THE EXTENT OF HOSPITAL SICKNESS

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Morbidity studies based on hospital admission rates are complicated because all admissions to a defined group of hospitals rarely come from a defined population and all admissions from a defined population rarely go to a defined group of hospitals. As a consequence, if the starting point of the study is either the complete records of a hospital group or the complete enumeration of the population in a geographical area, the available data are usually precise for either the numerator or the denominator of admission rates but not for both. For a morbidity study the most realistic starting point is the population of a given area, but this is often served by a large number of hospitals both inside and outside its boundaries. As a result, the scrutiny of a mass of medical records is necessary in order that residents of the given area, if admitted to hospital, are included in the survey no matter where the hospital is situated, and in order that non-residents are excluded even though they are admitted to hospitals inside the geographical boundaries of the area studied.

Apart from the practical difficulties of deriving reliable hospital admission rates with numerator and denominator properly related, their interpretation must be made with extreme care. Hospital admissions depend on several factors, such as the number of available beds in various specialties and the attitude of general practitioners and their patients to hospital treatment. Such factors vary between areas; hence what may be true of one area may not be true of another or of the country in general.

The Hospital In-Patient Enquiry (H.I.P.E.)—the 10 per cent. national sample survey of hospital patients organized by the General Register Office on behalf of the Ministry of Health—will enable the variation of hospital sickness between and within areas to be studied. Meanwhile the results of an analysis of all hospital admissions of persons living

in a defined area may be of interest. The present paper gives a general analysis of the results. In a future paper, an attempt will be made to relate this analysis with certain social indices.

PREVIOUS INVESTIGATIONS

Three reports have been issued using the material gathered in the national inquiry (Mackay, 1951; Registrar General, 1954, 1955), but they do not relate the admissions to specific populations. Although the reports contain much valuable information on such items as the age and sex distribution of admissions for different diagnostic groups, length of stay, and the social grouping of patients, they do not (as yet) give hospital admission rates.

The Nuffield Provincial Hospitals Trust, on the other hand, surveyed the hospital-treated sickness occurring in the Scottish Counties of Stirlingshire and Ayrshire (Nuffield Provincial Hospitals Trust, 1948, 1950). The total volume of hospital sickness was considered in terms of in-patients, in-patient bed days, and out-patients, and the influence of age, sex, social conditions, and domicile were examined. Not much was done, however, in the way of relating the admissions to the population at risk. Rates were given for in-patients and out-patients generally, and for certain diagnostic groups, but no analysis was made of composite medical departments. A sample of these patients was later followed up at 3 months and again at 2 years (Ferguson and MacPhail, 1954) to ascertain their ultimate disposal.

The Birmingham Regional Hospital Board has recently reviewed hospital morbidity in part of their regional area (Cross, 1957). The method adopted was similar to that followed in the present survey, except that the analysis was based on discharges instead of on admissions. The study was confined to three

separate areas (comprising an administrative county, a large county borough, and a group of local authority areas) and the sex-age-specific discharge rates were derived for each area separately for different diagnoses. Some important differences were found between the mainly rural administrative area and the highly industrialized county borough which were considered to be worthy of further inquiry.

The numbers discharged by specialty from hospitals in England and Wales are collected and published annually by the Ministry of Health. From these figures overall discharge rates for the various specialties can be calculated for the country, but no account is taken of age or sex (Ministry of Health, 1950-57, 1957).

PRESENT SURVEY

The material on which the present paper is based was obtained during an inquiry into the size of population served by a group of hospitals located in the Reading County Borough (Barr and Davies, 1957). An area surrounding the county borough was selected (see Fig. 1) and the total number of hospital

Key to Fig. 1			Registrar General's Estimated Population (June 30, 1955)
1	Reading C.B.	...	118,100
2	Abingdon M.B.	...	12,140
3	Aldershot M.B.	...	40,190
4	Basingstoke M.B.	...	19,610
5	Henley-on-Thames M.B.	...	8,010
6	High Wycombe M.B.	...	42,800
7	Maidenhead M.B.	...	28,600
8	Marlborough M.B.	...	5,430
9	Newbury M.B.	...	18,540
10	Wallingford M.B.	...	3,740
11	Wokingham M.B.	...	9,370
12	Farnborough U.D.	...	28,260
13	Fleet U.D.	...	9,560
14	Marlow U.D.	...	6,710
15	Thame U.D.	...	3,710
16	Wantage U.D.	...	5,560
17	Abingdon R.D.	...	25,390
18	Basingstoke R.D.	...	17,340
19	Bradfield R.D.	...	22,250
20	Bullington R.D.	...	38,770
21	Cookham R.D.	...	15,090
22	Easthampstead R.D.	...	30,230
23	Hartley Wintney R.D.	...	25,220
24	Henley R.D.	...	20,450
25	High Wycombe R.D.	...	42,910
26	Hungerford R.D.	...	9,860
27	Kingsclere & Whitchurch R.D.	...	19,180
28	Marlborough & Ramsbury R.D.	...	10,330
29	Newbury R.D.	...	19,930
30	Wallingford R.D.	...	16,610
31	Wantage R.D.	...	15,030
32	Wokingham R.D.	...	41,430

