The Impact of a Primary Care Physician Cooperative on the Caseload of an Emergency Department: The Maastricht Integrated Out-of-Hours Service

Caro J.T. van Uden, MSc,^{1,2} Ron A.G. Winkens, MD, PhD,^{1,2} Geertjan Wesseling, MD, PhD,^{1,3} Hans F.B.M. Fiolet, MD, PhD,¹ Onno C.P. van Schayck, PhD,² Harry F.J.M. Crebolder, MD, PhD^{1,2}

¹Department of Integrated Care, Research Institute Caphri, University Hospital Maastricht, Maastricht, The Netherlands; ²Department of General Practice, Research Institute Caphri, Maastricht University, Maastricht, The Netherlands; ³Department of Respiratory Diseases, Research Institute Caphri, University Hospital Maastricht, Maastricht, The Netherlands.

OBJECTIVE: To determine the effect of an out-of-hours primary care physician (PCP) cooperative on the caseload at the emergency department (ED) and to study characteristics of patients utilizing out-of-hours care.

DESIGN: A pre-post intervention design was used. During a 3-week period before and a 3-week period after establishing the PCP cooperative, all patient records with out-of-hours primary and emergency care were analyzed.

SETTING: Primary care in Maastricht (the Netherlands) is delivered by 59 PCPs. Primary care physicians formerly organized out-of-hours care in small locum groups. In January 2000, out-of-hours primary care was reorganized, and a PCP cooperative was established. This cooperative is located at the ED of the University Hospital Maastricht, the city's only hospital, which has no emergency medicine specialists.

MAIN OUTCOME MEASURES: The number of patients utilizing out-of-hours care, their age and sex, diagnoses, post-ED care, and serious adverse events.

RESULTS. After establishing the PCP cooperative, the proportion of patients utilizing emergency care decreased by 53%, and the proportion of patients utilizing primary care increased by 25%. The shift was the largest for patients with musculoskeletal disorders or skin problems. There were fewer hospital admissions, and fewer subsequent referrals to the patient's own PCP and medical specialists. No substantial change in new outpatient visits at the hospital or in mortality occurred.

CONCLUSIONS: In the city of Maastricht, the Netherlands, the PCP cooperative reduced the use of hospital emergency care during out-of-hours care.

KEY WORDS: primary care; emergency medicine; gatekeeping; after-hours care.

DOI: 10.1111/j.1525-1497.2005.0091.x

J GEN INTERN MED 2005; 20:612-617.

Primary care gatekeeping in the Netherlands, as in the UK,¹ is less controversial than in the United States. Whereas in the United States only about 40% of the population has a primary care physician (PCP) who acts as a gatekeeper to specialist care,² in the Dutch health care system all patients are required to have a referral from their PCP to utilize hospital services.³ However, for an emergency department (ED) visit in the Netherlands, a referral is not strictly needed. Many patients skip the PCP and attend the ED without referral.³ In Maastricht (the Netherlands), over 50% of all ED visitors were

self-referred. Increasing numbers of self-referrals and the lack of inpatient beds can cause overcrowding at EDs.⁴⁻⁸

Many patients present with non-urgent or minor primary care problems at the ED.^{7,9} Initiatives to deal with this problem were employing PCPs in EDs, establishing a separate stream for minor injuries, or directing patients with non-acute conditions to next-day care.¹⁰⁻¹⁶ Such initiatives did not focus exclusively on out-of-hours care.

Primary care physicians in the Netherlands have a 24-hour care responsibility to their patients. To deliver out-of-hours care, Dutch PCPs organized themselves in locum groups, establishing an out-of-hours coverage system.¹⁷ Recently, out-of-hours care in the Netherlands was reorganized into larger PCP cooperatives, similar to the British and Danish initiatives.^{17,18} An important motive for this change was the PCP's dissatisfaction with the high and increasing workload (out-of-hours care combined with regular work), and poor separation between work and private life.

Usually 40 to 120 full-time PCPs participate in these cooperatives, providing care for 80,000 to 300,000 patients. Currently, there are over 120 PCP cooperatives in the Netherlands providing out-of-hours primary care for approximately 90% of the Dutch population. By and large, the cooperatives are either situated at a central and easily accessible place at some distance from a hospital, or are located within or adjacent to a hospital.

