MULTIPLE SPELLS OF IN-PATIENT TREATMENT IN A CALENDAR YEAR

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Starting on January 1, 1962, the Oxford Record Linkage Study (ORLS) set out to collect data about every birth, discharge from hospital, and death of persons giving an address in Oxford County Borough, Oxfordshire (except Henley), and the part of Berkshire which adjoins Oxford City, an area which on June 30, 1962, was estimated to have a population of 325,000. The material used in this analysis consists of the 22,525 completed in-patient spells which occurred in the calendar year 1962. An in-patient spell was defined as a period of in-patient treatment in a single hospital which was completed (*i.e.* by discharge home, death, transfer to another hospital, etc.) during the calendar year 1962. It follows that a proportion of the spells dealt with commenced before January 1, 1962, but these are offset by the absence from the series of spells commencing in 1962 which had not been completed by December 31, 1962. This definition is identical to that used in the Hospital In-patient Inquiry (1959 *et seq.*) and is synonymous with the term "discharge" used in that publication.

The collection of data, which has been described elsewhere (Acheson, 1964; Acheson and Evans, 1964), was limited to the 29 National Health Service (NHS) hospitals within the boundaries of the area. Day cases, private and staff cases, and cases discharged from the maternity hospitals and from the local convalescent hospital are excluded from this analysis. The degree of ascertainment was checked against the number of in-patient spells notified to the Ministry of Health on Form SH3 and, when allowance was made for the exclusions, was found to amount to 94.3 per cent. of these notifications. The number of persons living in the area who were discharged from NHS hospitals outside the area in 1962 is not known exactly, but was probably about 5 per cent.*

METHOD

In 1962, the linkage of records was achieved by comparing the identification particulars on each in-patient abstract with a master index arranged alphabetically by birth surname, and cross-indexed by married surname in the case of married women. The successive abstracts of a patient were allocated a unique number and the data was coded and punched on a 80-column machine card. The records of second or subsequent in-patient spells were then collated with the previous record. Using a similar technique, death certificates (whether death had occurred at home or in hospital in 1962) were linked to the hospital's records, thus enabling patients to be classified as living or dead on December 31, 1962.† A summary card was then punched for each individual with more than one completed in-patient spell.

As the master index was arranged in one sequence only, it was impracticable to bring together pairs of records relating to the same person in one of which there was a discrepancy in the first character of the surname, or where the surname had been changed since the previous admission (*e.g.* on marriage) and the previous surname was not also given. These technical limitations will probably have resulted in failure to recognize a few individuals on a second or subsequent spell in hospital and will lead to an underestimate of the readmission and transfer rates for 1962. The reciprocal error where two different individuals are mistakenly considered to be the same person is extremely improbable under the manual system.

* This estimate is based on the number of deaths known to have occurred to ORLS residents in hospitals outside the area, and assumes that the hospital fatality ratio in such hospitals is similar to that in hospitals inside the area.

† The deaths of persons resident in the ORLS area which take place elsewhere are notified to us by the Registrar General, but not the deaths of those who have moved away from the area.

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The format of the summary card is shown in Fig. 1. The information recorded permits in-patient spells following readmission from home to be distinguished from those following transfer from another hospital. Patients known to have died in hospital or at home during the year can also be distinguished from the remainder.

Identifying number
Age, civil state, present address, G.P., social class as given at first admission
Living/Dead status on December 31, 1962
Total number of in-patient spells
Number of in-patient spells ending in discharge home or death
Blood group
Hospital, disposal, specialty, and principal diagnosis at first, second, third, fourth, and last spells
Principal operation during first spell
Duration of first, second, and last spells
Total accumulated days in hospital (All spells)

FIG. 1.—Contents of summary card.

A shortcoming of the analysis, which relates to the calendar year 1962, is that allowance is not made for differences in the chance of readmission of persons first discharged in different months. Thus on average a person first discharged in January, 1962, is obviously more likely to appear again as a re-admission than is a person first discharged in June or December, 1962. An analysis taking into account differences in exposure will be forthcoming later. Meantime the current analysis is of interest because it indicates the degree of inflation of medical statistics based on "discharges" by multiple in-patient spells in a calendar year. In Table III (below) persons known to have died either at home or in hospital during 1962 are shown separately from the remainder. In the remainder of the Tables the living and the dead are combined in the interests of brevity, but fatality rates are also shown where relevant. Fatality rates have been calculated as follows:

All persons discharged once or more in 1962 who died within the calendar year whether in hospital or at home

All persons discharged once or more

The average numbers of in-patient spells, of readmissions from home, and of interhospital transfers completed during the calendar year have been calculated for various categories of patient classified in terms of their first discharge in the year and are expressed per hundred patients discharged.