FIG. 1.—Map of survey area, showing local authority boundaries.

admissions of persons resident in this area was found by reference to hospitals inside and outside the area. Those participating included hospitals in the North-West and South-West Metropolitan Regional Hospital Boards and several private nursing homes, in addition to the United Oxford Hospitals and hospitals of the Oxford Regional Hospital Board. Altogether, 77 hospitals took part in the inquiry. A supplementary inquiry sent to general practitioners living in the survey area showed that there were a few patients (estimated at between thirty and forty) who were resident in the area but received treatment outside the hospitals surveyed. These consisted mainly of neurosurgical and orthopaedic cases for whom special facilities exist at Oxford. The number involved was small and therefore unlikely to affect the general results.

Each hospital was asked to supply on a proforma the address, sex, age, and department (medicine, surgery, traumatic and orthopaedic surgery, E.N.T. surgery, gynaecology, and obstetrics) of all patients admitted from the selected area during the months of April and May, 1956. This information was subsequently coded and transferred to punch cards. Although the basic material was simple, the results have been of value and, as Bailey (1956) suggests, work of this kind is worth repeating.

The term "admission" in this paper relates to new admissions staying for one night or more; day admissions and inter-hospital transfers have been excluded.

AREA SURVEYED

Population.—The total number of persons in the selected area, according to the 1951 Census, was 672,800 (336,300 males, 336,500 females). The largest centre of population was Reading County Borough (Area 1) with 114,200, the only county borough in the area. In addition, there were ten municipal boroughs, five urban districts, and sixteen rural districts spread over five counties (Berkshire, Buckinghamshire, Hampshire, Oxfordshire, and Wiltshire). Next in size to Reading were High Wycombe Municipal Borough (Area 6) with 40,700, High Wycombe Rural District (Area 25) with 39,400, Aldershot Municipal Borough (Area 3) with 37,600, and Bullingdon Rural District (Area 20) with 35,000. Apart from Aldershot M.B. (Area 3) and Farnborough U.D. (Area 12), the absolute numerical size of the population in each age group did not vary greatly between the sexes. To the presence of the military camp and R.A.F. station at

Aldershot (Area 3) and of the aircraft research unit at Farnborough (Area 12) was due an excess of young men between 15 and 30 years of age. A reliable estimate of the actual number involved by age could not be obtained, and hence it was not possible to exclude them from the estimated population at risk.

Size.—The area included some 940,000 acres or 1,470 square miles, the largest administrative areas being Marlborough and Ramsbury Rural District (Area 28) with 94,510 acres and Bullingdon Rural District (Area 20) with 90,541, and the smallest Wallingford Municipal Borough (Area 10) with 760 acres. The density of population ranged from 12.5 persons per acre in Reading County Borough (Area 1) to 0.12 in Marlborough and Ramsbury Rural District (Area 28).

RESULTS

The geographical distribution of the hospital admissions by specialty and sex is given in Table I. The greatest number of male patients was admitted for surgery while the gynaecological and obstetrical departments admitted the greatest number of female patients. The admission rates for the various specialties show some interesting differences between the administrative areas. It will be seen, for instance, that in all the rural districts except one (Bradfield R.D., Area 19), the male hospital admission rate exceeds the female in surgery. Similarly, in traumatic and orthopaedic surgery, eleven of the sixteen rural districts have a higher male rate. In other specialties and types of area the ratio of male to female patients seems to follow no consistent pattern. For both sexes, in both medicine and surgery, the minimum and the maximum admission rates are lower in rural districts than in the county borough, municipal boroughs, and urban districts, and the maximum rates for traumatic and orthopaedic surgery and E.N.T. surgery are also lowest in the rural district. The female rates for medicine appeared to have a greater range than the male, whereas the reverse is true in E.N.T. surgery and to a lesser extent in surgery. In gynaecology and obstetrics, the maximum and minimum admission rates are higher in the municipal boroughs (including the county borough) than in other types of areas. The admission rate for obstetrics is remarkably high in Abingdon Municipal Borough (Area 2).

