Cost-Sharing for Emergency Care and Unfavorable Clinical Events: Findings from the Safety and Financial Ramifications of ED Copayments Study

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Objective. To evaluate the effect of emergency department (ED) copayment levels on ED use and unfavorable clinical events.

Data Source/Study Setting. Kaiser Permanente–Northern California (KPNC), a prepaid integrated delivery system.

Study Design. In a quasi-experimental longitudinal study with concurrent controls, we estimated rates of ED visits, hospitalizations, ICU admissions, and deaths associated with higher ED copayments relative to no copayment, using Poisson random effects and proportional hazard models, controlling for patient characteristics. The study period began in January 1999; more than half of the population experienced an employer-chosen increase in their ED copayment in January 2000.

Data Collection/Extraction Methods. Using KPNC automated databases, the 2000 U.S. Census, and California state death certificates, we collected data on ED visits and unfavorable clinical events over a 36-month period (January 1999 through December 2001) among 2,257,445 commercially insured and 261,091 Medicare insured health system members.

Principal Findings. Among commercially insured subjects, ED visits decreased 12 percent with the \$20–35 copayment (95 percent confidence interval [CI]: 11–13 percent), and 23 percent with the \$50–100 copayment (95 percent CI: 23–24 percent) compared with no copayment. Hospitalizations, ICU admissions, and deaths did not increase with copayments. Hospitalizations decreased 4 percent (95 percent CI: 2–6 percent) and 10 percent (95 percent CI: 7–13 percent) with ED copayments of \$20–35 and \$50–100, respectively, compared with no copayment. Among Medicare subjects, ED visits decreased by 4 percent (95 percent CI: 3–6 percent) with the \$20–50 copayments compared with no copayment; unfavorable clinical events did not increase with copayments, e.g., hospitalizations were unchanged (95 percent CI: –3 percent to +2 percent) with \$20–50 ED copayments compared with no copayment.

Conclusions. Relatively modest levels of patient cost-sharing for ED care decreased ED visit rates without increasing the rate of unfavorable clinical events.

Key Words. Access/demand/utilization of services, observational data/quasi-experiments, health care financing/insurance/premiums, incentives in health care

Patients in the United States are paying more for their health care, in part through additional or higher copayments. This increased cost-sharing could improve efficiency if patients reduce unnecessary use of resources, but also could result in worse health if patients avoid necessary care (Phelps 1992; Rubin and Mendelson 1995; Zweifel and Manning 2000). Currently, we have limited information on whether cost-sharing has harmful clinical effects.

Studies including the RAND Health Insurance Experiment (HIE) have found that cost-sharing reduces both health care use and expenditures (O'Grady et al. 1985; Newhouse and The Insurance Experiment Group 1993; Selby, Fireman, and Swain 1996). Previous work by members of our team found that emergency department (ED) copayments reduced ED visits and expenditures, and appeared to decrease ED visits for low severity diagnoses preferentially (O'Grady et al. 1985; Selby et al. 1996). These and other studies also had limited ability to detect possible changes in unfavorable clinical events associated with ED care (i.e., adverse effects of ED cost-sharing resulting from delayed or avoided ED visits), given the large population sizes needed to assess changes in these typically rare events (Keeler et al. 1985; Lohr et al. 1986; Shapiro, Ware, and Sherbourne 1986; Lurie et al. 1989; Solanki, Schaffler, and Miller 2000; Wong et al. 2001). There is, however, substantial evidence of poor health outcomes associated with being uninsured, which represents an extreme version of cost-sharing (Weissman, Gatsonis, and Epstein 1992; Ayanian et al. 1993; Braveman et al. 1994; Blustein 1995; Baker et al. 2001; Institute of Medicine 2001; McWilliams et al. 2003).

We evaluated whether the amount of cost-sharing for emergency care decreased ED visits, and whether there was any association between the cost-sharing amount and unfavorable clinical event rates within a 2.7 million member, integrated delivery system (IDS). In this manuscript, we report on

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the impact of the ED copayment level on ED visits, hospitalizations, ICU admissions, and deaths between 1999 and 2001 for populations with Medicare and with commercial insurance. In this natural experiment, over half of each population experienced an increase in their ED copayments on January 1, 2000, and 13–21 percent of each population experienced another increase on January 1, 2001.