In Maastricht, the PCP cooperative aims to decrease the number of self-referrals to the ED and to reduce the PCP's dissatisfaction with the former out-of-hours care system. To that end, the Maastricht PCP cooperative was set up within the ED of the University Hospital Maastricht. Most other out-of-hours services—in the UK, Denmark, and in the Netherlands—work independently of the local hospital and do not provide an explicit gatekeeper function to specialist care. The current organization of out-of-hours care in Maastricht forces patients attending the ED without referral to be seen first by a PCP. When necessary, the PCP refers the patient to the ED. Because of this emphasis on the PCP's gatekeeper function, we expected a shift from ED services to primary care services for minor or non-urgent problems.

We assessed the effect of out-of-hours care in the city of Maastricht before and after the reorganization of the PCP's out-of-hours care.

METHODS

Setting

Maastricht is a city in the south of the Netherlands with a population of approximately 120,000 inhabitants. Out-of-hours

Accepted for publication December 15, 2004

None of the authors has any conflict of interest relevant to this manuscript or the data.

Address correspondence and reprint requests to Dr. van Uden: Department of Integrated Care (Bze7), University Hospital Maastricht, P. Debyelaan 25, P.O. Box 5800, 6202 AZ Maastricht, The Netherlands (e-mail: Caro.vanUden@hag.unimaas.nl).

service is delivered by 59 PCPs. Before the reorganization, the 59 PCPs were organized into 8 locum groups, delivering out-of-hours care separate from the ED. One PCP was on call per locum group. Consequently, each full-time PCP had approximately 944 on-call hours per year. In the new situation with PCP cooperatives, this is reduced to 298 hours (70% reduction) for out-of-hours care, because fewer PCPs are on call for the same population. Apart from telephone contacts and consultations at the practice or at the cooperative, the Dutch PCP also makes home visits.

The Maastricht PCP cooperative was established in January 2000. Every evening and night, and during the weekends, 2 to 3 PCPs are present at the cooperative depending on the time of day. Specially equipped chauffeured cars are available for home visits. Until 11 PM a practice nurse is present at the cooperative, and after 11 PM, 1 nurse from the ED supports the PCPs. Patients have free access to the PCP cooperative and can come without making an appointment or phone call.

The public was informed about the out-of-hours care reorganization by posters at their own PCP's practice and by the PCP's answering-machine service. Patients were encouraged to use out-of-hours services only if they could not wait until the next day to consult their own PCP. There were no economic incentives for any particular behavior.

The University Hospital Maastricht is the only hospital in Maastricht, and its ED the only ED. The ED is staffed by 4 to 6 emergency nurses and 1 surgical or orthopedic resident. There are no separate emergency medicine specialists. For out-of-hours care, there is always at least 1 medical specialist per specialty present at the hospital or on call. From 1993 to 1998 the total number of patients attending the ED increased from 22,248 to 27,358. The out-of-hours census increased from 12,976 patients in 1993 to 16,125 in 1998.

The most distinctive feature of the new organization of out-of-hours care in Maastricht is that all patients attending the ED during out-of-hours without a referral are first screened by a PCP or the practice nurse. Screening of these patients is performed based on the triage system developed by the Dutch College of General Practitioners. The triage system is not yet validated, but is considered a *best practice* guideline. With this system, the urgency of the patient's complaint is divided into 4 categories, from not urgent to highly urgent. PCPs are responsible for adequate triaging of these patients. Severe traumas and other severe conditions such as myocardial infarction or acute stroke are classified as highly urgent and immediately directed to a medical specialist. Patients with cardiac problems are referred to an existing fast track cardiac care system. In 1998, the number of attendances at this emergency cardiac care unit was 4,925, and in 2001, 5,464 contacts were registered. Conditions with a lower urgency

category are examined and, if necessary, treated by the PCP. Ambulances also bypass the PCP cooperative.

About 60% of the Dutch population is compulsorily insured with public health insurance funds. The government determines the cover provided and the income-linked contribution. People with higher incomes need private insurance. PCPs are paid by capitation for treatment of patients who participate in public health insurance funds, and by fee-for-service for treatment of those with private insurance.

