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- 1 Wilson K, Gibson N, Willan A, Cook D. Effect of smoking cessation on mortality after myocardial infarction: meta-analysis of cohort studies. *Arch Intern Med* 2000;160:939-44.
- 2 Daly LE, Mulcahy R, Graham IM, Hickey N. Long term effect on mortality of stopping smoking after unstable angina and myocardial infarction. *BMJ* 1983;287:324-6.
- 3 Rigotti NA, Singer DE, Mulley AG Jr, Thibault GE. Smoking cessation following admission to a coronary care unit. *J Gen Intern Med* 1991;6:305-11.
- 4 Rigotti NA, McKool KM, Shiffman S. Predictors of smoking cessation after coronary artery bypass graft surgery. Results of a randomized trial with 5-year follow-up. *Ann Intern Med* 1994;120:287-93.
- 5 DeBusk RF, Miller NH, Superko HR, Dennis CA, Thomas RJ, Lew HT, et al. A case-management system for coronary risk factor modification after acute myocardial infarction. *Ann Intern Med* 1994;120:721-9.
- 6 Van Elderen-van Kemenade T, Maes S, van den Broek Y. Effects of a health education programme with telephone follow-up during cardiac rehabilitation. *Br J Clin Psychol* 1994;33:367-78.
- 7 Jolly K, Bradley F, Sharp S, Smith H, Thompson S, Kinmonth AL, et al. Randomised controlled trial of follow up care in general practice of patients with myocardial infarction and angina: final results of the Southampton heart integrated care project (SHIP). The SHIP Collaborative Group. *BMJ* 1999;318:706-11.

- 8 Campbell NC, Ritchie LD, Thain J, Deans HG, Rawles JM, Squair JL. Secondary prevention in coronary heart disease: a randomised trial of nurse led clinics in primary care. *BMJ* 2002;324:87-9.
- 9 Carlsson R, Lindberg G, Westin L, Israelsson B. Influence of coronary nursing management follow up on lifestyle after acute myocardial infarction. *Heart* 1997;77:256-9.
- 10 Hajek P, Taylor TZ, Mills P. Brief intervention during hospital admission to help patients to give up smoking after myocardial infarction and bypass surgery: randomised controlled trial. *BMJ* 2002;324:87-9.
- 11 Moreno Ortigosa A, Ochoa Gomez FJ, Ramalle-Gomara E, Saralegui Reta I, Fernandez Esteban MV, Quintana Diaz M. Efficacy of an intervention in smoking cessation in patients with myocardial infarction. *Med Clin (Barc)* 2000;114:209-10. (In Spanish.)
- 12 Taylor CB, Houston-Miller N, Killen JD, DeBusk RF. Smoking cessation after acute myocardial infarction: effects of a nurse-managed intervention. *Ann Intern Med* 1990;113:118-23.
- 13 Dornelas EA, Sampson RA, Gray JF, Waters D, Thompson PD. A randomized controlled trial of smoking cessation counselling after myocardial infarction. *Prev Med* 2000;30:261-8.
- 14 Taylor CB, Houston-Miller N, Haskell WL, DeBusk RF. Smoking cessation after acute myocardial infarction: the effects of exercise training. *Addict Behav* 1988;13:331-5.
- 15 Ockene J, Kristeller JL, Goldberg R, Ockene I, Merriam P, Barrett S, et al. Smoking cessation and severity of disease: the coronary artery smoking intervention study. *Health Psychol* 1992;11:119-26.
- 16 Burt A, Thornley P, Illingworth D, White P, Shaw TR, Turner R. Stopping smoking after myocardial infarction. *Lancet* 1974;1:304-6.
- 17 Perkins KA, Scott RR. A low-cost environmental intervention for reducing smoking among cardiac inpatients. *Int J Addict* 1986;21:1173-82.

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Hospital bed utilisation in the NHS, Kaiser Permanente, and the US Medicare programme: analysis of routine data

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Abstract

Objective To compare the utilisation of hospital beds in the NHS in England, Kaiser Permanente in California, and the Medicare programme in the United States and California.

Design Analysis of routinely available data from 2000 and 2001 on inpatient admissions, lengths of stay, and bed days in populations aged over 65 for 11 leading causes of use of acute beds.