METHODS

Natural Experiment

Kaiser Permanente–Northern California (KPNC) is a prepaid IDS providing comprehensive medical care in 19 medical centers. During the study period (1999–2001), the IDS increased the use and size of ED copayments at the request of some employers to stem premium growth, but not all employers sought plans with copayments or with copayment increases. Importantly, individual employees of a given employer who chose Kaiser insurance could not self-select their copayment level. Members with Medicare insurance could have had either employer-supplemented traditional Medicare or Medicare + Choice. When employers supplemented Medicare, copayment levels often were identical to the generally lower levels of active employees.

In addition to any employer announcements, the IDS sent all members copayment information in routine annual mailings. The IDS also waived ED copayments for patients admitted to the hospital; members who were charged with a copayment could pay immediately or receive a mailed bill.

Population

The study population included all persons with either commercial or Medicare insurance who were IDS members in January 1999, except members who regularly received part of their care outside the IDS (5.5 percent), and members age < 1 year (1.2 percent) (Selby et al. 1996). We excluded members with Medicaid (1.9 percent) because they did not have copayments. We excluded IDS employees (0.9 percent) because they could self-select their copayment level and subjects who changed insurance-type (e.g., commercial to Medicare) during the study (1.7 percent).

Study Design and Predictor Measures

We used a quasi-experimental design with concurrent controls to evaluate ED copayment effects on both ED use and on clinical event measures that might

reflect inappropriate delay or underuse of the ED. We examined the overall clinical effects of copayments on the study population, with supplemental analyses exploring copayment effects in two time-sensitive sentinel diagnoses. For commercially insured subjects, we classified all available ED copayments into five mutually exclusive groups: \$0, \$1–5, \$10–15, \$20–35, and \$50–\$100 copayment per visit. For the smaller number of Medicare subjects, we used three groups: \$0, \$1–15, and \$20–50 copayment per visit. There were no other forms of ED cost-sharing during the study period. Although most benefit changes occurred on January 1, 13 percent of subjects had changes at other points of the year, thus we treated copayments as a monthly time-changing variable. The IDS's automated clinical databases, 2000 U.S. Census, and California state death certificates provided the study information. The Kaiser Foundation Research Institute institutional review board approved the study.

Outcome Events: ED Visits, Hospitalizations, ICU Admissions, and Deaths

We collected data on ED visits and three types of unfavorable clinical events for each month the subject was enrolled in the IDS over the 36-month study period. We examined the association between copayments and overall ED visit rates. To assess possible adverse effects of copayments, we examined nonelective hospitalization, ICU admission, and mortality events during the 3-year study period.

We included hospitalizations and deaths occurring both inside and outside the system. For out-of-system hospitalizations, we used the IDS's claims databases; for out-of-system deaths, we searched the California State death certificate databases. For ICU admissions, we focused only on in-system events, given the limited details in the claims databases. These databases have been very accurate in previous studies, e.g., 100 percent for the occurrence of a hospitalization and 98 percent for a discharge diagnosis of myocardial infarction (Selby and Zhang 1995; Selby 1996). During the study, 13 percent of ED visits and 7 percent of hospitalizations occurred outside the IDS; similarly, 14 percent of deaths were outside the IDS, i.e., deaths identified only in state death certificates. In addition to examining overall event rates, we also examined event rates for sentinel diagnoses for which there were measurable markers of greater disease severity: rupture for patients with appendicitis, and ICU admission for patients with pneumonia.

Covariates: Sociodemographic, Clinical, and System Measures

Using the U.S. 2000 Census block group, we created a low socioeconomic status (SES) neighborhood indicator, defined as ≥ 20 percent of residents having household incomes below the federal poverty level or ≥ 25 percent of residents ≥ 25 years old having less than a high-school education (Krieger 1992; Krieger and Gordon 1999). In addition to the previous validation studies using the same population as this study, this neighborhood measure was available for the entire population. We also included variables for age (nine categories), gender, having a regular primary care provider, and prior year's use of the ED, office, and hospital. We also used the 118 binary hierarchical condition category (HCC) indicators from the diagnostic cost group (DxCg) system, which has been adopted by the Centers for Medicare and Medicaid Services (CMS) for Medicare payment risk-adjustment; specifically, we used the prior year's HCC indicators for each patient, with yearly updates (Ash 2000; Zhao et al. 2001). Finally, we included members' prescription drug cost-sharing level and primary medical center within the IDS, again with yearly updates.

