.8)	1454 (5.6)	321 (1.2)	25871
Oxford	21960 (89.9)	1097 (4.5)	1094 (4.5)	274 (1.1)	24425
South Western	27680 (85.7)	2141 (6.6)	1787 (5.5)	675 (2.1)	32283
West Midlands	46099 (88.1)	2602 (5.0)	2851 (5.4)	792 (1.5)	52344
Mersey	23955 (88.3)	1236 (4.6)	1603 (5.9)	339 (1.2)	27133
North Western	45521 (87.9)	2645 (5.1)	2804 (5.4)	817 (1.6)	51787
All Regions	440385 (88.3)	23499 (4.7)	27648 (5.5)	7163 (1.4)	498695

Figures 1 - ( ) are percentages, rounded to nearest significant figure.

Table 2

DEATH RATE BY SPECIALTY REGION

SPECIALTY	NORTHERN	YORKSHIRE	TRENT	EAST ANGLIA	N.W. THAMES	N.E. THAMES	S.E. THAMES	S.W. THAMES	WESSEX	OXFORD	S. WESTERN	W. MIDLANDS	MERSEY	NORTH WESTERN	SPECIALTY
General Medical	12.50	10.50	11.05	10.32	10.21	11.05	10.80	12.24	12.48	9.45	9.42	10.91	12.61	9.88	General Medical
Paediatrics	0.50	0.41	0.10	0.32	0.32	0.32	0.57	0.15	0.67	0.40	0.27	0.24	0.24	0.18	Paediatrics
Infectious diseases	(2.56)	1.66	(1.64)	-	-	1.41	(2.04)	(0.48)	-	-	(4.00)	(1.69)	(2.56)	(2.90)	Infectious diseases
Chest	(19.18)	(10.34)	11.64	6.93	12.62	11.76	9.11	(7.38)	(11.16)	12.73	(13.54)	12.15	12.68	(9.65)	Chest
Dermatology	-	(1.74)	(0.96)	(8.70)	(1.72)	(3.57)	(0.68)	(4.00)	(2.86)	(6.85)	(0.79)	(2.08)	(1.08)	(0.63)	Dermatology
Neurology	(0.92)	(5.51)	(2.30)	(3.38)	(2.96)	(1.52)	(3.49)	2.81	(3.83)	2.74	(1.32)	1.50	(1.47)	(0.89)	Neurology
Cardiology	4.78	4.82	(3.61)	(2.87)	6.46	(3.38)	5.42	(3.45)	(1.18)	(6.90)	-	4.61	2.26	1.70	Cardiology
Physical Medicine	(3.17)	-	-	-	(1.92)	(1.47)	-	(3.81)	(2.78)	-	-	-	-	-	Physical Medicine
Venereal disease	-	-	-	-	-	(14.29)	-	-	-	-	-	-	-	-	Venereal disease
Rheumatology	(0.53)	(2.08)	(1.04)	(4.00)	(1.75)	(2.10)	(2.23)	(4.76)	(2.34)	(2.55)	(4.88)	(0.44)	(2.56)	(0.25)	Rheumatology
Geriatrics	27.49	22.70	25.40	29.68	23.93	28.65	25.70	26.18	24.18	22.41	22.82	25.96	23.82	25.11	Geriatrics
Younger disabled	(10.71)	(1.25)	(4.95)	(4.17)	(3.03)	-	-	(3.13)	-	-	-	(9.38)	-	-	Younger disabled
General surgery	3.60	3.14	3.05	2.83	3.58	3.04	3.07	2.61	3.04	2.39	2.87	2.88	4.02	3.63	General surgery
ENT	0.48	0.40	0.40	0.38	0.36	0.41	0.50	0.07	0.26	0.26	0.45	0.39	0.45	0.18	ENT
Trauma/Orthopaedics	1.97	1.75	1.74	1.62	2.17	2.71	2.40	2.53	2.11	1.22	1.38	1.67	1.90	2.16	Trauma/Orthopaedics
Opthalmology	0.10	0.26	0.08	0.14	0.38	0.36	-	-	-	-	-	-	0.15	0.14	Opthalmology
Radiotherapy	(4.63)	(9.20)	8.69	10.83	9.26	16.52	(12.19)	(13.47)	8.80	7.58	7.07	8.11	2.72	(2.61)	Radiotherapy
Urology	1.58	2.23	2.15	1.63	0.75	1.19	1.63	1.46	1.66	1.46	2.42	2.76	1.88	2.42	Urology
Plastic surgery	0.33	0.40	1.45	0.76	-	(1.32)	(0.65)	-	(0.45)	0.21	0.79	(0.40)	-	1.28	Plastic surgery
Thoracic surgery	(2.12)	(3.88)	(6.30)	(3.25)	(6.21)	(2.31)	(2.80)	(4.41)	(1.90)	(3.70)	(1.92)	(7.66)	(5.85)	3.33	Thoracic surgery
Dental surgery	-	-	-	0.22	-	-	-	0.21	0.19	-	-	-	0.26	0.11	Dental surgery
Orthodontics	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Orthodontics
Neurosurgery	(6.60)	(1.57)	(5.64)	(2.55)	15.49	(12.67)	(9.65)	6.86	(4.23)	(3.21)	(7.63)	(3.64)	(7.84)	(6.95)	Neurosurgery
Gynaecology	0.23	0.43	0.26	0.49	0.27	0.15	0.32	0.11	0.17	0.03	0.29	0.17	0.42	0.24	Gynaecology
SCBU	2.07	4.08	3.88	2.90	3.82	2.27	2.92	2.51	3.39	3.35	(4.07)	4.49	4.02	3.54	SCBU
GP	15.02	15.01	16.25	15.17	(20.41)	(20.27)	18.64	18.40	15.54	12.13	15.51	13.21	(25.68)	(18.56)	GP
Other	3.33	6.22	4.34	10.56	6.63	5.21	3.70	3.89	4.19	(11.32)	6.77	5.35	3.05	4.89	Other
All Specialties	5.81	5.69	5.68	5.89	5.78	5.64	5.55	5.66	5.62	4.48	5.54	5.45	5.91	5.41	All Specialties