Data collection

To detect changes in the number and characteristics of patients utilizing out-of-hours care before and after establishing the PCP cooperative, we used a pre-post design. All patient contact registration forms, with respect to the PCP and the ED, during 3 weeks (January 15 to February 9) in 1998, and 3 weeks (March 5 to March 26) in 2001 were analyzed. Data included patient's age and sex, type of consultation (telephone advice, consultation at the PCP's practice or cooperative, and home visit), and reason for encounter. With respect to the ED records, data included patient's age and sex, type of referral, post-ED care, and reason for encounter. Diagnostic information on the patient registration forms was coded by the researcher (C.v.U.) according to the chapters of the International Classification of Primary Care (ICPC).¹⁹ In case of doubt, an experienced PCP (H.C.) was consulted. Coding medical complaints by ICPC is considered reliable and valid.²⁰ Only patients from Maastricht city were included, on the basis of postal codes.

To detect serious adverse events, we analyzed all new hospital outpatient visits and the number of deaths in Maastricht from the hospital's annual reports and the Central Database of Statistics Netherlands from 1998 to 2001 (2 years before and 2 years after setting up the PCP cooperative).

The study was ruled exempt from review by the Institutional Medical Ethics Board.

Statistics

We used Pearson χ^2 tests to test for proportional differences, and the level of significance was set at .05.

RESULTS

Table 1 lists the out-of-hours patient visits to the PCP and the ED during the 2 study periods. After setting up the PCP cooperative, the proportion of patients utilizing out-of-hours emergency care decreased by 52.6%, whereas the proportion of patients utilizing out-of-hours primary care increased (+25.0%) ($P < .001$).

Table 1. Contact Rate with Out-of-Hours Care During the 3-Week Data Collection Periods

Number of Contacts*	Before the Establishment of the PCP Cooperative (1998)		After the Establishment of the PCP Cooperative (2001)		Absolute Change
	N	% (95% CI)	N	% (95% CI)	N (%)
Primary care	1,592	72.4 (70.5–74.3)	1,990	87.4 (86.0–88.7)	+398 (25.0)
Emergency care	607	27.6 (25.7–29.5)	288	12.6 (11.3–14.0)	–319 (–52.6)
Total	2,199	100.0	2,278	100.0	+79 (3.6)

*Significantly different distribution of patients utilizing primary or emergency care (Chi-square test: $\chi^2_{1\text{ df}} = 223.06$; $P < .001$). PCP, primary care physician; CI, confidence interval.

Table 2. Characteristics of Patients Utilizing Primary and Emergency Care During Out-of-Hours

	Primary Care Physician				Emergency Department			
	1998		2001		1998		2001	
	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)
Diagnoses*								
Musculoskeletal or skin	295	20.4 (18.3–22.5)	665	34.6 (32.5–36.7)	312	57.0 (52.9–61.2)	125	44.0 (38.2–49.8)
Respiratory tract	259	17.9 (15.9–19.9)	288	15.0 (13.4–16.6)	29	5.3 (3.4–7.2)	28	9.9 (6.4–13.3)
Digestive tract	234	16.2 (14.3–18.1)	250	13.0 (11.5–14.5)	54	9.9 (7.4–12.4)	31	10.9 (7.3–14.5)
Others	659	45.5 (43.0–48.1)	719	37.4 (35.2–39.6)	152	27.8 (24.0–31.5)	100	35.2 (29.7–40.8)
Total	1447	100.0	1922	100.0	547	100.0	284	100.0
Missing	145	9.1	68	3.4	60	9.9	4	1.4
*Chi-square test: $\chi^2_{1\text{ df}}=81.941$; $P<.001$					*Chi-square test: $\chi^2_{1\text{ df}}=15.287$; $P=.002$			
Gender*								
Male	601	42.0 (39.4–44.5)	927	46.6 (44.4–48.8)	336	55.6 (51.7–59.6)	160	55.6 (49.8–61.3)
Female	831	58.0 (55.5–60.6)	1062	53.4 (51.2–55.6)	268	44.4 (40.4–48.3)	128	44.4 (38.7–50.2)
Total	1432	100.0	1989	100.0	604	100.0	288	100.0
Missing	160	10.1	1	0.1	3	0.5	–	–
*Chi-square test: $\chi^2_{1\text{ df}}=7.243$; $P=.007$					*Chi-square test: NS			
Age (y)*								
0–10	362	27.7 (25.2–30.1)	365	18.3 (16.6–20.0)	86	14.2 (11.4–16.9)	31	10.8 (7.2–14.3)
11–50	581	44.4 (41.7–47.1)	1009	50.7 (48.5–52.9)	347	57.2 (53.2–61.1)	129	44.8 (39.0–50.5)
>50	366	28.0 (25.5–30.4)	616	31.0 (28.9–33.0)	174	28.7 (25.1–32.3)	128	44.4 (38.7–50.2)
Total	1309	100.0	1990	100.0	607	100.0	288	100.0
Missing	283	17.8	–	–	–	–	–	–
*Chi-square test: $\chi^2_{1\text{ df}}=39.996$; $P<.001$					*Chi-square test: $\chi^2_{1\text{ df}}=21.768$; $P<.001$			

CI, confidence interval.