Readmission rates calculated as follows are also given:

$$\frac{\text{Number of patients readmitted from home once or more}}{\text{Number of patients discharged who were alive at the end of their first in-patient spell}} \times 100$$

The corrected in-patient morbidity rate is the number of persons discharged once or more in a particular category divided by the mean population at risk.

RESULTS

Information was obtained about a total of 22,525 in-patient spells completed by residents of the ORLS area in 1962. These spells related to 18,366 persons (Tables I and II). Of these, 15,381 patients (83.7 per cent.) were neither transferred to another hospital nor readmitted from home; 1,745 (9.5 per cent.) were readmitted and discharged again at least once; 897 (4.9 per cent.) were transferred at least once; and 343 (1.9 per cent.) were both transferred between hospitals at least once and readmitted from home at least once during the calendar year. Thus a total of 2,985 patients (16.3 per cent.) were either readmitted, transferred, or both, once or more during 1962.

TABLE I
NUMBER OF PATIENTS READMITTED AND TRANSFERRED ONCE OR MORE DURING CALENDAR YEAR 1962, BY SEX (see text for definitions)

Type of Event	Males		Females		Total	
	No.	Per cent.	No.	Per cent.	No.	Per cent.
Not readmitted or transferred ..	7,477	84.3	7,904	83.1	15,381	83.7
Readmitted from home	885	10.0	860	9.0	1,745	9.5
Transferred not readmitted ..	351	4.0	546	5.7	897	4.9
Readmitted and transferred ..	147	1.7	196	2.1	343	1.9
Total readmitted or transferred ..	1,383	15.7	1,602	16.8	2,985	16.3
Total	8,860	100.0	9,506	99.9	18,366	100.0

TABLE II
DISTRIBUTION OF IN-PATIENT SPELLS COMPLETED IN 1962, BY SEX

In-patient Spells Completed in 1962	Patients Discharged						Total In-patient Spells	
	Males		Females		Total		No.	Per cent.
	No.	Per cent.	No.	Per cent.	No.	Per cent.		
1	7,477	84.3	7,904	83.1	15,381	83.7	15,381	68.3
2	988	11.3	1,195	12.6	2,183	11.9	4,366	19.4
3	277	3.1	296	3.1	573	3.1	1,719	7.6
4	88	1.0	70	0.7	158	0.9	632	2.8
5 or More	30	0.3	41	0.4	71	0.4	427	1.9
Total	8,860	100.0	9,506	99.9	18,366	100.0	22,525	100.0

Table I shows the number of patients in the various categories classified by sex. The chief difference between the sexes was that the proportion transferred between hospitals (7.8 per cent.) was higher in women than in men (5.7 per cent.). An excess was still present when gynaecological cases had been subtracted.

Table II shows the distribution of the 18,366 patients according to the number of in-patient spells completed in 1962. There was no significant difference between the sexes in this regard. The 229 patients with four or more spells experienced a total of 1,059 completed spells of in-patient treatment. In other words they contributed almost 5 per cent. of the spells experienced by the whole population at risk.

Table III shows the average number of in-patient spells, of readmissions from home, and of transfers between hospitals completed in 1962 per 100 patients discharged. Patients known to have died in hospital or subsequently at home after discharge from hospital are shown separately from the remainder. In spite of

the fact that those who died had on average a shorter period of exposure for readmission or transfer, the average number of spells completed by the dead was considerably higher than that completed by the living. An excess was present both for readmissions from home and transfers between hospitals. This presumably reflects a tendency for patients with fatal diseases to be selected for readmission and transfer.