Figures in ( ) based on less than 1% of Regional sample.

deaths are unexceptional in that only a relatively small number are subject to post-mortems.

Death rates for 26 speciality groups in each of the Regions are given in table 2. Since HIPE does not hold information on maternity admissions the obstetrics group (codes 740 - 779) do not appear in this table. Deaths amongst Geriatric admissions exceed 20% in all Regions with the highest rate being in East Anglia (29.68%) and the lowest in Oxford (22.41%). Mersey has the highest death rate amongst General Medicine admissions (12.61%), a figure which equates to that in Northern Region. The lowest rates for this specialty are in South Western (9.42%) and Oxford (9.45%). Rates for General Surgery in all Regions were below the national average of 5.5% for all admissions. Once again Mersey (4.02%) had the highest rate and Oxford (2.39%) the lowest rate. Although rates are given for deaths amongst General Practice admissions, these are based on subsamples of less than 1% in 3 Regions. Nevertheless there seems to be considerable variation in the rates. Oxford's rate (12.13%) is half that of Mersey's, which at 25.68% is the highest for this specialty.

The location of a supra-Regional facility may also contribute to the distortion of local death rates. Neurosurgery in North West Thames has a relatively high death rate of 15.49% which falls by half when patients transferred from other Regions are excluded. A similar reduction does not occur however, for Radiotherapy in North East Thames where the rate falls marginally from 16.52% to 16.00%, when transfers are removed.

ICD codes in the HIPE record were used to classify patients according to diagnostic group. Table 3 gives the death rates for each of these groups by Region. Death rates are highest amongst patients diagnosed as having heart or other circulatory disease (around 18.0%). Death rates

TABLE 3:

DEATH RATE BY DIAGNOSTIC GROUP FOR 14 REGIONS

DIAGNOSTIC GROUP	ICD CODE	NORTHERN	YORKSHIRE	TRENT	EAST ANGLIA	NW THAMES	NE THAMES	SE THAMES	SW THAMES	WESSEX	OXFORD	SOUTH WESTERN	WEST MIDLANDS	MERSEY	NORTH WESTERN	AGGREGATE RATE	DIAGNOSTIC GROUP
Infectious disease	1-139	2.83	2.15	2.60	5.61	2.74	1.96	3.40	3.13	2.65	2.69	3.70	1.58	2.27	1.77	2.48	Infectious disease
Malignant neoplasm	140-208	16.44	15.00	16.08	17.40	15.04	17.59	16.23	14.83	16.51	13.20	14.46	15.08	17.27	14.81	15.74	Malignant neoplasm
Benign neoplasm	210-239	1.51	0.75	0.62	1.28	0.20	0.47	0.73	1.28	0.80	1.05	0.89	1.15	2.22	0.80	0.93	Benign neoplasm
Endocrine and metabolic disease	240-279	3.37	3.05	5.65	5.90	2.51	4.99	4.46	6.33	5.14	3.73	5.74	4.40	3.24	3.60	4.34	Endocrine and metabolic disease
Diseases of the blood	280-289	3.05	1.71	3.02	2.92	2.22	2.80	3.13	7.87	3.64	2.12	5.00	2.82	2.37	2.65	3.04	Diseases of the blood
Mental disorders	290-319	10.26	7.81	5.03	10.61	1.24	8.59	8.07	8.88	4.17	9.09	7.20	8.59	12.75	6.07	7.74	Mental disorders
Nervous system	320-389	2.19	2.76	2.05	2.65	1.06	2.51	2.39	2.15	1.63	1.86	2.50	2.95	2.37	2.42	2.31	Nervous system
Heart disease	390-429	19.00	19.98	18.52	20.62	18.22	17.58	16.63	21.44	17.07	17.53	19.44	16.48	18.45	15.70	17.98	Heart disease
Other circulatory disease	430-459	17.58	16.10	17.07	18.45	17.37	20.73	19.29	18.21	17.64	15.82	17.64	19.30	18.59	17.98	18.04	Other circulatory disease
Respiratory disease	460-519	11.18	9.58	10.63	7.43	10.37	7.76	9.27	9.24	9.00	9.33	8.21	6.61	8.26	6.57	8.70	Respiratory disease
Digestive system	520-579	2.54	2.74	2.29	2.80	1.59	2.05	2.72	1.99	1.89	1.81	2.58	2.72	4.22	2.51	2.45	Digestive system
Nephritis and other urinary disease	580-599	5.99	5.34	5.65	4.49	5.04	4.28	5.29	4.50	6.16	3.40	4.22	5.76	5.20	7.04	5.28	Nephritis and other urinary disease
Male genital	600-608	0.19	0.30	0.0	0.41	0.36	0.14	0.32	0.20	0.22	0.45	0.75	0.22	0.23	0.50	0.29	Male genital
Female genital	609-629	0.0	0.09	0.13	0.0	0.05	0.08	0.11	0.21	0.06	0.0	0.06	0.07	0.0	0.0	0.06	Female genital
Skin	680-709	1.25	0.79	1.02	2.30	0.76	0.96	0.99	1.48	0.41	0.96	0.99	2.52	1.34	1.01	1.21	Skin
Musculoskeletal system	710-739	0.46	1.17	1.11	1.73	0.42	1.30	1.30	0.95	0.81	0.51	1.05	1.28	1.34	0.69	1.01	Musculoskeletal system
Congenital anomalies	740-759	1.58	2.54	0.90	1.05	1.71	2.06	1.28	2.40	0.96	1.83	0.98	2.48	1.09	1.29	1.61	Congenital anomalies
Perinatal conditions	760-779	1.09	3.38	2.79	2.51	3.38	1.41	2.72	1.32	3.56	1.76	2.78	2.77	4.47	3.28	2.73	Perinatal conditions
Ill-defined	780-799	2.53	1.83	1.81	1.45	3.04	3.10	2.88	2.60	3.00	2.67	2.29	1.70	2.82	2.16	2.51	Ill-defined
Fractures	800-849	2.90	4.36	3.52	3.21	2.70	5.35	4.91	4.47	4.00	2.88	3.35	4.49	4.38	4.09	3.97	Fractures
Other injuries	850-959	0.55	1.08	1.41	1.16	0.85	0.84	0.52	1.09	0.80	0.60	1.82	0.94	0.65	1.42	1.00	Other injuries
Poisoning	960-989	0.30	0.43	0.23	0.0	0.53	0.66	0.33	0.47	0.39	0.28	1.01	0.42	0.39	0.19	0.40	Poisoning
Other	990-999	2.94	1.80	3.03	3.87	3.11	1.64	3.06	2.99	1.29	3.86	3.88	1.88	2.62	1.35	2.52	Other

for heart disease ranged from 15.7% in North Western to 21.4 in South West Thames. Malignant neoplasms were the only other diagnostic group to have a comparable mortality rate. Death rates amongst patients diagnosed as having mental disorders reveal a very wide range - 1.24 in North West Thames and 12.75 in Mersey. Since there is a separate hospital activity record of psychiatric cases these admissions to general hospitals must be regarded with some suspicion. It is possible that other elderly confused patients with other acute conditions are being admitted/transferred to general hospital beds where they subsequently expire. It is likely that the use of this diagnostic category will differ according to the patient admission policies followed by individual Health Authorities.

There are some wide variations between Regional Health Authorities. Infectious diseases are associated with an average mortality rate of 2.48%. The West Midlands rate of 1.58 is almost a quarter of that found in East Anglia, which at 5.61 is virtually double the national rate. Equally, diseases of the blood have a low death rate in Yorkshire Region (1.71) compared to that of South West Thames (7.87).