TABLE

GEOGRAPHICAL DISTRIBUTION OF HOSPITAL
AVERAGE NUMBER OF CASES AND RATE PER 1,000 PER MONTH

Administrative Area	Area Code (see Fig. 1)	MALE							
		Medicine		Surgery		Traumatic and Orthopaedic Surgery		E.N.T. Surgery	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate
County Borough	1	37.5	0.69	100.0	1.85	49.0	0.91	34.5	0.64
Municipal Boroughs	2	12.0	2.45	12.0	2.46	4.5	0.92	6.5	1.33
	3	15.0	0.67	25.5	1.14	—	—	11.5	0.51
	4	22.5	2.76	19.5	2.39	4.0	0.49	13.5	1.66
	5	6.0	1.64	9.5	2.59	3.0	0.82	4.0	1.09
	6	24.0	1.22	33.0	1.68	22.0	1.12	26.0	1.32
	7	23.0	1.83	34.0	2.71	13.5	1.07	4.5	0.36
	8	5.0	2.34	3.0	1.40	3.5	1.64	0.5	0.23
	9	9.0	1.08	18.5	2.23	3.5	0.42	13.0	1.57
	10	2.0	1.21	4.0	2.42	1.5	0.91	—	—
	11	3.0	0.77	12.5	3.19	5.0	0.13	5.0	1.28
Urban Districts	12	11.0	0.73	16.5	1.10	0.5	0.33	14.0	0.93
	13	3.5	0.80	11.5	2.64	2.0	0.46	4.0	0.92
	14	3.0	0.99	3.5	1.15	3.5	1.16	1.0	0.33
	15	3.0	1.76	7.0	4.09	2.0	1.17	3.5	2.05
	16	5.5	2.38	9.5	4.11	1.5	0.65	6.0	2.59
All Municipal Boroughs and Urban Districts		147.5	1.29	219.5	1.93	70.0	0.62	113.0	0.99
Rural Districts	17	13.0	1.07	8.0	0.66	3.0	0.25	7.0	0.57
	18	8.0	0.92	12.5	1.45	1.0	0.12	4.5	0.52
	19	8.0	0.89	15.5	1.73	7.0	0.78	4.5	0.50
	20	5.5	0.31	11.5	0.64	4.5	0.25	6.0	0.34
	21	3.5	0.52	6.5	0.97	2.0	0.30	4.5	0.67
	22	8.0	0.66	21.5	1.78	6.0	0.50	8.0	0.66
	23	8.5	0.69	9.5	0.77	2.0	0.16	7.0	0.56
	24	5.5	0.57	13.5	1.39	3.0	0.31	6.0	0.62
	25	13.5	0.70	25.5	1.32	11.5	0.59	12.5	0.65
	26	9.0	1.91	9.0	1.91	3.0	0.64	4.0	0.85
	27	5.5	0.59	12.0	1.28	2.5	0.27	8.0	0.85
	28	6.0	1.01	9.0	1.51	4.5	0.75	2.0	0.33
	29	5.0	0.72	11.5	1.66	5.5	0.79	8.5	1.22
	30	5.0	0.64	11.0	1.42	6.0	0.77	10.5	1.35
	31	6.5	0.87	10.0	1.34	3.0	0.40	6.0	0.80
	32	11.0	0.60	28.0	1.53	18.0	0.98	13.5	0.74
All Rural Districts		121.5	0.73	214.5	1.27	82.5	0.49	112.5	0.67
All Areas		306.5	0.91	534.0	1.59	201.5	0.60	260.0	0.77

Like the hospital admission rate for all ages combined, the admission rate for specific ages differs between areas, but the numbers are too small to permit a detailed analysis by individual areas. Instead, in Table II (opposite) and Fig. 2 (overleaf), a comparison is made between specific sex and age groups in the aggregate urban districts (including the county borough and municipal boroughs) and the aggregate rural areas.

The urban (county borough + municipal boroughs + urban districts) admission rates exceed the rural in every age group and both sexes for medicine (except females aged 30–44), surgery, traumatic and orthopaedic surgery (except females aged 75+), gynaecology, and obstetrics. This is also true of E.N.T. surgery, except in the age groups where the rates are negligible. If, however, the rates for the county borough alone are compared with the rural

rates, then in quite a few instances the age-specific rates for the rural areas exceed those for the town. There is a consistent upward trend in admission rates with age in both sexes and all types of districts, and in males for surgery in all types of districts. But the age trends are much less definite for surgery in females; in urban districts, the age distribution of the female surgical rates is bimodal in character. On the other hand, there is little association between age and admission in traumatic and orthopaedic surgery. The E.N.T. surgery admissions, as would be expected, reached a peak in children (*i.e.* persons under 15 years of age) after which there is a steep decline.