Setting Comparison of NHS data with data from Kaiser Permanente in California and the Medicare programme in California and the United States; interviews with Kaiser Permanente staff and visits to Kaiser facilities.

Results Bed day use in the NHS for the 11 leading causes is three and a half times that of Kaiser's standardised rate, almost twice that of the Medicare California's standardised rate, and more than 50% higher than the standardised rate in Medicare in the United States. Kaiser achieves these results through a combination of low admission rates and relatively short stays. The lower use of bed days in Medicare in California compared with Medicare in the United States suggests there is a "California effect" as well as a "Kaiser effect" in hospital utilisation.

Conclusion The NHS can learn from Kaiser's integrated approach, the focus on chronic diseases and their effective management, the emphasis placed on self care, the role of intermediate care, and the leadership provided by doctors in developing and supporting this model of care.

Introduction

Feachem and colleagues have compared the costs and performance of the NHS and the health maintenance organisation Kaiser Permanente in California.¹ They reported at the aggregate level that the NHS used three times the number of acute bed days as Kaiser.

To explore the issues raised in their analysis further, we took a number of the leading causes of bed day use in the NHS and compared resource utilisation for each cause. In so doing, we sought to understand how Kaiser is able to limit the use of beds for conditions such as stroke and hip fracture, which are a major source of demand on NHS hospitals.

We concentrated on people aged 65 and over because older people make the greatest use of acute beds. Also, focus on this age group enables the comparison between the NHS and Kaiser to be located in the context of the utilisation of services by the Medicare population for the United States as a whole and in California.

Throughout the paper we use the term Kaiser as shorthand for the Kaiser Permanente Medical Care Programme. The programme is made up of the Kaiser Foundation Health Plan, Kaiser Foundation Hospitals, and the Permanente Medical Groups. There are more than 10 000 Permanente physicians in the medical groups and they serve more than 8 million Kaiser Permanente members.

Methods

We used routinely available data from the hospital episodes statistics for 2000-1 to identify 11 leading



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Table 1 Selected healthcare resource groups—11 leading causes of use of NHS bed days (England, 2000-1)²

Group	No (%) total bed days	Bed days per 1000 population
A22 Non-transient stroke or cerebrovascular accident >69 or with complications	1 040 324 (2.0)	20.8
H33 Neck of femur fracture >69 or with complications	740 000 (1.5)	14.8
D20 Chronic obstructive pulmonary disease or bronchitis	713 416 (1.4)	14.3
D21 Asthma >49 or with complications	599 583 (1.2)	12.0
E18 Heart failure or shock >69 or with complications	590 356 (1.2)	11.8
L09 Kidney or urinary tract infections >69 or with complications	470 240 (0.9)	9.4
H02 Primary hip replacement	422 099 (0.8)	8.4
E12 Acute myocardial infarction without complications	416 254 (0.8)	8.3
H04 Primary knee replacement	354 866 (0.7)	7.1
E33 Angina >69 or with complications	345 977 (0.7)	6.9
E04 Coronary bypass	196 141 (0.4)	3.9
Total	5 889 256 (11.5)	

Healthcare resource groups were ranked according to bed days used in the NHS and the leading causes of admissions and day case rates were also examined. "Invalid primary diagnosis" and "ill defined signs and symptoms" were excluded from the list of leading causes of bed day use, resulting in the selection of the 11 causes in this table for analysis.

causes of acute hospital admission and bed day use in the NHS in England. Together, these causes account for 11.5% of total bed day use in the NHS (table 1).

Data from Kaiser were drawn from Kaiser's cost management information system and are for the year 2000. Medicare data were drawn from the 5% analytic file (inpatient) for beneficiaries in fee for service Medicare and are also for the year 2000. The population for Kaiser was the membership aged 65 and over. For Medicare, the population included all beneficiaries aged 65 and over, living in the United States, with parts A and B coverage, in fee for service plans. For all causes, we tried to match NHS definitions as closely as possible with the definitions used by Kaiser and Medicare. We took differences in the age structure of the populations studied into account by standardising Kaiser and Medicare data to populations in England. NHS data used provider spells rather than finished consultant episodes for a closer match to the definitions used in the Kaiser and Medicare data.

To understand the reasons for differences in bed day use between the NHS and Kaiser, one of us (CH) visited California and interviewed senior clinical and managerial staff in Kaiser's headquarters and in one of its medical facilities. This was followed by a further visit in which 35 clinicians and managers from the NHS saw at first hand Kaiser's facilities and services.