The results presented so far have shown variations at Regional level in terms of specialties and diagnostic groups. Crude mortality rates for individual Health Authorities within Regions can of course be computed, despite the small numbers of admissions in some instances. Local circumstances may mean that there are significant differences in the character of the hospital population which makes up the HIPE sample. Such variations in, say age and casemix, can be corrected by a suitable process of standardisation. Table 4 gives the death rates for all 192 Health Authorities. The first column shows the number of patient episodes within the HIPE sample. The number of these episodes which resulted in the patient's death, is given in the second column. The crude mortality rate is simply the proportion of episodes for which death was the outcome. The rate is expressed here as the number per 100 admissions. National mortality rates for specific age/diagnostic groups were calculated using the full HIPE data set. These national rates for each of 9x24 age/diagnostic groups were superimposed on the local hospital population, as represented by the HIPE sample, to generate an expected number of deaths. The ratio of expected deaths to observed deaths produces the standardised mortality rates given in the last column of this table. The Authority with the highest death rate appears to be Halton in Mersey Region, with a crude rate of 14.3% (1 admission in 7 results in a patient's death). Further enquiry revealed the hospital beds which are provided in this Authority are mainly for long-stay geriatric care. In addition to these obvious biases in the local hospital population the actual size of the HIPE sample is demonstrably smaller than for other Authorities indicative of low levels of hospital activity. Thus the Halton figures should properly be treated with some caution. There are 7 other Authorities with patients samples below 1000 (Northallerton, Bassetlaw, Tower Hamlets, Bromsgrove and Redditch, Kidderminster, Rugby, Chorley and South Ribble). The same caveat must also apply to these Authorities. However, crude death rates vary widely within this group (2.7 to 9.1), so that size alone cannot be the only factor at work. The crude mortality rate based on the entire HIPE sample (i.e., the national average), was earlier reported as 5.5%. Three Health Authorities (Northumberland, North West Surrey and North Sefton) have crude rates which are some 50% higher than this average. At the other end of the spectrum, Bloomsbury has a crude rate which is 50% below the national average. Three other Authorities have comparable crude death rates - Bromsgrove and Redditch (2.7%), Solihull (2.9%) and Central Manchester (2.8%).

The standardised rates reveal a range from 0.577 (Harrow) to 1.51 (North-West Herts.). Other Health Authorities with low rates include Bromsgrove and Redditch (0.631), Bloomsbury (0.644), Central Manchester (0.695) and Bristol and Weston (0.699). These figures are substantially lower than those observed at the top end of the range where North West Surrey (1.500), and Grimsby (1.414) have rates which are over 40% higher than the national average for this index. Various factors might help to explain the differences between the rates - the location of a teaching hospital within an Authority, the age structure of the hospital population, social class variations and baseline health status in the local community. Some of these factors can be investigated more easily than others.

Standardised death rates provide one method of comparing the outcomes in Health Authorities using the available HIPE data. These sterile indices can be portrayed more graphically if the "excess" deaths are computed. For example, Grimsby's standardised rate represents a figure which is nearly 41% above the national average. If the national rate applied to the Grimsby hospital population then some 360 deaths fewer would be expected for this Health Authority.

Table 4: Death rates in English Health Authorities

HEALTH AUTHORITY	No. of cases	Actual no. of deaths	Crude mortality rate	Expected no. of deaths	Standardised mortality rate
NORTHERN RHA					
Hartlepool	1403	76	5.4	72.1	1.055
North Tees	1752	112	6.4	85.0	1.317
South Tees	2591	135	5.2	122.7	1.100
East Cumbria	1711	93	5.4	99.3	0.937
South Cumbria	1426	98	6.9	96.4	1.016
West Cumbria	1030	55	5.3	52.0	1.058
Darlington	1515	67	4.4	73.8	0.908
Durham	1361	93	6.8	78.1	1.191
North West Durham	1133	75	6.6	59.1	1.269
South West Durham	1010	85	8.4	61.7	1.378
Northumberland	1713	162	9.5	124.9	1.297
Gateshead	1620	114	7.0	101.0	1.128
Newcastle upon Tyne	6741	310	4.6	344.2	0.901
North Tyneside	1444	117	8.1	91.4	1.280
South Tyneside	1297	82	6.3	72.5	1.132
Sunderland	3987	227	5.7	208.4	1.089
YORKSHIRE					
Hull	3936	221	5.6	210.7	1.049
East Yorkshire	1749	145	8.3	124.8	1.162
Grimsby	1930	124	6.4	87.7	1.414
Scunthorpe	2026	108	5.3	124.0	0.871
Northallerton	735	48	6.5	47.4	1.013
York	2521	152	6.0	148.1	1.027
Scarborough	1650	114	6.9	93.9	1.214
Harrogate	1676	84	5.0	112.4	0.748
Bradford	4652	232	5.0	252.0	0.921
Airedale	1593	99	6.2	99.7	0.993
Calderdale	1894	120	6.3	119.4	1.005
Huddersfield	2090	137	6.6	117.7	1.164
Dewsbury	1564	101	6.5	93.4	1.081
Leeds Western	4561	269	5.9	302.5	0.889
Leeds Eastern	4776	201	4.2	240.2	0.837
Wakefield	2183	135	6.2	113.9	1.185
Pontefract	1926	125	6.5	123.8	1.010