In Table III (overleaf, p. 68), the admission rates have been standardized by the method used in obtaining Standardized Mortality Ratios (S.M.R.). For each sex and specialty, the age-specific admission

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ADMISSIONS BY SPECIALTY AND SEX

BASED ON 2-MONTH SURVEY PERIOD (APRIL AND MAY, 1956)

FEMALE											
Medicine		Surgery		Traumatic and Orthopaedic Surgery		E.N.T. Surgery		Gynaecology		Obstetrics	
No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
38.0	0.63	71.0	1.18	24.5	0.41	40.5	0.67	74.0	1.23	98.0	1.63
12.0	2.27	16.5	3.12	4.0	0.76	5.5	1.04	9.0	1.70	29.5	5.58
14.0	0.92	16.5	1.08	1.5	0.10	13.0	0.85	15.0	0.98	23.5	1.54
19.5	2.21	17.0	1.93	2.5	0.28	11.0	1.25	15.5	1.76	32.0	3.63
7.5	1.74	7.0	1.62	5.5	1.27	4.5	1.04	4.5	1.04	11.0	2.55
20.5	0.98	29.5	1.40	17.0	0.81	26.0	1.24	26.0	1.24	46.0	2.19
18.5	1.27	21.5	1.47	9.5	0.75	6.0	0.41	29.5	2.02	31.5	2.16
7.0	2.89	5.0	2.07	2.0	0.83	—	—	2.5	1.03	7.0	2.89
11.0	1.16	18.5	1.95	6.0	0.63	13.5	1.42	12.0	1.27	20.0	2.11
2.0	1.07	5.5	2.95	2.0	1.07	1.5	0.81	3.0	1.61	3.0	1.61
2.0	0.42	8.0	1.66	6.0	1.25	7.0	1.46	5.5	1.14	14.5	3.02
9.5	0.85	18.0	1.61	—	—	11.0	0.98	4.5	0.40	27.0	2.41
10.5	2.25	5.0	1.07	2.5	0.54	4.5	0.96	5.5	1.18	5.0	1.07
8.0	2.32	5.0	1.45	1.5	0.44	4.5	1.30	3.0	0.87	4.5	1.30
7.0	3.73	5.5	2.93	1.5	0.80	2.0	1.07	0.5	0.27	1.5	0.80
4.5	1.62	6.5	2.34	1.0	0.36	3.0	1.08	2.5	0.90	5.5	1.98
153.5	1.37	185.0	1.65	62.5	0.56	113.0	1.01	138.5	1.24	261.5	2.34
5.0	0.44	6.5	0.58	2.5	0.22	7.5	0.67	10.5	0.93	19.0	1.69
10.0	1.20	9.5	1.14	3.0	0.36	6.0	0.72	6.0	0.72	20.0	2.40
9.5	0.96	19.5	1.96	6.5	0.66	8.0	0.81	9.5	0.96	19.0	1.91
8.5	0.50	9.0	0.53	3.0	0.18	7.5	0.44	8.0	0.47	11.5	0.67
5.5	0.76	6.5	0.90	2.0	0.28	2.5	0.35	5.5	0.76	11.0	1.52
8.0	0.70	20.0	1.76	8.5	0.75	9.0	0.79	12.0	1.06	21.5	1.89
12.5	1.21	5.5	0.53	4.5	0.44	8.0	0.78	10.0	0.97	16.0	1.55
7.5	0.73	10.5	1.02	5.0	0.48	5.5	0.53	7.5	0.73	17.5	1.70
19.5	0.97	25.0	1.25	9.5	0.47	18.0	0.90	17.0	0.85	23.0	1.15
2.5	0.53	6.5	1.38	0.5	0.11	4.0	0.85	3.5	0.74	7.0	1.49
8.0	0.87	9.0	0.98	2.5	0.27	5.0	0.55	10.0	1.09	10.0	1.09
10.5	2.08	7.5	1.49	2.0	0.40	1.5	0.30	3.5	0.69	13.0	2.58
8.0	1.11	9.0	1.25	3.0	0.42	9.0	1.25	6.5	0.90	17.0	2.36
2.5	0.32	9.5	1.21	1.5	0.19	5.5	0.70	6.5	0.83	12.0	1.53
4.0	0.56	7.5	1.06	2.0	0.28	5.5	0.78	6.5	0.91	10.5	1.48
13.5	0.76	21.0	1.19	9.5	0.54	9.0	0.51	21.5	1.22	31.5	1.79
135.0	0.82	182.0	1.11	65.5	0.40	111.5	0.68	144.0	0.88	259.5	1.58
326.5	0.97	438.0	1.30	152.5	0.45	265.0	0.79	356.5	1.06	619.0	1.84

TABLE II

AVERAGE MONTHLY NUMBER OF ADMISSIONS TO HOSPITAL, AND HOSPITAL ADMISSION RATE PER 1,000 PER MONTH OF THE POPULATION IN COUNTY BOROUGH, AGGREGATE URBAN DISTRICTS (INCLUDING MUNICIPAL BOROUGH), AND THE AGGREGATE RURAL DISTRICTS, BY SPECIALTY, AGE, AND SEX
BASED ON 2-MONTH SURVEY PERIOD, APRIL AND MAY, 1956