Statistical Analysis

We analyzed subjects with commercial and Medicare insurance separately; we also conducted additional analyses for subjects living in low SES neighborhoods. For each patient, we constructed monthly counts of ED visits, hospitalizations, and ICU admissions (overall and by diagnosis) for each of the 36 study-months that a subject was enrolled. Subjects could leave and rejoin the study as their membership status changed. We treated the copayment as a monthly time-varying covariate. To calculate unadjusted event rates, we divided events within each copayment level by the total person-years of exposure in the level; thus, subjects could contribute events and exposure to more than one copayment level. To estimate adjusted event relative rates (RR), we applied Poisson-regression analysis with γ -distributed patient random-effects to the patients' 36 repeated monthly event-counts (xtpoisson in Stata 8.2). This uses both cross-sectional and longitudinal information, and allows for patient-level random effects. We modeled secular trends with terms for year and month within year. We condensed the other covariates into a propensity score (Rubin 1997; Imbens 1999; Joffe and Rosenbaum 1999). The propensity score reduces potential bias resulting from the nonrandom distribution of covariates across the copayment categories, by balancing covariates across the copayment categories; this approach also substantially improved the computational efficiency of the statistical analyses. Specifically, we estimated the propensity to

be in each copayment level (five levels for commercial, three levels for Medicare) using the predicted probability from a multinomial logit model (\$0 copayment as the base category). We calculated the propensity score annually and centered each score on its annual mean to avoid confounding with secular trends; we included this annually centered propensity score as a continuous variable in the models. In sensitivity analyses, we also repeated all analyses without the propensity score, using either the DxCG score or chronic disease indicators (asthma, diabetes, heart failure, coronary artery disease, and hypertension) as comorbidity measures. We also repeated the analyses on members who experienced only a single copayment change (compared with no change), and on continuously enrolled members. All analyses yielded similar results.

To assess effects on mortality rates, we estimated hazard ratios using a Cox proportional hazards model with time-varying covariates. Similarly, we used a Cox model to assess the copayment effect on hospitalizations for appendicitis and for appendiceal rupture. We also assessed the odds of rupture given a hospitalization for appendicitis and the odds of an ICU admission given a hospitalization for pneumonia using a logistic regression model.

In addition to the ED copayments, subjects also faced a range of copayments for office visits, a plausible alternative to ED use. To evaluate the potential office copayment effects on ED visits, we examined the joint distribution of the two copayments. Subjects with ED copayments between \$0 and \$15 also paid the same amount for office visits, during all study years and for both types of insurance. In contrast, subjects with ED copayments of $\geq$ \$20 faced a range of associated, lesser office copayment amounts (\$0–15), i.e., an incentive for using office visits rather than the ED. We repeated the random-effects Poisson analyses using indicators for each of the copayment levels, and included additional terms to model the effect of varying office visit copayments among subjects with the \$20–35 and \$50–100 ED copayments.

Funding Source

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RESULTS

There were 2,257,445 commercially insured and 261,091 Medicare subjects in January 1999. Table 1 lists the baseline subject characteristics. Figure 1 shows

Table 1: Subject Baseline Characteristics (1999)

<i>Total</i>	<i>Commercial Insurance</i>		<i>Medicare Insurance</i>	
	<i>n = 2,257,445</i>	<i>(%)</i>	<i>n = 261,091</i>	<i>(%)</i>
Age (years)				
< 15	480,188	(21.3)	26	(0.0)
15–17	111,607	(4.9)	0	(0.0)
18–29	375,413	(16.6)	298	(0.1)
30–39	394,481	(17.5)	1,309	(0.5)
40–49	413,975	(18.3)	2,646	(1.0)
50–64	433,680	(19.2)	9,924	(3.8)
65–74	36,106	(1.6)	142,447	(54.6)
75–84	10,022	(0.4)	85,074	(32.6)
85+	1,973	(0.1)	19,367	(7.4)
Female	1,146,478	(50.8)	145,810	(55.8)
Low SES neighborhood in 1999	508,861	(22.5)	49,251	(18.9)
Regular primary care provider in 1999	1,600,968	(70.9)	245,550	(94.0)
Asthma in 1998	211,684	(9.4)	24,646	(9.4)
Diabetes in 1998	69,065	(3.1)	35,750	(13.7)
Heart failure in 1998	6,936	(0.3)	14,380	(5.5)
Coronary artery disease in 1998	25,194	(1.1)	36,600	(14.0)
Hypertension in 1998	177,524	(7.9)	118,204	(45.3)
ED visits in 1998				
None	1,947,136	(86.3)	194,327	(74.4)
1 visit	239,453	(10.6)	41,651	(16.0)
2+ visits	70,856	(3.1)	25,113	(9.6)
Office visits in 1998				
None	555,516	(24.6)	22,146	(8.5)
1 visit	367,332	(16.3)	16,963	(6.5)
2 visits	298,834	(13.2)	19,818	(7.6)
3 visits	230,207	(10.2)	21,549	(8.3)
4 visits	173,761	(7.7)	20,887	(8.0)
5+ visits	631,795	(28.0)	159,728	(61.2)
Hospitalizations in 1998				
None	2,222,704	(98.5)	237,142	(90.8)
1+	34,741	(1.5)	23,949	(9.2)
Drug copayments in 1999				
\$0–\$5	1,536,891	(68.1)	119,672	(45.8)
\$7–\$15	556,085	(24.6)	130,166	(49.9)
Drug coinsurance in 1999	164,469	(7.3)	11,253	(4.3)