TRENT RHA

North Derbyshire	2216	173	7.8	146.9	1.178
South Derbyshire	4235	274	6.5	283.8	0.965
Leicestershire	7300	400	5.5	422.0	0.948
North Lincolnshire	2397	170	7.1	143.3	1.187
South Lincolnshire	2456	158	6.4	152.0	1.039
Bassetlaw	968	76	7.9	57.7	1.318
Central Nottinghamshire	2882	161	5.6	154.8	1.040
Nottingham	7593	398	5.2	393.2	1.012
Barnsley	2252	138	6.1	126.7	1.089
Doncaster	2982	208	7.0	168.0	1.238
Rotherham	2452	119	4.9	128.4	0.927
Sheffield	8165	385	4.7	464.3	0.829

EAST ANGLIA

Cambridge	2937	155	5.3	160.7	0.965
Peterborough	2100	113	5.4	99.8	1.132
West Suffolk	2018	129	6.4	116.7	1.106
East Suffolk	2681	173	6.5	174.1	0.994
Norwich	5081	318	6.3	296.2	1.073
Great Yarmouth	1888	116	6.1	111.6	1.040
West Norfolk and Wisbech	1713	112	6.5	111.6	1.004
Huntingdon	1140	66	5.8	73.8	0.894

NORTH WEST THAMES

North Bedfordshire	1825	101	5.5	80.4	1.257
South Bedfordshire	2244	121	5.4	100.6	1.203
North Hertfordshire	1755	106	6.0	100.5	1.055
East Hertfordshire	1475	93	6.3	76.1	1.222
North West Hertfordshire	1838	108	5.9	71.5	1.510
South West Hertfordshire	1466	81	5.5	78.4	1.033
Barnet	2932	225	7.7	220.7	1.020
Harrow	2202	75	3.4	129.9	0.577
Hillingdon	3432	213	6.2	239.0	0.891
Hounslow and Spelthorne	3034	184	6.1	164.1	1.121
Ealing	1401	82	5.9	75.0	1.094
Brent	1703	110	6.5	90.4	1.217
Paddington	3269	118	3.6	152.5	0.774
Hammersmith & Fulham	4963	209	4.2	275.3	0.759

NORTH EAST THAMES

Basildon and Thurrock	2261	137	6.1	117.6	1.165
Mid Essex	2032	117	5.8	92.9	1.260
North East Essex	3069	219	7.1	205.4	1.066
West Essex	2386	138	5.8	117.8	1.171
Southend	2647	210	7.9	175.7	1.196
Barking, Havering and Brentwood	3900	295	7.6	222.9	1.323
Hampstead	2234	114	5.1	99.4	1.147
Bloomsbury	5353	133	2.5	206.6	0.644
Islington	2396	119	5.0	121.4	0.980
City and Hackney	3480	156	4.5	175.8	0.887
Newham	1739	120	6.9	100.0	1.199
Tower Hamlets	889	44	4.9	47.9	0.919
Enfield	1851	124	6.7	114.4	1.084
Haringey	2137	124	5.8	124.0	1.000
Redbridge	1412	103	7.3	97.5	1.057
Waltham Forest	3064	194	6.3	208.3	0.931

SOUTH EAST THAMES

Brighton	3576	200	5.6	224.5	0.891
Eastbourne	1952	158	8.1	172.7	0.915
Hastings	1840	134	7.3	150.0	0.893
South East Kent	2493	153	6.1	149.2	1.026
Canterbury & Thanet	3335	219	6.6	242.0	0.905
Dartford and Gravesham	2256	121	5.4	122.7	0.986
Maidstone	1674	89	5.3	71.7	1.241
Medway	2512	173	6.9	139.6	1.239
Tunbridge Wells	2703	151	5.6	156.5	0.965
Bexley	1431	102	7.1	101.3	1.007
Greenwich	3413	187	5.5	189.4	0.987
Bromley	2281	134	5.9	135.4	0.989
West Lambeth	2829	103	3.6	80.7	1.277
Camberwell	3202	159	5.0	155.8	1.021
Lewisham and North Southwark	5168	210	4.1	202.4	1.038

SOUTH WEST THAMES

North West Surrey	1073	100	9.3	66.7	1.500
West Surrey and North East Hampshire	1370	44	3.2	57.2	0.770
South West Surrey	2299	112	4.9	145.6	0.769
Mid Surrey	1234	78	6.3	83.3	0.936
East Surrey	1728	69	4.0	94.0	0.734
Chichester	1364	95	7.0	87.8	1.082
Mid Down	2106	116	5.5	101.8	1.140
Worthing	2258	195	8.6	178.7	1.091
Croydon	1946	128	6.6	120.6	1.061
Kingston and Esher	1342	75	5.6	90.0	0.833
Richmond, Twickenham and Roehampton	1253	102	8.1	73.8	1.382
Wandsworth	2706	108	4.0	139.3	0.775
Merton and Sutton	2911	137	4.7	157.8	0.868