Patients with musculoskeletal or skin problems were, in particular, responsible for this shift. The proportion of this patient group seen by the PCP increased by 125% ($\chi^2=81.84$; $P<.001$), whereas the proportion utilizing emergency care decreased by 60% ($\chi^2=12.72$; $P<.001$) (Table 2). ED data from 1998 showed that, of all patients with musculoskeletal or skin problems utilizing out-of-hours care, 84% were self-referred.

The overall referral rates to the ED during out-of-hours changed substantially after the establishment of the PCP's cooperative (Table 3). The number of self-referrals reduced

significantly, and the number of referrals by PCPs to the ED increased by approximately 45%.

With respect to patients utilizing out-of-hours emergency care after the reorganization, there was an absolute reduction of 39 hospital admissions, indicating a decrease of 34%. Furthermore, the number of patients not receiving any post-ED care dropped by 91%: from 256 patients in 1998 to 22 in the year 2001.

In 1998, PCPs handled a substantial number of health problems during out-of-hours by telephone. However, in 2001,

Table 3. Referrals to the Emergency Department (ED) and Care After Utilizing Emergency Care

	1998		2001		Absolute Change n (%)
	N	% (95% CI)	N	% (95% CI)	
Referral to the emergency department*					
Self	392	67.9 (64.1–71.7)	44 [†]	16.4 (11.9–20.8)	– 348 (– 88.8)
GP	109	18.9 (15.7–22.1)	158	58.7 (52.9–64.6)	+ 49 (45.0)
Ambulance	58	10.1 (7.6–12.5)	51	19.0 (14.3–23.6)	– 7 (12.1)
Other	18	3.1 (1.7–4.5)	16	5.9 (3.1–8.8)	– 2 (11.1)
Total	577	100.0	269	100.0	
Missing	30	4.9	19	6.6	
*Chi-square test: $\chi^2_{1\text{ df}}=201.957$; $P<.001$					
Post-ED care*					
Hospital admission	114	20.0 (16.7–23.3)	75	32.2 (26.2–38.2)	– 39 (34.2)
GP	53	9.3 (6.9–11.7)	22	9.4 (5.7–13.2)	– 31 (58.5)
Outpatient clinic	142	25.0 (21.4–28.5)	113	48.5 (42.1–54.9)	– 29 (20.4)
Elsewhere	4	0.7 (0–1.4)	1	0.4 (0–1.3)	– 3 (75.0)
None	256	45.0 (40.9–49.1)	22	9.4 (5.7–13.2)	– 234 (91.4)
Total	569	100.0	233	100.0	
Missing	38	6.3	55	19.1	
*Chi-square test: $\chi^2_{1\text{ df}}=99.645$; $P<.001$					

[†]These patients have been directed to the emergency doctor without formal referral, because they suffered severe injuries and needed to be treated immediately.

CI, confidence interval.

Table 4. Type of Consultation Performed by Primary Care Physicians During Out-of-Hours

Type of Consultation*	1998		2001	
	N	% (95% CI)	N	% (95% CI)
Telephone advice	730	48.2 (45.7–50.7)	360	18.4 (16.7–20.1)
Consult at practice or cooperative	496	32.8 (30.4–35.1)	1,431	73.1 (72.1–75.1)
Home visit	288	19.0 (17.0–21.0)	166	8.5 (7.2–9.7)
Total	1,514	100.0	1,957	100.0
Missing	78	4.9	33	1.7

*Chi-square test: $\chi^2_{df=564.71}$; $P < .001$.

CI, confidence interval.

the number of telephone consults halved, and the number of consultations at the PCP's office almost tripled (Table 4). Also, fewer home visits were made by the PCP.