This table reports the number and column percentages of subjects with each sociodemographic and clinical characteristic in the baseline year (1999), unless otherwise noted. We determined whether subjects lived in a low SES neighborhood, using 2000 U.S. Census indicator for a neighborhood (census block) with low average educational attainment or household income. The subjects' chronic diseases status is based on chronic disease registry information from 1998. Under the drug coinsurance structure, patients pay 80–100% of their drug costs.

ED, emergency department; SES, socioeconomic status.

Figure 1: Distribution of Emergency Department (ED) Copayment Level by Year

This figure displays the distribution of ED copayment levels in each study year for commercially insured and Medicare insured subjects. For the commercially insured subjects, we examined five categories of ED copayments: 0, \$1–\$5, \$10–\$15, \$20–\$35, and \$50–\$100 copayments for each visit. For Medicare insured subjects, we examined three categories of ED copayments: 0, \$1–\$15, and \$20–\$50 copayments for each visit. The total number of subjects in the study decreased over time as subjects died or left the IDS.

the distribution of ED copayment levels in each study year. Among commercially insured subjects in 1999, 23 percent had no copayment, 35 percent paid \$1–5, 23 percent paid \$10–15, 14 percent paid \$20–35, and 5 percent paid \$50–100 per ED visit. In January 2000, 52 percent of subjects had their copayment increase, 45 percent had no change, and 3 percent had lower levels. In January 2001, 21 percent of subjects experienced a copayment increase, 75 percent had no change, and 4 percent had a decrease.

There were similar copayment changes for Medicare subjects. In 1999, 25 percent of Medicare subjects had no copayment, 71 percent paid \$1–15, and 3 percent paid \$20–50 per ED visit. In January 2000, 60 percent had their copayment increase, 37 percent had no change, and 3 percent had lower levels. In January 2001, 13 percent of subjects experienced a copayment increase, 87 percent had no change, and 1 percent had a decrease.

Outcome Counts and Rates

Table 2 displays the unadjusted clinical event rates for each ED copayment level. The table also shows the mean office copayments by ED copayment level. ED and office copayments were identical at low copayment levels ($\leq \$15$) for subjects with either insurance-type. For the commercially insured, the mean office copayment associated with the \$10–15 ED copayments was higher than for the \$20–35 and \$50–100 ED copayments (office = \$12, \$8,

Table 2: Unadjusted Rates of Clinical Events by ED Copayment Level across All Years (1999–2001)

						ICU				
ED Copayment Level	Mean Office Copayment	Person-years	ED Visits		Hospitalizations		Admissions		Deaths	
			Visits	Rate	Admits	Rate	Admits	Rate	Counts	Rate
Commercial insurance population										
\$0	\$0	1,077,940	219,349	20.35	26,419	2.45	7,331	0.68	1,940	0.18
\$1–5	\$5	1,102,233	216,740	19.66	26,445	2.40	6,914	0.63	2,236	0.20
\$10–15	\$12	600,072	110,254	18.37	10,852	1.81	2,392	0.40	640	0.11
\$20–35	\$8	2,490,448	441,951	17.75	64,556	2.59	17,454	0.70	5,453	0.22
\$50–100	\$11	377,448	53,425	14.15	7,248	1.92	1,969	0.52	531	0.14
Total		5,648,142	1,041,719	18.44	135,520	2.40	36,060	0.64	10,800	0.19
Medicare insurance population										
\$0	\$0	140,558	74,367	52.91	25,595	18.21	8,220	5.85	5,025	3.58
\$1–15	\$4	241,198	125,599	52.07	41,742	17.31	13,670	5.67	8,287	3.44
\$20–50	\$9	324,614	167,641	51.64	58,829	18.12	19,075	5.88	12,527	3.86
Total		706,369	367,607	52.04	126,166	17.86	40,965	5.80	25,839	3.66

This table displays the unadjusted event-counts and rates per 100 person-years, the mean office copayment amount, and the person-years in the study, by copayment level. Patients with time-varying ED copayments contribute person-time to multiple copayment levels. Some patients also had drug copayments or coinsurance as noted in Table 1. During the study period, the primary forms of cost-sharing were the ED, office visit, and prescription drug copayments.