WESSEX

East Dorset	3883	296	7.6	291.0	1.017
West Dorset	1420	81	5.7	88.8	0.913
Portsmouth	3433	181	5.3	177.0	1.023
South West Hampshire and Southampton	5175	239	4.6	297.2	0.804
Winchester	1081	68	6.3	63.6	1.069
Basingstoke	1678	78	4.6	72.1	1.082
Salisbury	1475	77	5.2	79.6	0.968
Swindon	2313	119	5.1	107.9	1.103
West Wiltshire and Bath	3655	241	6.6	240.8	1.001
Isle of Wight	1092	70	6.4	67.9	1.031

OXFORD

East Berkshire	3232	165	5.1	155.6	1.060
West Berkshire	3729	163	4.4	161.2	1.011
Aylesbury	1850	70	3.8	73.8	0.949
Wycombe	1838	110	6.0	105.0	1.048
Milton Keynes	1378	51	3.7	53.6	0.952
Kettering	2058	129	6.3	115.1	1.121
Northampton	2822	147	5.2	138.4	1.063
Oxfordshire	6302	241	3.8	320.3	0.752

SOUTH WESTERN

Bristol and Weston	4444	154	3.5	220.2	0.699
Frenchay	1876	156	8.3	136.7	1.141
Southmead	2345	142	6.1	149.4	0.950
Cornwall and Isles of Scilly	3167	175	5.5	191.6	0.913
Exeter	3190	198	6.2	220.0	0.900
North Devon	1330	92	6.9	104.1	0.884
Plymouth	4128	190	4.6	230.6	0.824
Torbay	2424	148	6.1	184.8	0.801
Cheltenham	1891	136	7.2	131.3	1.036
Gloucester	2486	128	5.1	121.3	1.055
Somerset	3121	230	7.4	169.7	1.355

WEST MIDLANDS

Bromsgrove and Redditch	966	26	2.7	41.2	0.631
Herefordshire	1517	72	4.7	96.6	0.745
Kidderminster and District	992	70	7.1	60.7	1.153
Worcester and District	2156	118	5.5	127.8	0.923
Shropshire	4091	216	5.3	231.0	0.935
Mid Staffordhire	1943	86	4.4	111.4	0.772
North Staffordshire	4419	253	5.7	254.6	0.994
South East Staffordshire	1536	81	5.3	74.1	1.093
Rugby	774	38	4.9	45.5	0.835
North Warwickshire	1367	84	6.1	71.7	1.171
South Warwickshire	1837	137	7.5	112.4	1.219
Central Birmingham	4401	184	4.2	232.4	0.792
East Birmingham	2751	165	6.0	166.8	0.989
North Birmingham	1929	125	6.5	118.8	1.052
South Birmingham	3028	163	5.4	153.9	1.059
West Birmingham	2929	200	6.8	178.7	1.119
Coventry	3874	214	5.5	217.5	0.984
Dudley	2926	198	6.8	180.2	1.099
Sandwell	1869	106	5.7	99.5	1.066
Solihull	1004	29	2.9	37.9	0.765
Walsall	2086	133	6.4	119.1	1.117
Wolverhampton	3303	152	4.6	130.1	1.168

MERSEY

Chester	2136	124	5.8	108.5	1.142
Crewe	2366	140	5.9	142.4	0.983
Halton	315	45	14.3	37.1	1.214
Macclesfield	1053	93	8.8	69.9	1.330
Warrington	1833	82	4.5	91.2	0.899
Liverpool Central Southern	3580	177	4.9	184.4	0.960
Liverpool Eastern	3962	149	3.8	122.8	1.214
St. Helens and Knowsley	2544	176	6.9	131.1	1.343
North Sefton	1206	115	9.5	89.8	1.281
South Sefton	3841	256	6.7	227.0	1.128
Wirral	3758	238	6.3	264.3	0.900

NORTH WESTERN

Lancaster	1954	106	5.4	130.7	0.811
Blackpool, Wyre & Fylde	3193	253	7.9	244.2	1.036
Preston	3321	180	5.4	183.0	0.983
Blackburn and Ribble Valley	3319	189	5.7	189.8	0.996
Burnley, Pendle & Rossendale	2411	158	6.6	147.1	1.074
West Lancashire	1434	71	5.0	62.3	1.140
Chorley and South Ribble	264	24	9.1	18.2	1.318
Bolton	2893	157	5.4	160.6	0.978
Bury	1784	101	5.7	105.3	0.959
North Manchester	3519	190	5.4	175.5	1.083
Central Manchester	3722	105	2.8	151.0	0.695
South Manchester	5663	239	4.2	343.9	0.695
Oldham	2394	191	8.0	153.9	1.241
Rochdale	1930	108	5.6	111.1	0.972
Salford	3459	158	4.6	171.6	0.921
Stockport	3108	157	5.1	163.3	0.961
Tameside and Glossop	1918	129	6.7	111.8	1.154
Trafford	1571	92	5.9	99.7	0.923
Wigan	2903	193	6.6	166.2	1.162