READMISSION FROM HOME TO THE SAME AND DIFFERENT HOSPITALS

In Table IV, the 2,088 patients who were re-admitted from home once or more in 1962 (see also Table I) have been classified according to the type of hospital to which they were admitted on the first and second occasions. In the interests of brevity and because of small numbers, certain hospitals have been grouped. The two general teaching hospitals (the Radcliffe and Churchill), although on different sites, are functionally a unit and share a single system of medical records. They are therefore considered together. The remainder of the hospitals in the teaching group, including the ophthalmic, orthopaedic, geriatric, infectious diseases, and chest specialities, in addition to being on separate sites, have independent records systems. They have been grouped because each contributes a small number of readmissions. The five cottage hospitals and three mental hospitals are also dealt with as groups.

Taken overall, about four-fifths (78.8 per cent.) of the patients were readmitted on the second occasion to the same hospital or group of hospitals from which they had been discharged home on the first occasion. This proportion of concordant readmissions varied according to the type of hospital from which the first discharge took place. It was

TABLE III
AVERAGE NUMBER OF IN-PATIENT SPELLS, READMISSIONS, AND TRANSFERS COMPLETED IN 1962, PER 100 PATIENTS DISCHARGED, ACCORDING TO WHETHER THE PATIENT WAS LIVING OR DEAD ON DECEMBER 31, 1962

Sex	Assumed to be living			Discharged dead or died at home in 1962		
	Average No. per 100 patients			Average No. per 100 patients		
	In-patient Spells	Read-missions	Trans-fers	In-patient Spells	Read-missions	Trans-fers
Male	120	15	5	148	32	12
Female	122	14	8	142	24	18
Total	121	15	6	145	28	17

TABLE IV
PATTERN OF READMISSION TO THE SAME AND DIFFERENT CLASSES OF HOSPITAL IN 1962

First Hospital		Second Hospital					
		General Teaching	Special Teaching	District General	Cottage	Mental	Other
General Teaching	No. Per cent.	1,069 85.5	92 7.4	16 1.3	42 3.4	30 2.4	2 0.1
Special Teaching	No. Per cent.	84 30.0	181 64.6	7 2.5	6 2.2	1 0.4	1 0.4
District General	No. Per cent.	28 12.2	3 1.3	188 82.1	2 0.9	4 1.7	4 1.7
Cottage	No. Per cent.	44 28.4	14 9.0	2 1.3	88 56.8	7 4.5	0 0.0
Mental	No. Per cent.	35 22.2	3 1.9	7 4.4	0 0.0	113 71.5	0 0.0
Other		1	1	6	0	0	7
Total		1,261	294	226	138	155	14
							2,088

highest (85.5 per cent.) for patients first discharged from the two main teaching hospitals which contain the general medical and surgical departments, and a similar figure (82.1 per cent.) was observed for the district general hospital. At the other extreme, only slightly more than half the patients first discharged from cottage hospitals who were readmitted from home (56.8 per cent.) returned to this type of hospital. Presumably this reflects the limited facilities of cottage hospitals and their dependence on others in the area. It is interesting that, of the readmitted mental hospital patients, more than a quarter (26.6 per cent.) went on the second occasion to general hospitals. Substantial proportions of patients first discharged from the special hospitals and the

district general hospital who were readmitted also went to the general teaching hospitals.

AGE

Table V shows the influence of age on the average number of in-patient spells, readmissions, and transfers per patient, and upon the readmission and fatality rates. With minor exceptions, the pattern was similar in all categories, the rates falling from infancy to a minimum in childhood and then rising again throughout adult life. In extreme old age, the total number of in-patient spells and the numbers transferred continued to rise, but the readmission rate falls slightly. Fig. 2 demonstrates for each sex separately the degree of inflation in the various age

TABLE V
EFFECT OF AGE UPON AVERAGE NUMBERS OF IN-PATIENT SPELLS, READMISSIONS AND TRANSFERS PER 100 PATIENTS DISCHARGED AND UPON THE READMISSION AND FATALITY RATES FOR 1962 BOTH SEXES COMBINED

Age (yrs)	Number of				Average per 100 Patients			Readmission Rate Per cent.	Fatality Rate Per cent.
	Patients Discharged	Spells Completed	Readmission from Home	Inter-hospital Transfers	In-patient Spells	Readmission	Transfers		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<5	1,526	1,768	218	24	116	14	2	11.1	2.0
5-	2,316	2,550	184	50	110	8	2	6.6	0.4
15-	2,409	2,754	262	83	114	10	4	8.6	0.8
25-	1,998	2,343	274	71	117	14	3	10.4	0.7
35-	1,973	2,435	310	152	123	16	7	11.9	2.5
45-	2,198	2,726	372	156	124	17	7	12.9	4.5
55-	2,296	3,045	542	207	133	24	9	16.0	11.4
65-	1,896	2,541	419	226	134	22	12	17.4	18.2
75+	1,754	2,363	323	286	135	18	17	15.2	33.0
Total	18,366	22,525	2,904	1,255	123	16	7	11.6	7.7