Results

For the 11 causes selected for analysis, we have data on admission rates, length of stay, and bed day use for inpatients. The main comparisons are between the NHS and Kaiser. Data for Medicare are included to provide context for these comparisons.

Admission rates

Table 2 shows the comparison of admission rates. For most causes, though not all, crude admission rates are higher in the NHS than in Kaiser. The biggest differences in admission rates are for angina and for bronchitis or asthma; NHS rates are four to five times higher than in Kaiser. Admission rates in Kaiser are higher for heart failure or shock, acute myocardial infarction, knee replacements, and kidney or urinary tract infection. Standardised admission rates display a similar pattern.

Medicare admission rates (crude and standardised) in both California and the United States are generally higher than in the NHS. The exceptions are angina and bronchitis or asthma.

Lengths of stay

Table 3 shows that for all causes, crude lengths of stay are higher in the NHS than in Kaiser. The biggest differences in lengths of stay are for stroke and hip fracture; NHS stays are five to six times higher than in Kaiser. Standardised lengths of stay are also higher in the NHS than in Kaiser (table 3).

Medicare lengths of stay (crude and standardised) in both California and the United States are all shorter than in the NHS and usually longer than in Kaiser.

Bed days

For all causes, crude bed day use is higher in the NHS than in Kaiser (table 4). The biggest differences are for angina and for bronchitis or asthma; NHS bed day utilisation is 14 to 15 times higher than in Kaiser. Standardised bed days display a similar pattern.

Medicare bed day use (crude and standardised) in both California and the United States is usually lower than in the NHS. The exceptions are for coronary bypass and for heart failure or shock.

Overall utilisation

For the 11 causes selected for study, total bed day use in the NHS is three and a half times that of Kaiser's standardised rate, almost twice that of the Medicare California standardised rate, and over 50% higher than the standardised rate in Medicare in the United States. Kaiser achieves these results through a combination of

Table 2 Number of inpatient admissions (per 100 000 population) in people aged over 65

Group	NHS	Kaiser		Medicare California		Medicare United States	
		Unstandardised	Standardised	Unstandardised	Standardised	Unstandardised	Standardised
Stroke	823	712	788	1201	1155	1212	1183
Chronic obstructive pulmonary disease	699	536	558	1081	1067	1262	1256
Bronchitis or asthma	531	129	141	231	225	318	310
Coronary bypass	144	103	97	289	296	313	321
Acute myocardial infarction	550	836	893	702	675	942	923
Heart failure/shock	556	1008	1118	1966	1893	2332	2272
Angina pectoris	783	146	152	180	176	205	203
Hip replacement	342	250	256	622	602	661	644
Knee replacement	344	373	367	479	479	557	557
Hip fracture	315	311	388	516	489	562	535
Kidney or urinary infection	396	449	526	762	726	736	708

Table 3 Length of hospital stay (days) for people aged over 65

Group	NHS	Kaiser		Medicare California		Medicare United States	
		Unstandardised	Standardised	Unstandardised	Standardised	Unstandardised	Standardised
Stroke	27.08	4.29	4.26	5.84	5.84	6.54	6.53
Chronic obstructive pulmonary disease	9.87	3.82	3.79	5.43	5.35	5.42	5.37
Bronchitis or asthma	11.73	3.11	3.09	4.05	4.22	4.41	4.41
Coronary bypass	13.27	9.82	9.60	8.86	8.63	10.37	9.98
Acute myocardial infarction	9.39	4.37	4.35	5.22	5.14	5.60	5.46
Heart failure or shock	12.42	3.72	3.70	5.29	5.28	5.39	5.37
Angina pectoris	5.88	2.22	2.21	2.66	2.58	2.62	2.56
Hip replacement	12.60	4.52	4.54	5.71	5.41	5.69	5.46
Knee replacement	11.32	4.16	4.17	4.52	4.54	4.39	4.40
Hip fracture	26.88	4.94	4.89	5.99	5.97	6.48	6.47
Kidney or urinary tract infection	15.19	3.78	3.80	5.14	5.11	5.31	5.32

low admission rates and short lengths of stay in hospital. By contrast, Medicare has high admission rates and relatively short stays. The NHS has long stays and admission rates that tend to come between those of Medicare and Kaiser.