Health Authorities were categorised according to a simple decision rule. Rates in excess of 1.15 were classified as having "high" mortality rates, those below 0.85 were classified as "low". The residual category with a standardised mortality rate between 0.85 and 1.15 were classified as "average". Table 5 shows the distribution of these categories across the 14 Regional Health Authorities. There are some obvious differences. Northern RHA has no "low" Authorities and $^6/_{16}$ have mortality rates above 1.15. Similarly Mersey RHA has $^5/_{11}$ "high" rated Authorities. This contrasts markedly with, say South West Thames with $^5/_{13}$ "low" rated Authorities. West Midlands, too, has a relatively high proportion of "low" rated Authorities. It would be interesting to compare these results with a similar contingency table based on hospital activity data for other years and to assess any changes taking account of resource redistributions which may have taken place in the intervening period.

Table 5: Distribution of "High" and "Low" Mortality Rate Authorities

Health Authority	Category of Mortality Rate "Low"	"Average"	"High"
Northern	0	10	6
Yorkshire	2	10	5
Trent	1	7	4
East Anglia	0	8	0
North West Thames	3	6	5
North East Thames	1	9	6
South East Thames	0	12	3
South West Thames	5	5	3
Wessex	1	9	0
Oxford	1	7	0
South Western	3	7	1
West Midlands	6	12	4
Mersey	0	6	5
North Western	3	12	4
TOTAL	26	120	46

Discussion

The analysis of the HIPE data presented in this paper has been deliberately restricted to a relatively superficial descriptive level. Wherever sample size has been a problem the interpretation of results has been heavily qualified. Whatever criticisms might be levelled at the results they cannot be dismissed as being dependent upon tortuous statistical processing. There are, however, two areas where the data analysis is vulnerable. Firstly the HIPE data relates to hospital admissions, not to patients. Furthermore, the data for a single health authority may actually cover a number of hospitals of different types and with varying capacity and consultant specialties. Unfortunately, it is not possible to disaggregate HIPE data to examine outcomes in specific hospitals. Consideration of the resource-mix has not formed any part of the analysis which has been conducted here. As has been noted a relative concentration of long-stay beds for one authority was sufficient to raise the death rate to nearly 3 times the national average. Death rates might be influenced by such factors as the rate of readmission in a Health Authority, and these may vary both with the age group of the patients and with the condition for which they are admitted.

There may be reservations too, about the overall quality of the data in the HIPE sample. Whilst the sample may represent a numerically accurate fraction of the total HAA record, how far has the sampling process succeeded in capturing representative data on all age groups and specialties ? If the HIPE sample is based on a chronological sequence of patient admissions does this ensure that all diagnostic conditions are properly represented ? Finally, there is the long running question of accuracy and completeness in the HAA records themselves. It is for individual hospitals and their medical records staff to ensure satisfactory quality control, but this can only realistically be achieved given proper resourcing and the necessary motivation of staff. There can be fewer tasks that have more tenuous connections with patient care than the encoding of medical records for transmission to Regional computer centres. The routine collection of data without a clear purpose is likely to encourage attitudes which in the long run, devalue the status of the task and jeopardise the integrity of the data. This is as true for consultants as it is for the medical records personnel engaged in translating the HAA data. The diagnostic information within the HAA record is usually produced indirectly the doctor whose patient it refers to. If there are errors in these data then the responsibility must be shared by all those party to the information system-including medical staff. One way of ensuring the accurate coding of diagnostic information - if this is indeed a significant problem - would be to ensure that the relevant diagnostic code was signified directly by the doctor when the patient is first admitted.

The variations across health authorities and between specialties may be dismissed in some instances as artefactual since relatively small numbers of deaths are involved. The overwhelming majority of the authorities covered by these data are, however, represented by samples of over 1500 patient admissions. The case-mix variation may be such that with low levels of activity some doubts might be entertained concerning the stability of the standardised death rates. However, if interpreted with caution they should provide a useful insight into the outcome of health care. The sample size may be a relevant consideration and the way is open to test the effect of this factor by reworking the exercise using the total HAA record This could only be undertaken by Regional Health Authorities concerned, and those with access to the full data set. It is for others to pursue this point.

The interpretation of standardised mortality data for health authorities is best carried out by those with an intimate knowledge of local circumstances. The figures are expressed as a ratio of observed outcomes in a health authority compared to those which would be expected on the basis of the national pattern. Deviation from the expected number of deaths might be attributable to a number of local characteristics which may occur as a result of differences in resources, or patterns of organisation and management. The mortality rates calculated for this analysis have been based on hospital in-patients. If Health Authorities support high levels of day-case activity then many patients are treated who might otherwise become in-patients. Where there is significant day-case provision, there will be an increase in the density of in-patients with a poorer initial health status, since many others will have been selected out, leaving the sicker, more difficult cases for admission. Mortality rates under this scenario may incorrectly appear to be elevated. Just what level of deviation should be regarded as significant might be the subject of a review conducted internally by Health Authorities themselves, but gross differences warrant a more immediate and detailed evaluation.