In out-of-hours care, the PCP is confronted with 4 main categories of diagnoses: digestive problems, musculoskeletal problems, respiratory problems, and problems related to the skin and subcutaneous tissue (Table 2). Another large category is general and unspecified diagnoses (about 10% of all cases). At the ED in 1998, the 2 largest medical categories were musculoskeletal and skin problems. These numbers reduced substantially after the establishment of the PCP cooperative.

In 1998, a total of 76,088 new outpatient visits were registered (during office hours). In 1999, there were 78,726 new outpatient visits. In the first year of the PCP cooperative, the total number of new outpatient visits decreased to 74,633. In 2001, this number hardly changed compared with the year 2000: 74,668 new outpatient visits. Annual numbers of death rates in Maastricht showed no significant changes after the setting up of the PCP cooperative. In 1998, 1,239 people died in Maastricht; in 1999, 1,217; in 2000, 1,268; and in 2001, 1,278. The population of Maastricht increased from 120,179 in 1998 to 122,163 in 2001.

DISCUSSION

This study showed a major shift in patient flow, from emergency care to primary care, after the establishment of the PCP cooperative integrated with the ED.

Although for practical reasons we could not involve a control situation, it is unlikely that the observed shift in patient flow has been caused by any other factor than the PCP's out-of-hours reorganization. No other substantial change has occurred in the health care system in Maastricht between 1998 and 2001. The data collection periods were only 3 weeks long and were performed in different months. Annual reports of the PCP cooperative and ED, however, showed little fluctuation in numbers of patients between January/February and March. In addition, a possible confounding because of seasonal changes, particularly with influenza, is unlikely because we found no changes in the number of respiratory diseases. The observed changes are large enough to assume that they have not been altered by short or different data collection periods. The total number of patient contacts analyzed in this study is comparable with those in similar studies.^{13,14} Missing values in this study are considered random because they were mainly caused by poor handwriting on patient records.

In our study, we used 2 indirect measures of health outcome: deaths and new outpatient visits at the city's only hospital. Although these measures are rather crude and do not supply us with direct information about the patient's health status, they give some insight into the occurrence of serious adverse events. Besides, the Dutch PCP is trained to be a gatekeeper to secondary care and is well equipped to decide whether a patient can be treated in primary care or should be referred to specialty care.

The absence of specialists for emergency medicine in the Netherlands does not affect the potential role of a PCP cooperative in relation to the ED, as the PCP can still act as gatekeeper to the ED. At the time that PCPs were considering reorganizing their out-of-hours service, the ED suffered from overcrowding, mainly caused by self-referred patients. Therefore, the integration of primary and hospital care during out-of-hours, while keeping professional autonomy, was no more than a logic step.

Several authors have reported inappropriate ED use. Depending on setting and health care system, studies have identified a substantial number of ED attendees, ranging from 17% to 57% as primary care patients.^{7,9,12,14} The results of our study showed a 53% reduction of patients utilizing emergency care during out-of-hours. This suggests that about half of all attendees at the ED have minor problems that a PCP can solve. In the literature, various other initiatives have been described to deal with this substantial number of primary care patients at the ED.^{10–16} These initiatives reduced waiting times,¹⁰ number of investigations,^{13,14} number of referrals,^{13,14} and hospital follow-up care or admissions.^{12,14} In addition, health outcome was comparable with primary care patients at the ED treated by emergency staff.^{13,14} Our study showed comparable results with respect to reduced post-ED care, expressed by reduced admission rates and fewer subsequent referrals to the patient's own PCP and medical specialists. A reason for this reduction might be the result of the way PCPs function as gatekeeper in the out-of-hours setting.²¹

The current study differs from other studies on primary care patients at the ED on some points.^{10–14} First, in contrast to other studies that employed PCPs in the ED, this study focused exclusively on out-of-hours care. Second, the PCPs were not employed in the hospital's ED, but operated completely independently. Third, but most important, there was no primary care facility open to patients during out-of-hours other than the one located at the ED. Therefore, this study gives a good insight into all patient contacts with out-of-hours care in the city of Maastricht.

The total number of patient contacts with out-of-hours care increased slightly by 3.6% from 1998 to 2001. This

indicates an increase of no more than 1.2% per year. Considering the steady increase of about 4% per year in the number of patient contacts with the ED before the setting up of the PCP cooperative, and the increase in the Maastricht population (approximately 0.5% per year), we conclude that there was no significant increased demand or usage of out-of-hours care.