Discussion

The overall differences between the NHS and Kaiser for these 11 healthcare resource group clusters are consistent with the findings of Feachem and colleagues on aggregate bed day use for all healthcare resource groups. This suggests that these 11 causes are not unrepresentative of others. However, in contrast to Feachem and colleagues, we found that differences in lengths of stay are more important in accounting for overall differences in bed day use than differences in admission rates. This is probably because our approach focused on the leading causes of NHS bed day use.

The Medicare data included in our analysis allow the performance of Kaiser to be viewed in a wider context. Our results indicate that aspects of Kaiser's approach to health care contribute to its performance over and above the impact of payment methods and managed care approaches prevalent in the United States.

Our data also suggest that there is a "California effect" in the way in which acute beds are used. The fact that Kaiser is a major insurer and provider in California may help in part to explain lower bed day use in Medicare in California than in Medicare in the United States.

Limitations

Three limitations should be noted. Firstly, differences in coding or recording may be affecting some of the comparisons. It seems that a relatively high proportion

of heart patients admitted in the NHS are recorded as having angina, whereas in Kaiser and Medicare more patients would be recorded under heart failure or shock or under acute myocardial infarction. Similar issues arise in relation to bronchitis or asthma and chronic obstructive pulmonary disease.

Secondly, NHS data excludes the use of beds in the private sector. Omission of these data means that admission rates and bed day use for some health resource groups are understated in our analysis.

Thirdly, the NHS data presented here do not distinguish between the time that patients spend in an acute hospital and the time they spend in a community hospital or similar facility.

The net effect of the exclusion of the use of private beds and inclusion of the use of community hospitals on bed day use in the NHS is not known.

Integration

The qualitative study we undertook found that the most distinctive feature of the Kaiser model is the way in which it integrates care. The model contains three important aspects of integration.

Firstly, Kaiser integrates funding with the provision of care in that as an insurer it collects premiums from members and as a provider it delivers care to these members. Providers know that they have to work within the envelope of resources earned by the insurance plan. Physicians in the Permanente medical groups have an interest in minimising hospital stay because they share responsibility for the success of the programme.

Secondly, Kaiser integrates inpatient care and outpatient care. This enables patients to move easily between hospitals and the community, or into skilled nursing facilities should care in these facilities be needed. Medical specialists are uncoupled from the

Table 4 Number of bed days per 100 000 population aged over 65

Group	NHS	Kaiser		Medicare California		Medicare United States	
		Unstandardised	Standardised	Unstandardised	Standardised	Unstandardised	Standardised
Stroke	22 289	3 053	3 358	7 012	6 750	7 930	7 726
Chronic obstructive pulmonary disease	6 906	2 046	2 118	5 874	5 709	6 833	6 747
Bronchitis or asthma	6 224	402	435	936	951	1 403	1 368
Coronary bypass	1 915	1 006	935	2 562	2 552	3 250	3 205
Acute myocardial infarction	5 166	3 651	3 886	3 667	3 470	5 278	5 040
Heart failure or shock	6 905	3 746	4 137	10 403	9 999	12 569	12 191
Angina pectoris	4 600	325	334	478	454	538	520
Hip replacement	4 314	1 132	1 161	3 552	3 258	3 762	3 514
Knee replacement	3 893	1 553	1 533	2 164	2 172	2 444	2 448
Hip fracture	8 455	1 536	1 899	3 094	2 921	3 639	3 460
Kidney or urinary tract infection	6 010	1 698	2 000	3 914	3 712	3 906	3 767

What is already known on the topic

Kaiser Permanente in California uses far fewer acute bed days in relation to the population served than the NHS

The integrated model of care used in Kaiser Permanente explains its ability to keep patients out of hospital and to provide care in the community

What this study adds

The NHS uses three and a half times the number of acute bed days as Kaiser Permanente for 11 leading causes of bed day use in the NHS; it uses twice the number of acute bed days as Medicare in California and 50% more than Medicare in the United States for these causes

Differences in length of stay are more important than differences in admission rates in explaining variations in bed day use for the conditions selected in this study

Kaiser Permanente achieves lower utilisation of acute bed days through integration of care, active management of patients, the use of intermediate care, self care, and medical leadership

hospital and work alongside generalists in multi-specialty medical groups. Specialists have no incentive to admit patients to hospital or keep them in longer than is appropriate.