FIG. 2.—Discharge rates for males and females $\left(\frac{\text{number of discharges}}{\text{mean population at risk}} \times 100 \right)$ and corrected in-patient morbidity rates $\left(\frac{\text{number of persons discharged once or more}}{\text{mean population at risk}} \times 100 \right)$ by age for ORLS area in 1962.

groups produced if hospital morbidity rates are calculated from in-patient spells or discharges (as in the Hospital In-patient Inquiry) as opposed to persons discharged. These rates have been calculated on the basis of the Registrar General's estimates of the population of the Oxford area on June 30, 1962.

The readmission rates by age are shown for each sex in Fig. 3.

FIG. 3.—Readmission rates for males and females

$$\left(\frac{\text{number of persons readmitted from home once or more}}{\text{number of persons discharged who were alive at the end of their first in-patient spell}} \times 100 \right)$$

 by age for ORLS area in 1962.

SOCIAL CLASS

An attempt was made to derive the social class of each patient from the occupation recorded on the hospital notes at time of admission, using the rules of the General Register Office (General Register Office Classification of Occupations, 1960). The material was then classified according to social class as given at the time of the patient's first admission, and the average number of in-patient spells, readmissions, etc., was calculated for each social class in the usual way. The results for males between the ages of 15 and 64 years are shown in Table VI. Sufficient information to permit classification was recorded in 87.3 per cent. of the cases. A similar Table for women is not given because only 60 per cent. of the cases could be classified. No consistent trend with social class was seen in terms of the average number of spells of treatment, the average number of readmissions, or the readmission rate. However, the average number of transfers between hospitals increased slightly with less favourable social circumstances. A similar trend was observed in the case of women aged 15 to 64 years (not shown).

MARITAL STATUS

To study the effect of marital status on readmission and transfer, patients over 15 years of age were selected and classified according to the marital condition recorded at the time of their first admission to hospital in 1962. Single, widowed, and separated persons have been considered together, as they have in common the absence of a spouse to look after them at home. In Fig. 4 (opposite), their average number of readmissions and transfers is compared with that of married patients in each of four age groups in each sex. Fig. 4 shows that, as far as readmissions were concerned, there were no consistent differences between patients with spouses and those without for either sex. In five of the eight

TABLE VI
 RELATIONSHIP OF SOCIAL CLASS AT TIME OF FIRST DISCHARGE FROM HOSPITAL TO SUBSEQUENT NUMBER OF SPELLS READMISSIONS, TRANSFERS, ETC., FOR 1962. MALES AGED 15-64.

Social Class	Number of				Average per 100 Patients			Readmission Rate Per cent.	Fatality Rate Per cent.
	Patients Discharged	Spells Completed	Readmission from Home	Inter-Hospital Transfers	In-patient Spells	Readmission	Transfers		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
I	201	253	37	15	126	18	7	14.3	4.0
II	480	580	71	29	121	15	6	11.5	7.1
III	1,839	2,231	256	136	121	14	7	11.3	5.6
IV	890	1,094	119	85	123	13	10	10.7	6.8
V	639	822	121	62	129	19	10	14.0	6.4
Students and Armed Forces	317	363	41	5	114	13	1	7.6	0.9
Not Specified	637	740	100	3	116	16	0	11.7	4.4
Total	5,003	6,083	745	335	122	15	7	11.8	5.6

FIG. 4.—Average numbers of readmissions from home and of transfers between hospitals per 100 patients discharged, by marital status, age, and sex, for ORLS area in 1962.

comparisons the average number of readmissions was higher in persons with spouses, in two this situation was reversed, and in one pair the average number of readmissions was identical.