This study did not include a cost analysis. However, based on the reduced production at the ED, the regional Health Insurance Fund has cut the hospital's annual budget by about \$1.73 million US dollars. This amount is roughly balanced by the costs of the PCP cooperative, which are about \$1.58 million US dollars. More specific cost analysis will need to be performed to supply detailed information on health care costs in the Maastricht situation. In addition, other studies have shown reduced health care costs with PCPs working at EDs.^{13,14,22}

The overcrowding at the ED, caused by patients with non-urgent health problems, has attracted worldwide attention. Considering the many patients with non-urgent problems utilizing emergency care, it is clear that there is a role for PCPs in the spectrum of emergency care. When the goal is to reduce inappropriate use of hospital emergency care, a close collaboration between primary and emergency care seems critical. Coleman et al.²³ showed that alternative services, separate from the hospital, offering first contact care for non-urgent health problems were likely to have little impact on the demand for emergency services. Therefore, it may be essential to create an integrated care facility in which the PCP acts as gatekeeper to secondary care. In addition, one of the biggest advantages of the Maastricht out-of-hours care is that the patient always receives adequate care at a single site. No critical time is lost traveling from the primary care cooperative to the ED because both services are at the same location. Moreover, continuity of care is guaranteed because, when patients have visited or contacted the PCP cooperative for out-of-hours care, the patient's own PCP receives a report the next day concerning this contact.

In the first year after the establishment of the PCP cooperative, a small survey was held among employees (emergency nurses, physicians, managers, and PCPs) and patients. The results showed that all interviewed people, including ED staff, PCPs, and patients, were satisfied with the current out-of-hours organization. The ED staff and physicians reported that they preferred the new out-of-hours organization compared with the former one (survey published only as internal report).

Ferris et al.²⁴ found little evidence of the beneficial effects of gatekeeping on secondary care. In contrast, other studies showed positive effects of primary care gatekeeping.^{25,26} During the 1990s, USA-managed care organizations rapidly introduced the primary care gatekeeping system, but they have recently begun to retreat from this system.¹ Although patients in the United States valued the PCP for first-contact and coordinating care, they seemed to be dissatisfied when they perceived that their PCP kept them from seeing a specialist.²⁷ Also, not all PCPs seem to be in favor of gatekeeping. However, some believe gatekeeping improves their role as care coordinators.²⁸ European countries with gatekeeping systems spent less on health care as a percentage of their gross national product than those allowing direct access to specialists.^{29,30} High referral rates to specialist care are considered one of the

contributing factors of the United States' exceptionally high health care expenditure.³¹

In conclusion, this study showed that a primary care cooperative for out-of-hours care located at the gate of the hospital can reduce the use of hospital emergency care, and provides the PCP with an important coordinative role within the health care system, complementing the ED in the provision of out-of-hours care.

This study was financially supported by a grant from the Dutch Health Insurance Board (registered as VAZ/CVZ project no. 00103) and by AstraZeneca.