Specialty		Area	Age Group (yrs) and Sex														Not Stated		All Ages	
			0—		15—		30—		45—		60—		75+							
			Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		
Number of Admissions	Medicine	C.B.	—	1.5	5.0	3.5	5.5	6.5	11.5	12.0	11.0	11.0	4.0	3.5	0.5	—	37.5	38.0		
		U.D.	8.0	9.5	12.5	17.5	21.5	15.0	44.5	38.5	41.5	41.0	18.5	30.0	1.0	2.0	147.5	153.5		
		R.D.	4.0	3.0	14.0	15.5	14.5	23.0	35.0	29.0	37.0	44.0	15.5	19.0	1.5	1.5	121.5	135.0		
	All Areas	12.0	14.0	31.5	36.5	41.5	44.5	91.0	79.5	89.5	96.0	38.0	52.5	3.0	3.5	306.5	326.5			
	Surgery	C.B.	2.5	1.5	11.0	20.5	23.0	17.5	28.0	14.0	22.5	13.5	13.0	4.0	—	—	100.0	71.0		
		U.D.	35.5	17.5	27.0	37.5	50.0	39.5	53.5	34.0	39.5	36.5	13.0	19.0	1.0	1.0	219.5	185.0		
R.D.		22.0	17.5	28.0	30.5	44.0	45.0	54.5	39.0	45.0	33.0	20.0	15.0	1.0	2.0	214.5	182.0			
All Areas	60.0	36.5	66.0	88.5	117.0	102.0	136.0	87.0	107.0	83.0	46.0	38.0	2.0	3.0	534.0	438.0				

—continued

TABLE II (continued)