Thirdly, Kaiser integrates prevention, diagnosis, treatment, and care. This is most apparent in relation to management of chronic disease—for example, for patients with heart failure or asthma. Care for patients with these conditions is delivered within the framework of evidence based clinical guidelines and is actively managed at all stages. Doctors who work for Kaiser also have fast access to diagnostic services in the outpatient setting, thereby avoiding patients staying in hospital.

Managed care

When patients are admitted to hospital, there is a strong emphasis on minimising stays and maintaining the flow of patients through the hospital through the use of managed care techniques. For example, care pathways have been developed for patients undergoing hip replacements and knee replacements, specifying what should happen on each day of hospital treatment. Kaiser employs specialist discharge staff to ensure that patients are not kept in hospital unnecessarily. This avoids the practice of patients lying in wait for discharge, so familiar in the NHS.³

Patients are enabled to return home by being supported to do as much as possible for themselves. By offering advice and support and by managing the expectations of patients and families, Kaiser staff enable hospitals to be used only when necessary. Skilled nursing facilities also play a part in accounting for the much shorter lengths of stay in Kaiser.

Two characteristics of the Kaiser model—one internal, one external—enable care to be delivered in this way. The internal characteristic is the leadership provided by Permanente physicians in developing and supporting this model of care.⁴ The external characteristic is the market environment in which Kaiser operates. The ever present threat of members leaving the health plan means that Kaiser must be responsive to its membership by offering accessible services to a high standard and at a reasonable cost.⁵

Differences between Kaiser and the NHS

Three differences between the NHS and Kaiser may affect the transferability of aspects of the Kaiser model. Firstly, as Feachem and colleagues reported, Kaiser has considerably more specialists per 100 000 population than the NHS—for example, twice the concentration of gynaecologists and three times the concentration of cardiologists. It is likely that the availability of extra specialists contributes to the differences we have observed. One hypothesis would be that there is a substitution effect between beds and staff, with the NHS having to make greater use of beds because it employs fewer doctors.

Secondly, the opportunities for private practice for hospital specialists in the NHS, and the independent contractor status of general practitioners, mean that the incentives facing doctors are different from those in Kaiser. In Kaiser there is a strong sense that doctors and the health plan are working to a common purpose and that doctors have a commitment to the success of the organisation.

Thirdly, the NHS is a universal service, but Kaiser is not. By focusing on the population aged 65 and over, who in the United States are all covered by Medicare, and by standardising the data on utilisation by age bands, we have sought to control for differences in population characteristics. Despite this, the comparison may still not be on a like for like basis because of evidence that older people enrolled in managed care plans use fewer resources than those served by fee for service schemes.⁶

Conclusion

The data we have analysed confirm that there is scope for acute hospital beds to be used differently in the NHS.⁷ Specifically, the NHS can learn from Kaiser's approach by developing closer integration between primary and secondary care, making use of intermediate care, focusing on chronic diseases and their effective management, and giving priority to self care and the use of patients and families as co-providers. The NHS can also learn from Kaiser's experience of engaging doctors in developing and supporting an integrated model of care.

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- 1 Feachem RGA, Sekhri N, White K. Getting more for their dollar: a comparison of the NHS and California's Kaiser Permanente. *BMJ* 2002;324:135-43.
- 2 *Hospital episode statistics 2000-2001*. London: Department of Health, 2001.
- 3 Audit Commission. *Lying in wait: the use of medical beds in acute hospitals*. London: HMSO, 1992.
- 4 Crosson FJ. Kaiser Permanente: a propensity for partnership. *BMJ* 2003;326:654.
- 5 Enthoven AC. Competition made them do it [commentary]. *BMJ* 2002;324:143.
- 6 Hellinger FJ, Wong HS. Selection bias in HMOs: a review of the evidence. *Med Care Res Rev* 2000;57:405-39.
- 7 Goddard M, McDonagh M, Smith D. Avoidable use of beds and cost-effectiveness of care in alternative locations. In: Department of Health. *Shaping the future NHS: long term planning for hospitals and related services*. London: Department of Health, 2000:96-101. www.doh.gov.uk/pub/docs/doh/nationalbedsanalysis.pdf (accessed 21 Oct 2003).

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