REFERENCES

1. Bindman AB, Majeed A. Primary care in the United States: organisation of primary care in the United States. *BMJ*. 2003;326:631-4.
2. St. Peter RF. Gatekeeping arrangements are in widespread use. *Data Bull (Cent Stud Health Syst Change)*. 1997;7:1-2.
3. Kulu-Glasgow I, Delnoij D, de Bakker D. Self-referral in a gatekeeping system: patients' reasons for skipping the general-practitioner. *Health Policy*. 1998;45:221-38.
4. Schneider SM, Gallery ME, Schafermeyer R, Zwemer FL. Emergency department crowding: a point in time. *Ann Emerg Med*. 2003;42:167-72.
5. Derlet R, Richards J, Kravitz R. Frequent overcrowding in U.S. emergency departments. *Acad Emerg Med*. 2001;8:151-5.
6. Shah NM, Shah MA, Behbehani J. Predictors of non-urgent utilization of hospital emergency services in Kuwait. *Soc Sci Med*. 1996;42:1313-23.
7. Lee A, Lau FL, Hazlett CB, et al. Factors associated with non-urgent utilization of accident and emergency services: a case-control study in Hong Kong. *Soc Sci Med*. 2000;51:1075-85.
8. Fatovich DM. Emergency medicine. *BMJ*. 2002;324:958-62.
9. Dale J, Green J, Reid F, Glucksman E. Primary care in the accident and emergency department. I: Prospective identification of patients. *BMJ*. 1995;311:423-6.
10. Cooke MW, Wilson S, Pearson S. The effect of a separate stream for minor injuries on accident and emergency department waiting times. *Emerg Med J*. 2002;19:28-30.
11. Freeman GK, Meakin RP, Lawrenson RA, Leydon GM, Craig G. Primary care units in A&E departments in North Thames in the 1990s: initial experience and future implications. *Br J Gen Pract*. 1999;49:107-10.
12. Ward P, Huddy J, Hargreaves S, Touquet R, Hurley J, Fothergill J. Primary care in London: an evaluation of general practitioners working in an inner city accident and emergency department. *J Accid Emerg Med*. 1996;13:11-5.
13. Dale J, Green J, Reid F, Glucksman E, Higgs R. Primary care in the accident and emergency department. II: Comparison of general practitioners and hospital doctors. *BMJ*. 1995;311:427-30.
14. Murphy AW, Bury G, Plunkett PK, et al. Randomised controlled trial of general practitioner versus usual medical care in an urban accident and emergency department: process, outcome, and comparative cost. *BMJ*. 1996;312:1135-42.
15. Washington DL, Stevens CD, Shekelle PG, Baker DW, Fink A, Brook RH. Safely directing patients to appropriate levels of care: guideline-driven triage in the emergency service. *Ann Emerg Med*. 2000;36:15-22.
16. Washington DL, Stevens CD, Shekelle PG, Henneman PL, Brook RH. Next-day care for emergency department users with nonacute conditions. A randomized, controlled trial. *Ann Intern Med*. 2002;137:707-14.
17. Hallam L. Primary medical care outside normal working hours: review of published work. *BMJ*. 1994;308:249-53.
18. Olesen F, Jolleys JV. Out of hours service: the Danish solution examined. *BMJ*. 1994;309:1624-6.
19. Lamberts H, Wood M, eds. *International Classification of Primary Care*. Oxford: Oxford University Press; 1987.
20. Britt H, Angelis M, Harris E. The reliability and validity of doctor-recorded morbidity data in active data collection systems. *Scand J Prim Health Care*. 1998;16:50-5.
21. Starfield B. Is primary care essential? *Lancet*. 1994;344:1129-33.
22. Dale J, Lang H, Roberts JA, Green J, Glucksman E. Cost effectiveness of treating primary care patients in accident and emergency: a compar-

- ison between general practitioners, senior house officers, and registrars. *BMJ*. 1996;312:1340-4.
23. **Coleman P, Irons R, Nicholl J.** Will alternative immediate care services reduce demands for non-urgent treatment at accident and emergency? *Emerg Med J*. 2001;18:482-7.
24. **Ferris TG, Chang Y, Blumenthal D, Pearson SD.** Leaving gatekeeping behind—effects of opening access to specialists for adults in a health maintenance organization. *N Engl J Med*. 2001;345:1312-7.
25. **Schillinger D, Bibbins-Domingo K, Vranizan K, Bacchetti P, Luce JM, Bindman AB.** Effects of primary care coordination on public hospital patients. *J Gen Intern Med*. 2000;15:329-36.
26. **Rask KJ, Deaton C, Culler SD, et al.** The effect of primary care gatekeepers on the management of patients with chest pain. *Am J Manag Care*. 1999;5:1274-82.
27. **Grumbach K, Selby JV, Damberg C, et al.** Resolving the gatekeeper conundrum: what patients value in primary care and referrals to specialists. *JAMA*. 1999;282:261-6.
28. **Halm EA, Causino N, Blumenthal D.** Is gatekeeping better than traditional care? A survey of physicians' attitudes. *JAMA*. 1997;278:1677-81.
29. **Boerma WG, van der Zee J, Fleming DM.** Service profiles of general practitioners in Europe. European GP Task Profile Study. *Br J Gen Pract*. 1997;47:481-6.
30. **Anderson GF, Hurst J, Hussey PS, Jee-Hughes M.** Health spending and outcomes: trends in OECD countries, 1960-1998. *Health Aff (Millwood)*. 2000;19:150-7.
31. **Forrest CB.** Primary care in the United States: primary care gatekeeping and referrals: effective filter or failed experiment? *BMJ*. 2003;326:692-5.