Specialty		Area	Age Group (yrs) and Sex															
			0-		15-		30-		45-		60-		75+		Not Stated		All Ages	
			Male	Fe- male	Male	Fe- male	Male	Fe- male	Male	Fe- male	Male	Fe- male	Male	Fe- male	Male	Fe- male	Male	Fe- male
Number of Ad- missions (contin.)	Traumatic and Orthopaedic Surgery	C.B.	16.0	7.5	12.0	4.0	10.5	2.5	6.5	4.5	2.0	5.0	1.0	1.0	1.0	—	49.0	24.5
		U.D.	15.5	10.5	16.0	11.5	9.0	10.5	15.5	13.0	9.5	9.5	4.0	6.5	0.5	1.0	70.0	62.5
		R.D.	19.5	12.5	22.0	9.5	14.5	9.5	15.5	15.0	5.5	9.5	3.0	7.5	2.5	2.0	82.5	65.5
	Ear, Nose, and Throat Surgery	All Areas	51.0	30.5	50.0	25.0	34.0	22.5	37.5	32.5	17.0	24.0	8.0	15.0	4.0	3.0	201.5	152.5
		C.B.	23.0	30.5	3.0	5.5	2.5	0.5	3.0	2.5	2.0	1.0	1.0	—	0.5	—	35.0	40.0
		U.D.	85.0	85.0	6.5	13.0	8.0	5.5	6.5	2.0	1.5	3.0	1.5	—	4.0	4.5	113.0	113.0
	Gynaecology	R.D.	69.5	70.5	7.0	14.0	9.5	11.0	10.5	5.5	5.5	3.5	1.5	1.0	8.5	6.5	112.0	112.5
		All Areas	177.5	186.0	16.5	32.5	20.0	17.0	20.0	10.0	9.0	7.5	4.0	1.0	13.0	11.0	260.0	265.0
		C.B.	—	—	—	15.5	—	29.5	—	22.5	—	4.5	—	1.5	—	0.5	—	74.0
	Obstetrics	U.D.	—	—	—	37.5	—	46.5	—	40.0	—	11.5	—	2.5	—	0.5	—	138.5
		R.D.	—	—	—	29.0	—	58.0	—	41.0	—	13.0	—	1.5	—	1.5	—	144.0
		All Areas	—	—	—	82.0	—	134.0	—	103.5	—	29.0	—	5.5	—	2.5	—	356.5
Ad- mission Rate per 1,000 Popu- lation	Medicine	C.B.	—	0.12	0.46	0.30	0.46	0.50	1.12	1.01	1.77	1.31	2.30	1.17	—	—	0.69	0.63
		U.D.	0.33	0.41	0.39	0.77	0.90	0.61	2.32	1.82	3.75	2.78	5.80	5.62	—	—	1.30	1.37
		R.D.	0.11	0.08	0.33	0.48	0.40	0.64	1.21	0.95	2.05	1.99	2.85	2.45	—	—	0.72	0.82
	Surgery	All Areas	0.16	0.20	0.37	0.54	0.58	0.61	1.56	1.25	2.53	2.12	3.67	3.27	—	—	0.91	0.97
		C.B.	0.19	0.12	1.01	1.75	1.91	1.36	2.74	1.18	3.61	1.60	7.48	1.34	—	—	1.85	1.18
		U.D.	1.44	0.75	0.85	1.65	2.09	1.61	2.79	1.61	3.57	2.47	4.07	3.56	—	—	1.93	1.65
	Traumatic and Orthopaedic Surgery	R.D.	0.59	0.49	0.66	0.94	1.22	1.25	1.89	1.28	2.49	1.49	3.68	1.94	—	—	1.27	1.11
		All Areas	0.80	0.51	0.77	1.32	1.62	1.39	2.34	1.37	3.03	1.83	4.44	2.36	—	—	1.59	1.30
		C.B.	1.24	0.61	1.11	0.34	0.87	0.19	0.64	0.38	0.32	0.59	0.58	0.33	—	—	0.90	0.41
	Ear, Nose, and Throat Surgery	U.D.	0.63	0.45	0.50	0.50	0.38	0.43	0.81	0.62	0.86	0.64	1.25	1.22	—	—	0.62	0.56
		R.D.	0.52	0.35	0.52	0.29	0.40	0.26	0.54	0.49	0.30	0.43	0.55	0.97	—	—	0.49	0.40
		All Areas	0.68	0.43	0.59	0.37	0.47	0.31	0.64	0.51	0.48	0.53	0.77	0.93	—	—	0.60	0.45
	Gynaecology	C.B.	1.78	2.48	0.28	0.47	0.21	0.04	0.29	0.21	0.32	0.12	0.57	—	—	—	0.64	0.67
		U.D.	3.45	3.63	0.20	0.57	0.33	0.22	0.34	0.09	0.14	0.20	0.47	—	—	—	0.99	1.01
		R.D.	1.86	1.98	0.16	0.43	0.26	0.31	0.36	0.18	0.30	0.16	0.28	0.13	—	—	0.67	0.68
	Obstetrics	All Areas	2.37	2.61	0.19	0.49	0.28	0.23	0.34	0.16	0.25	0.17	0.39	0.60	—	—	0.77	0.79
		C.B.	—	—	—	1.32	—	2.28	—	1.90	—	0.53	—	0.50	—	—	—	1.23
		U.D.	—	—	—	1.65	—	1.90	—	1.90	—	0.78	—	0.47	—	—	—	1.24
	Traumatic and Orthopaedic Surgery	R.D.	—	—	—	0.89	—	1.61	—	1.35	—	0.59	—	0.19	—	—	—	0.88
		All Areas	—	—	—	1.22	—	1.82	—	1.63	—	0.64	—	0.34	—	—	—	1.06
		C.B.	—	—	—	5.50	—	2.59	—	—	—	—	—	—	—	—	—	1.63
	Ear, Nose, and Throat Surgery	U.D.	—	—	—	8.02	—	3.17	—	0.05	—	—	—	—	—	—	—	2.34
		R.D.	—	—	—	5.51	—	2.18	—	0.02	—	—	—	—	—	—	—	1.58
		All Areas	—	—	—	6.36	—	2.58	—	0.02	—	—	—	—	—	—	—	1.84

rate of the total area surveyed was applied to the corresponding age-specific population of each administrative area, thereby giving the expected number of admissions which would have occurred had each

area experienced the same series of age specific admission rates. The ratio per cent. of the total observed or actual admissions to total expected admissions in each area gives the standardized

FIG. 2.—Hospital admission rates for April and May, 1956 by specialty, age, and sex.

ratio for the area. The standard error of this ratio can be taken as $100\sqrt{O/E}$ where O denotes the number of hospital admissions observed and E the number expected. Differences from 100 per cent. which are greater than twice the standard error (*i.e.* roughly equivalent to the 5 per cent. probability level) may be taken as significant and are shown in the Table in bold type. Theoretically, the standard error is subject to a small error due to the possible admission of a patient more than once, but in a 2-month period this is unlikely to happen often and can be ignored.

It will be seen that the standardized admission ratios fluctuate considerably between local authority areas. This may be partly due to the small numbers, involved but this alone does not fully explain the differences. For instance, at Basingstoke Municipal Borough (Area 4), where there were 45 medical admissions, the standardized ratio was 28.5 per cent., compared with 73 per cent in Reading County Borough (Area 1). Or again, for male surgical admissions, the ratio in Maidenhead Municipal Borough (Area 7) was 162 per cent. based on 68 admissions compared with 113 per cent. in Reading (Area 1) based on 200 admissions, or 102 per cent. in High Wycombe Municipal Borough (Area 6) based on 66 admissions.