In contrast, Fig. 4 shows an excess of transfers in patients without spouses in almost every comparison, the difference being most marked in each sex for patients over the age of 65 years. It is also worth noting that the two exceptions to the rule were in the youngest age groups, where the presence of an able-bodied parent in the home of unmarried, widowed, or separated patients may be an important mitigating factor. Taken in conjunction with Table VI, the results suggest that in the Oxford area social factors exert an important influence in determining the pattern of interhospital transfers but not that of readmission from home. This is of particular interest when it is recalled that transfers to the local convalescent hospital have been excluded from the analysis. It is assumed that the generally higher average number of transfers in persons with no spouse in the home or in the less favourable social

groups may reflect a greater use of in-patient facilities for preconvalescent, chronic, and terminal care by these people.

TYPE OF ILLNESS

As the principal diagnosis reached during each spell of in-patient treatment had been included on the summary card (Fig. 1), it was possible to classify the patients by type of illness. In view of the limitation of space and the small number of cases in many of the diagnostic rubrics, concise presentation of this material is difficult. There appeared to be two alternative methods. The first was to use all the cases by classifying them into broad groups such as the seventeen major classes of illness of the International List; the second, which was finally adopted, was to select the commonest causes of admission to hospital and limit the analysis to these.

In Table VII (overleaf), the 25 3-digit rubrics have been selected containing the largest number of discharges for the year. The total number of discharges

experienced by the population are shown (Col. 2) and discharge rates have been calculated and expressed per 10,000 mean population (Col. 3). In Col. 4 corrected in-patient morbidity rates are also shown expressed in the same way. These have been derived by counting the number of *persons* discharged with the appropriate diagnosis at the end of their first in-patient spell, and adding to this total the numbers of persons discharged with that diagnosis after their second or subsequent spell of treatment in whom the same diagnosis had not been reached during an earlier spell. This method avoids persons readmitted or transferred for the same condition being counted in the numerator more than once, and also ensures that persons in whom the appropriate principal diagnosis is reached for the first time during their second or subsequent spell in hospital during the year will also be included. The reduction effected by the correction for each of the selected diagnoses is shown in Col. 5, and as might be expected the degree of inflation of the discharge rate due to multiple spells of treatment for the same condition differs widely. It varied from a maximum of 29 per cent. for carcinoma of the bronchus to 1 per cent. for concussion and hypertrophy of the tonsils and adenoids.

The remaining columns of Table VII are concerned with the readmission and fatality rates for each con-

dition. In the case of the readmission rates, the total number of patients readmitted from home once or more has been expressed as a percentage of all patients discharged alive with the appropriate condition. The patients readmitted have been further classified according to whether the principal diagnosis reached on the second occasion, was the same as (concordant) or different from (discordant) the first. The fatality rates have been calculated as previously in this paper. The Table is arranged in rank order of readmission rate.

A wide range of total readmission rates occurs. In the case of carcinoma of bronchus 31.6 per cent. of patients who survived the first spell in hospital were readmitted from home once or more during the same calendar year. At the other extreme only 2.6 per cent. of the patients with hypertrophy of tonsils and adenoids were readmitted from home. As might be expected, some correlation can be seen between fatality rates and readmission rates, indicating that patients with lethal diseases tend if they survive their first admission, to require further care. Another factor which influences the readmission rate is the chronicity or relapsing nature of the illness; thus patients classified to rubric 790*, who consist chiefly

*Nervousness and debility

TABLE VII

NUMBER OF DISCHARGES, DISCHARGE RATES, CORRECTED IN-PATIENT MORBIDITY RATES, READMISSION RATES ETC., FOR 25 COMMON CAUSES OF DISCHARGE FROM HOSPITAL, ORLS AREA, 1962