The results of analysing these crude outcome data may be criticised from a number of points of view. The HIPE data are only a sample of total hospital activity. Death, as an outcome, represents a very small proportion of this total and extrapolating the results to the general hospital population might be considered unsafe. The full HAA dataset, however, can be regarded as sufficiently large to overcome this reservation, but the need is for results which can be applied at, or below, the level of the individual Health Authority. Variations between hospitals are likely to be masked when only examining national figures and it is precisely this detailed local focus which is required for management and peer review. The evolution of a new generation of hospital information systems offers scope for producing statistics which relate to individual

Consultants and specialties. The long lead-time which characterised the production of HAA reports should, in theory, give way to a more responsive pattern of working in which summary data can be provided on a monthly/quarterly basis. These summaries will be based on all patient admissions, and should satisfy those who argue against the use of results based on the HIPE sample.

A second element to this statistically grounded reluctance to accept HAA/HIPE data is that of data quality. There have been many studies of HAA and these have demonstrated a huge degree of variability, both in the accuracy of the data and in its coverage and completeness. A strange dual standard seems to apply to HAA data. On the one hand its content is regarded as acceptable for the purposes of estimating cross-boundary flows and servicing other high-level information requirements - on the other hand, its use at a local level is heavily qualified because of inherent inaccuracies in the data. Whatever problems there might be with a specific field in the HAA record, there seems no reason to suppose that the death of a patient is inaccurately recorded. Hence the crude mortality rates must offer a relatively good indicator of outcome in hospital populations. It might be that certain diagnostic or operation codes are systematically in error, but this can only be verified by manually checking the source material.

Of greater interest than these technical considerations is the question of interpretation of the mortality rates. What inferences can be drawn from comparing local mortality rates with national standards ? Death may be the most probable outcome for some patients. Emergency admissions, for example following traumatic injury, or the late management of terminally ill patients, may be associated more frequently with death than with the discharge home of the patient. The severity of a patient's condition and the reasons for their admission are two items of information which might be used to refine the crude data that are currently available. It seems unlikely, however, that such data will be routinely forthcoming. If local mortality rates are well out of line with expected levels then these data might be requested as part of any review process which resulted. Even where there are similar patterns of case-mix or age-structure, it may be the patient's condition on admission which proved to be the decisive factor in explaining differences in outcome. Since no systematic recording of patient health status on admission or discharge is undertaken, this must remain a matter of speculation. Baseline health status in local populations will be influenced by a number of social and economic factors which shape health behaviours and lifestyles. Some are more readily amenable to investigation than others, but the design of NHS information systems does not assist such lines of enquiry. Variations in the health status of population subgroups which can be related to social class differences are difficult to tie down. There is little or no recorded information which identifies the social class of hospital patients, although the First Korner Report (1982), recommended that research should be carried out to find ways of establishing these data. If death is accepted as a valid indicator of outcome for hospital services and variations in mortality rates can be attributed to basic inequalities in housing/education/employment status then this must raise questions about the legitimacy of requiring Health Authorities to correct for deficiencies which result from other areas of welfare activity.

This paper has been concerned with a single year's data and has provided a snapshot based on one health outcome. The NHS is a dynamic system in which local and Regional resourcing varies over time, and the impact of changing clinical practice and new technologies continually makes new demands. Variations in both the availability of resources and the intensity of their usage may be significant over a period of years and it would therefore be prudent to treat the results presented here with some caution.

Differences in mortality rate may be accounted for, at least in part, if allowance is made for qualitative or quantitative variations in resources provided by Health Authorities. Some information on the provision of services can be assembled from existing sources but behavioural differences, in respect of admissions for example, are less easy to monitor. If patients' admission to hospital is delayed then the disease process may reduce the likelihood of a successful intervention. It seems on the face of it improbable that such delays would be tolerated, but in the absence of any proper outcome assessment or peer review process it cannot wholly be taken for granted. Even if improved forms of outcome measurement were in place, there still remains the question of establishing a causal relationship between the treatment/management within a hospital episode and its outcome. However problematic this task seems to be, it will not normally be undertaken outside the remit of a research initiative.

This paper has presented a one-sided view of death in the hospital population. Patient disposal represents the only outcome variable for which data is routinely collected but it is seldom, if ever, presented in its disaggregated form. Hence important consumer and provider groups are kept largely ignorant of a critical aspect of hospital performance. The advent of information systems capable of producing locally relevant reports increases the potential for monitoring hospital activity and performance. The opportunity exists, therefore, for all Health Authorities to report on deaths by hospital specialty. The public dissemination of such information may be awkward to handle but this should not be accepted as justification for its continued suppression.

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