The product-moment correlation coefficients derived from the standardized admission ratios (Table IV, overleaf) show some important tendencies. First, there is a highly significant correlation between the male and female standardized ratios in each of the four specialties considered (see cells in Table outlined with heavy lines). Secondly, medical admissions are highly correlated with surgical admissions but not with the other surgical specialties, with two minor exceptions. Thirdly, male and female surgical admissions give significant correlations with other sex-specialty groups, except in the case of female surgery and female E.N.T. surgery. Fourthly, there is little correlation between the standardized ratios for traumatic and orthopaedic surgery and E.N.T. surgery.

TABLE III

AGE STANDARDIZED ADMISSION RATIOS BY SPECIALTY AND SEX (RATIOS DIFFERING SIGNIFICANTLY FROM 100 PER CENT IN BOLD TYPE)

Administrative Area	Area Code No. (see Fig. 1)	Specialty and Sex									
		Medicine		Surgery		Traumatic and Orthopaedic Surgery		E.N.T. Surgery		Gynaecology	Obstetrics
		Male	Female	Male	Female	Male	Female	Male	Female	Female	Female
County Boroughs	1	73	64	113	91	154	91	82	92	116	91
Municipal Boroughs	2	275	242	155	244	155	174	163	136	161	303
	3	99	109	89	87	—	23	87	109	92	72
	4	285	232	142	150	85	63	218	171	165	199
	5	154	158	151	119	136	268	154	164	99	155
	6	132	106	102	110	191	185	177	165	114	114
	7	189	125	162	111	182	144	48	58	189	118
	8	238	286	83	161	304	190	30	—	98	171
	9	108	114	131	147	72	140	205	216	121	120
	10	125	98	140	211	150	235	—	115	158	90
	11	70	37	176	123	213	255	169	203	113	199
Urban Districts	12	105	99	83	130	6	—	139	118	38	121
	13	82	208	161	80	80	116	127	134	115	66
	14	103	246	70	111	194	94	44	170	83	73
	15	182	389	241	224	190	167	269	143	26	45
	16	282	164	260	181	111	80	308	143	89	112
Rural Districts	17	131	52	44	46	42	42	76	79	89	88
	18	94	117	87	86	20	78	74	101	69	140
	19	88	97	102	150	133	146	67	114	89	102
	20	37	57	43	43	43	41	43	52	46	35
	21	57	79	60	69	51	63	83	47	71	82
	22	72	72	111	136	86	167	95	102	101	108
	23	85	125	54	41	27	98	89	96	96	87
	24	59	75	84	78	52	110	83	75	68	93
	25	75	102	81	97	101	107	84	119	81	63
	26	196	54	115	107	109	23	110	107	73	85
	27	61	93	78	77	46	62	118	70	106	60
	28	112	214	97	116	129	89	46	38	68	148
	29	73	110	99	95	138	92	163	157	86	134
	30	70	34	89	95	132	43	188	90	80	84
	31	96	65	84	83	69	65	107	91	88	77
	32	66	78	97	91	167	121	104	68	115	101
All Areas		100	100	100	100	100	100	100	100	100	100

TABLE IV

CORRELATION CO-EFFICIENTS (*r*) BETWEEN THE STANDARDIZED ADMISSION RATIOS IN FOUR SPECIALTIES IN 32 ADMINISTRATIVE AREAS

Variables Correlated		Medicine		Surgery		Traumatic and Orthopaedic Surgery		Ear, Nose, and Throat Surgery	
		Male	Female	Male	Female	Male	Female	Male	Female
Medicine	Male		+0.58***	+0.57***	+0.66***	+0.35	+0.16	+0.41*	+0.15
	Female			+0.45*	+0.58**	+0.41*	+0.25	+0.25	+0.11
Surgery	Male				+0.69***	+0.37*	+0.44*	+0.67***	+0.47*
	Female					+0.49**	+0.50**	+0.37*	+0.33
Traumatic and Orthopaedic Surgery	Male						+0.64***	+0.03	+0.06
	Female							+0.03	+0.31
Ear, Nose, and Throat Surgery	Male								+0.60***
	Female								

* Significant at 5 per cent.

** Significant at 1 per cent.

*** Significant at 0.1 per cent.

DISCUSSION

A study of this kind can have several important applications. First, it is obvious that an accurate assessment of illness should lead to the best use being made of the treatment facilities available. Secondly, such information should provide a more realistic basis for the planning of future hospital developments both as to the number of beds required and where they should be located. Thirdly, the analysis of cost in terms of population served may give a better yardstick for comparing the volume of hospital work and a more equitable basis for the allocation of exchequer grants. Fourthly, an epidemiological study of sickness against its sociological background may throw some light on how far illness can be prevented.