ED, emergency department.

and \$11, respectively), because some subjects at the high ED copayment levels had low office visit copayments.

ED Copayments and Visits

In all subjects, higher ED copayments were associated with monotonically lower ED visit rates (Table 3). For commercially insured subjects, the relative ED visit rates were 0.96 (\$1–5, 95 percent confidence interval [CI]: 0.96–0.97), 0.93 (\$10–15, 95 percent CI: 0.92–0.94), 0.88 (\$20–35, 95 percent CI: 0.87–0.89), and 0.77 (\$50–100, 95 percent CI: 0.76–0.77), compared with no copayment. For Medicare subjects, the RR were 0.97 (\$1–15, 95 percent CI: 0.96–0.99), and 0.96 (\$20–35, 95 percent CI: 0.94–0.97), compared with no copayment. In supplemental analyses, there was no evidence that the size of office copayments independently influenced the effect of the ED copayment on visit rates.

Table 3: Adjusted Relative Rates of Clinical Events by ED Copayment Level

<i>ED Visits</i>		<i>Hospitalizations</i>		<i>ICU Admissions</i>		<i>Deaths</i>	
<i>RR</i>	<i>95% CI</i>	<i>RR</i>	<i>95% CI</i>	<i>RR</i>	<i>95% CI</i>	<i>RR</i>	<i>95% CI</i>
Commercial insurance population (<i>n</i> = 2,257,445)							
\$0	1.0	1.0		1.0		1.0	
\$1–5	0.962 (0.955, 0.970)	0.999 (0.978, 1.020)		1.010 (0.972, 1.050)		1.086 (1.021, 1.156)	
\$10–15	0.932 (0.922, 0.941)	0.932 (0.905, 0.960)		0.895 (0.845, 0.947)		0.909 (0.822, 1.006)	
\$20–35	0.879 (0.873, 0.886)	0.961 (0.943, 0.980)		0.954 (0.922, 0.988)		0.857 (0.810, 0.907)	
\$50–100	0.765 (0.756, 0.774)	0.902 (0.873, 0.932)		0.946 (0.891, 1.004)		0.903 (0.818, 0.998)	
Medicare insurance population (<i>n</i> = 261,091)							
\$0	1.0	1.0		1.0		1.0	
\$1–15	0.973 (0.956, 0.989)	0.987 (0.962, 1.013)		0.990 (0.949, 1.031)		1.007 (0.966, 1.050)	
\$20–50	0.956 (0.939, 0.973)	0.994 (0.967, 1.022)		1.003 (0.959, 1.049)		0.873 (0.834, 0.913)	

This table reports relative rates (RR) of clinical events by ED copayment level, using a Poisson regression model with a patient-level random effect (ED visits, hospitalizations, ICU admissions), or using a Cox proportional hazard model (deaths). There were 1,041,719 ED visits, 135,520 hospitalizations, 36,060 ICU admissions, and 10,800 deaths between 1999 and 2001 among the 2,257,445 commercially insured subjects. There were 367,607 ED visits, 126,166 hospitalizations, 40,965 ICU admissions, and 25,839 deaths between 1999 and 2001 among the 261,091 Medicare insured subjects. The relative rates were adjusted for year, month, and for age, gender, SES, comorbidity, prior utilization (ED, office, hospital), having a regular PCP, drug cost-sharing level, and medical center using a propensity score.

ED, emergency department; SES, socioeconomic status; CI, confidence interval; PCP, primary care provider.