Principal Diagnosis†	Number of Discharges	Discharges per 10,000 Population	Corrected In-patient Morbidity Rate per 10,000 Population	Difference between Cols 3 and 4 (Per cent.)	Readmission Rates (Per cent.)			Fatality Rate (Per cent.)
					All-Patients Re-admitted	Patients Re-admitted with the Same Condition	Patients Re-admitted with Other Condition	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Carcinoma of bronchus (162)	214	6.6	4.7	-29	31.6	27.4	4.2	47.0
Nervousness and debility (790)	211	6.5	5.7	-12	24.4	8.2	16.3	6.0
Schizophrenia (300)	242	7.4	6.4	-14	21.2	15.5	5.7	5.9
Neurotic depressive reaction (314)	227	7.0	6.0	-14	19.6	9.1	10.5	3.4
Carcinoma of breast (170)	151	9.0*	7.4*	-18	19.2	14.4	4.8	19.1
Bronchitis (501)	202	6.2	5.8	-6	15.8	4.2	11.5	4.7
Diabetes (260)	189	5.8	5.0	-14	15.0	10.0	5.0	8.7
Ulcer of duodenum (541)	202	6.2	5.8	-6	12.4	4.7	7.7	6.7
Symptoms referable to abdomen and lower gastro-intestinal tract (785)	343	10.6	10.2	-4	12.3	2.3	10.0	2.9
Cataract (385)	174	5.4	4.8	-11	12.2	6.1	6.1	0.0
Arteriosclerotic heart disease (420)	392	12.1	11.2	-7	10.0	4.6	5.4	30.9
Disorders of menstruation (634)	304	18.2	17.4	-4	9.7	3.4	6.3	0.4
Haemorrhoids (461)	143	4.4	4.3	-2	9.6	1.5	8.1	0.7
Otitis media (391)	190	5.8	5.5	-5	9.0	3.6	5.4	0.0
Abortion (650)	409	24.5*	23.5*	-4	8.5	3.2	5.3	0.0
Redundant prepuce (615)	155	9.8*	9.4*	-4	8.3	3.5	4.9	0.0
Infective diseases of the uterus, vagina, etc. (630)	183	11.0*	10.8*	-2	8.3	1.2	7.1	1.2
Broncho-pneumonia (491)	183	5.6	5.4	-4	8.3	1.2	7.1	44.8
Hernia (560)	538	16.6	15.9	-4	7.0	1.6	5.4	0.8
Uterovaginal prolapse (631)	238	14.3	13.8	-3	7.0	1.4	5.6	0.0
Strabismus (354)	128	3.9	3.8	-3	6.6	4.1	2.5	0.7
Varicose veins (460)	323	9.9	9.6	-3	5.3	2.0	3.3	0.7
Acute appendicitis (550)	400	12.3	12.1	-2	5.3	1.3	4.0	0.0
Concussion (852)	765	23.5	23.2	-1	5.0	0.8	4.2	0.8
Hypertrophy of tonsils and adenoids (510)	1,120	34.5	34.3	-1	2.6	0.3	2.3	0.0

* Figures relate to males or females only as appropriate.

† ISC 3-digit rubric in parentheses

of persons with the symptom "depression not otherwise specified"; schizophrenics; and persons with the neurotic-depressive reaction, rank higher in terms of readmission rates than in terms of fatality rates. Conversely, it is interesting that patients with the extremely fatal conditions classified as arteriosclerotic heart disease or as bronchopneumonia have relatively low readmission rates. It is not certain to what extent *the planned interruption of in-patient treatment by periods at home* is a factor in determining readmission rates. In the conditions selected for study, it was detected as important in the case of cataract, where the majority of the concordant readmissions were for treatment of the other eye, and of strabismus, where the operations on the various ocular muscles were sometimes carried out in stages.

When the concordant and discordant readmission rates are considered, it is convenient to divide the types of illness into those where the concordant readmission rate was the same or higher than the discordant and *vice versa*. In the case of patients discharged alive with carcinoma of the bronchus or breast, schizophrenia, diabetes, cataract, and strabismus, the chance of being readmitted within the same calendar year for the same condition was as great or greater than for all other conditions combined. As far as the remainder is concerned, the excess of discordant readmissions is sometimes due to the tentative or inadequate nature of the initial diagnosis (*e.g.* nervousness and debility, symptoms referable to the abdomen, bronchitis) or to readmission for closely related conditions (*e.g.* menorrhagia, and other gynaecological conditions following abortion).

The time-span of the material reported here is obviously too short to disclose biological associations between diseases the onset of which in a person is separated in time, but it is hoped that eventually a systematic search of the material will prove rewarding in this regard.

DISCUSSION

So far as is known the material reported here represents the first systematic attempt to study multiple spells of in-patient treatment as they occurred in a community to all persons who had been discharged from hospital over a defined period. When the successive records of the patients had been linked together, it was found that the 22,525 spells of in-patient treatment completed by residents of our defined area within the calendar year 1962 had been experienced by 18,366 persons. Expressed in terms of the population of the area, this means a reduction from a discharge rate of 6.8 per cent.