The present analysis is rather limited in scope, the data having been obtained as a secondary product of another inquiry. Nevertheless, it serves to illustrate the kind of approach to hospital sickness which might be developed and carried out to advantage in different regional areas. In a future paper it is hoped to examine the hospital admission rates given in this paper in relation to certain social indices.

It would obviously have been desirable to have used diagnosis rather than specialty, but for the reason already given this information was not obtained. The introduction of diagnosis would have entailed the collection of a much larger series of cases before analysis could have been undertaken. In a relatively small and compact area like that under study, the grouping of cases by specialties has no serious disadvantages, provided a common standard is applied. In this survey the patient was classified according to specialty at the time of admission to hospital. Inevitably, there were a number of patients who were admitted, for example, as medical cases and later transferred and ultimately discharged from a surgical ward. Such patients were regarded as medical. The numbers thus involved were probably small and do not distort the general picture. In any wider comparison, say between one part of the country and another, it would be essential to use diagnoses because of the differences in the groups of diseases covered by specialists in different areas. The national survey of hospital patients (H.I.P.E.) should provide the kind of information required.

It is clear that there are wide differences between administrative areas in the pattern of sickness. The Nuffield Provincial Hospitals Trust (1955) showed in their investigation of the demand for hospital beds in 1951 that the hospital admission rates varied considerably; for instance, in the catchment area of the General Hospital at Northampton, the admission

rates were as high as 103 per 1,000 in the Bletchley Urban District and as low as 16 per 1,000 in Raunds Urban District. In the Norfolk and Norwich areas the rates varied roughly between 10 and 104 per 1,000 of the population. In the urban districts 52 people out of every 1,000 were admitted and only 31 per 1,000 in the rural areas. The Trust concluded that "if a difference in the admission rates for urban and rural areas were to be confirmed by similar data from other parts of the country, it would then be an important consideration to be taken into account when assessing the hospital needs of a community".

The present survey provides further examples of the difference in the hospital admission rates. Generally, the rate in the county borough and urban districts was above that for rural areas, and this applied in most age groups (Fig. 2). No adequate explanation can be given at the moment for the age and geographical differences, but this is a problem which is worth investigating, since it not only influences future planning of the hospital services but also affects the current cost of the health service.

The product-moment correlations suggest either that some areas are more prone to hospital sickness than others or that doctors in different areas make varying demands upon the hospital service. For instance, the standardized admission ratio for men in Thame Urban District (population 3,600) ranked seventh in medicine (out of 32 areas), second in surgery, fifth in traumatic and orthopaedic surgery, and second in E.N.T. surgery. Again, in Abingdon Municipal Borough (population 10,000), the standardized male admission ratio ranked third for medicine, sixth for surgery, eighth for traumatic and orthopaedic surgery, and eighth for E.N.T. surgery. The corresponding female admission ratio ranked fourth for medicine, first for surgery, sixth for traumatic and orthopaedic surgery, tenth for E.N.T. surgery, fourth for gynaecology, and first for obstetrics. At the other end of the scale, in Bullingdon Rural District (population 35,000), the standardized male admission ratio ranked last for medicine, last for surgery, 27th for traumatic and orthopaedic surgery, and 30th for E.N.T. surgery, while the female admission ratio ranked 28th for medicine, last for surgery, 29th for traumatic and orthopaedic surgery, 28th for E.N.T. surgery, 31st for gynaecology, and last for obstetrics. It would be interesting to discover the exact reasons for such dissimilarities.

SUMMARY

(1) The hospital admissions in a defined area during April and May, 1956 have been analysed.

(2) The admission rate varied considerably between areas.

(3) Among men, medical cases occurred largely in the older age groups, surgical cases in middle life, and traumatic and orthopaedic cases in younger adults. The trend was similar for women, except that the peak in medical cases occurred in the older age groups and that for surgical cases in younger age groups.

(4) The hospital admission rate was generally higher in the urban (including municipal and county boroughs) areas than in the rural areas, with the exception of traumatic and orthopaedic admissions.

(5) The hospital admission rate increased with age in medicine and surgery. In traumatic and orthopaedic surgery, there was little difference between the age groups, and in E.N.T. surgery the peak rate occurred in children under 15 years of age. The gynaecological admission rate remained fairly static until 60 years and thereafter declined.

(6) There was good agreement between the standardized admission ratios for males and females in the 32 administrative areas in each of the four specialties of medicine, surgery, traumatic and orthopaedic surgery, and E.N.T. surgery. The surgical admission ratio for males and females correlated significantly with each of the other sex-specialty ratios, with one exception. Medical admissions showed agreement with surgical admissions, with only two exceptions. There was no

agreement between the ratios for traumatic and orthopaedic surgery and E.N.T. surgery.

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