All discharges completed in 1962
Area population at risk

to a corrected in-patient morbidity rate of 5.5 per cent.

All persons discharged once or more in 1962
Mean population at risk

Morbidity rates calculated on the basis of the first of these two indices are thus subject to substantial inflation. The degree of inflation of morbidity rates computed from the number of discharges has been found to vary with age (Fig. 2), according to whether the patient was living or dead at the end of the year (Table III) and according to the type of illness (Table VII). It is clear that a linked system of records permits more accurate indices of in-patient morbidity to be worked out than are currently available.

As a patient may be admitted to hospital many times but can die only once, fatality rates computed by dividing the number of deaths by the number of discharges, as is standard practice (Hospital In-patient Inquiry 1959, *et seq.*), are likely to lead to an underestimate. The degree of underestimation may be expressed by the average number of in-patient spells per 100 patients in a given group. Thus, in patients over 75, the fatality rate as usually calculated will underestimate the true state of affairs by 35 per cent. (Table V) and in patients with carcinoma of the bronchus by 29 per cent. (Table VII). It is also worth noting that the fatality rate and the surplus of in-patient spells per 100 patients tend to vary together; in other words, the higher the fatality rate the greater the degree of underestimation of the true figure will result from a calculation based on the number of discharges. The extended use of a linked file of hospital records would permit the hospital fatality rate to be used with greater confidence than is possible at present as an index of the quality of medical care.

A point of administrative interest is the relationship between duration of stay and the number of in-patient spells per 100 patients. Average duration of stay has been used as an index in comparison between the performance of hospitals handling similar types of case, but as at present statistics are used where "discharges" and "persons discharged" cannot be distinguished this may be misleading.

READMISSION FROM HOME AND THE READMISSION RATE

Taken overall, 2,088 (11.6 per cent.) of the patients discharged alive from hospital on the first occasion were readmitted from home and discharged again at least once during the calendar year, and the total number of readmissions completed by these patients during 1962 was 2,904. The fact that the average

period of exposure to the risk of readmission of those who survived until the end of the calendar year was about 6 months (and less for the remainder) underlines the magnitude of this phenomenon which is borne out by other workers. Beck, Gardner, and Witts (1947), in a survey of patients discharged from four wards of the Radcliffe Infirmary, Oxford, found that 21 per cent. had been readmitted to hospital in the subsequent 18 months. Ferguson and McPhail (1954) studied a sample of adult males discharged from medical wards in the Glasgow area; 3 months after discharge 5 per cent. of the men had been readmitted and by the end of 2 years 27 per cent. of those still living had been readmitted at least once. MacKenzie, Weir, and Richardson (1962) found that, of 452 adult male patients who had survived a full year after discharge, 25 per cent. had been readmitted to hospital on one or more occasions.

Among the factors which influence the readmission rate, *the nature of the illness* appears to be most important. Some lethal diseases (*e.g.* cancer of the bronchus and breast) are characterized by high readmission rates, but others (bronchopneumonia and arteriosclerotic heart disease) have lower than average readmission rates. The duration and relapsing nature of the illness (as in schizophrenia, depression, bronchitis, and diabetes) are of obvious importance. The readmission rate tends to increase with age but it is not clear whether such an effect could be shown for individual diseases or whether it reflects changes in the pattern of disease in different age groups. Contrary to the experience of Ferguson and MacPhail (1954), we were unable to show a relationship between readmission rate and social class; nor did the presence or absence of a spouse in the home appear important. The proportion of patients readmitted once or more in each sex was very similar.

Methods of treatment must also play their part in determining the readmission rate although no attempt has been made to separate the effect of treatment from that of the disease in this study. Two diseases in which the planned interruption of surgical treatment by periods at home was important (cataract and strabismus) were encountered in the 25 common conditions studied.

It would be attractive if the readmission rate could be used as an index of the quality of medical care, but further work will be necessary to determine any possible use it may have for this purpose.

According to MacKenzie and others (1962), 90 per cent. of the Aberdeen patients readmitted to hospital within one year were suffering from a recurrence or complication of their original complaint. At first sight, the analysis in Table VII would appear not to bear out this finding because in only

four of the 25 conditions studied was the readmission rate for the condition diagnosed during the first admission higher than for all other conditions combined. This, however, does not take into account the fact that many of the readmissions for "other" conditions were related to the first condition, although coded to different 3-digit rubrics in the International List.

Perhaps one of the most interesting applications of the accumulated file of linked records will be the definition of cohorts in terms of their admission to hospital for an illness or operation and their surveillance for the development of associated disease the onset of which occurs after an interval. The system also provides a follow-up service in respect of in-patient morbidity and death for samples of patients classified *ad hoc* in the field.

INTERHOSPITAL TRANSFER

Inter-hospital transfer was less common than readmission from home and was experienced once or more by 6.8 per cent. of the patients discharged from hospital. Transfers occur for two main reasons: either to enable the patient to have access to facilities not available in the hospital of first admission (*e.g.* transfers from Cottage to General Hospitals); or to relieve expensively-equipped General Hospitals of the care of patients in the preconvalescent, chronic, or terminal stages of illness (*e.g.* transfers between General or Special Hospitals and Cottage Hospitals). In either event the pattern of inter-hospital transfer will depend to a large degree on such local matters as the relative availability of different types of bed, the siting of beds, and so on. In Oxford, where for historical reasons the teaching hospital group is split up so that, for example, orthopaedic, ophthalmic, neurological, dermatological, and neuro-surgical departments are each situated at a different site, and general medicine and surgery is split between two sites, the transfer rate is higher than average. For these reasons the inter-hospital transfer pattern is likely to be of administrative rather than of biological interest. The suggestion in this series that the average number of transfers is increased where home circumstances are unfavourable emphasizes once again the importance of social factors in the demand for hospital beds (Forsyth and Logan, 1960).

SUMMARY AND CONCLUSIONS

- (1) This paper reports an attempt to obtain information about every spell of in-patient treatment under the National Health Service experienced by an English population of 325,000 people during the calendar year 1962. When the records

had been linked together in a series of personal files, it was found that 22,525 in-patient spells had been experienced by 18,366 persons. Of the 18,366 persons, 15,381 (83·7 per cent.) had experienced one spell of in-patient treatment, 1,745 (9·5 per cent.) had been readmitted once or more from home, 897 (4·9 per cent.) had been transferred once or more between hospitals, and 343 (1·9 per cent.) had been readmitted and transferred within the calendar year.

- (2) The second and successive spells of treatment were classified into two groups: (a) inter-hospital transfers and (b) readmissions from home. The average numbers of transfers and readmissions per person were calculated by age, marital condition, and social class. Readmission rates and fatality rates based on the number of persons discharged once or more are also given.
- (3) The pattern of readmission between hospitals is described. Taken overall about one-fifth (21·2 per cent.) of the patients readmitted to hospital from home during the year went to a different group of hospitals on the second occasion.
- (4) Total, concordant, and discordant readmission rates are given for the 25 commonest conditions causing admission to hospital according to the principal diagnosis reached at the time of

the patients' first discharge from hospital as compared with that reached during the first readmission from home.

- (5) Corrected in-patient morbidity rates are given by age and sex (all causes combined) and crude rates are given for each of the 25 commonest causes of discharge from hospital.

REFERENCES

- Acheson, E. D. (1964). *Brit. J. prev. soc. Med.*, **18**, 8.
 — and Evans, J. G. (1964). *Proc. roy. Soc. Med.*, **57**, 269.
 Beck, I. F., Gardner, F. V., and Witts, L. J. (1947). *Brit. J. soc. Med.*, **1**, 197.
 Ferguson, T., and MacPhail, A. N. (1954). "Hospital and Community". Oxford University Press, London.
 Forsyth, G., and Logan, R. F. L. (1960). "The Demand for Medical Care. A Study of the Case-load in the Barrow and Furness Group of Hospitals". Oxford University Press, London.
 General Register Office (1960). "Classification of Occupations, 1960." H.M.S.O., London.
 McKenzie, M., Weir, R. D., Richardson, I. M., Mair, A., Harnett, R. W. F., Curran, A. P., and Ferguson, T. (1962). "Further Studies in Hospital and Community". Oxford University Press, London.
 Ministry of Health and General Register Office (1959, et seq.). "Reports on Hospital In-patient Enquiry for 1955, et seq." H.M.S.O., London.
 W.H.O. (1957). "Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death", 7th Revision. W.H.O., Geneva.