ED Copayments and Hospitalizations, ICU Admissions, and Deaths

Despite the reductions in ED visits, the ED copayment was not associated with higher unfavorable clinical event rates. In the commercially insured, there appeared to be fewer unfavorable clinical events associated with having copayments, after adjustment for sociodemographic and clinical characteristics. The one exception is a marginally significant, slightly increased mortality rate with the lowest copayment level (\$1–5; RR = 1.09, 95 percent CI: 1.02–1.16) compared with no copayment; however, we did not observe increased relative mortality rates for any of the three higher ED copayment levels. The hospitalization and ICU admission rates decreased monotonically with increasing ED copayment levels up to \$10–15; the rates decreased again with increasing copayment levels of \$20 or more. In Medicare subjects, the unfavorable clinical event RR were comparable for subjects with and without copayments. The one exception was a decreased mortality rate (RR = 0.87, 95 percent CI: 0.83–0.91) with the highest (\$20–50) ED copayment level. These findings were robust across multiple analytic approaches, e.g., using the propensity score, using the DxCG comorbidity adjustment, and using chronic disease indicators.

ED Copayment Effects in Subjects Living in Low SES Neighborhoods

Table 4 displays the adjusted event RR in the 508,861 commercially insured and 49,251 Medicare subjects living in low SES neighborhoods. For subjects with either commercial or Medicare insurance, the copayment effect on ED visits was greater in the low SES than in the overall population. The RR of ED visits were 0.85 (95 percent CI: 0.84–0.86) and 0.74 (95 percent CI: 0.72–0.76) for commercially insured subjects with \$20–50, and \$50–100 copayment levels, respectively, compared with no copayment; the relative ED visit rate was 0.93 (95 percent CI: 0.89–0.97) for Medicare subjects with \$20–50, compared with no copayment.

The rates of hospitalizations and ICU admissions also were lower with higher ED copayments in the low SES groups. In commercially insured subjects, none of the relative mortality rate estimates was statistically significantly different, compared with no copayment, but these insignificant differences were based on only 2,560 total deaths. The relative mortality rate was lower with higher ED copayments for Medicare subjects (5,062 total deaths).

Time-Sensitive Sentinel Diagnoses—Appendiceal Rupture and Pneumonia ICU Admission

Figure 2 displays the adjusted rates for hospitalization for appendicitis in commercially insured subjects, and for pneumonia in commercially and

Table 4: Adjusted Relative Rates of Clinical Events by ED Copayment Level in Subjects Living in Low SES Neighborhoods

ED Visits		Hospitalizations		ICU Admissions		Deaths	
RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Commercial insurance population living in low SES neighborhoods (n = 508,861)							
\$0	1.0	1.0		1.0		1.0	
\$1–5	0.930 (0.916, 0.944)	0.955 (0.915, 0.996)		0.971 (0.898, 1.050)		1.057 (0.932, 1.199)	
\$10–15	0.909 (0.891, 0.928)	0.919 (0.866, 0.976)		0.876 (0.779, 0.985)		0.996 (0.810, 1.226)	
\$20–35	0.847 (0.835, 0.859)	0.947 (0.911, 0.984)		0.931 (0.866, 1.000)		0.922 (0.823, 1.033)	
\$50–100	0.737 (0.719, 0.756)	0.842 (0.787, 0.900)		0.826 (0.727, 0.938)		1.084 (0.885, 1.327)	
Medicare insurance population (n = 49,251)							
\$0	1.0	1.0		1.0		1.0	
\$1–15	0.924 (0.889, 0.961)	0.953 (0.897, 1.013)		0.959 (0.872, 1.055)		0.894 (0.814, 0.983)	
\$20–50	0.929 (0.893, 0.967)	0.961 (0.904, 1.022)		0.942 (0.852, 1.041)		0.846 (0.765, 0.937)	

For patients living in low SES neighborhoods, this table reports relative rates (RR) of clinical events by ED copayment level, using a Poisson regression model with a patient-level random effect (hospitalizations, ICU admissions), or using a Cox proportional hazard model (deaths). The relative rates were adjusted for year, month, and for age, gender, SES, comorbidity, prior utilization (ED, office, hospital), having a regular PCP, drug cost-sharing level, and medical center using a propensity score. We defined the low SES neighborhoods as areas with low income ($\geq 20\%$ of residents have household incomes below the federal poverty level) or low educational attainment ($\geq 25\%$ of residents ≥ 25 years old have less than a high-school education), using the 2000 U.S. Census.

ED, emergency department; SES, socioeconomic status; CI, confidence interval; PCP, primary care provider.

Medicare insured subjects. There was no statistically significant association between the ED copayment and hospitalization for appendicitis, as expected because all appendicitis cases likely will result in hospitalization; importantly,

These figures display the relative rates (RR), hazard ratios (HR), or odds ratio (OR) of clinical events by emergency department (ED) copayment level, using a Poisson regression model with a patient-level random effect (pneumonia ED Visits, hospitalizations, ICU admissions), using a Cox proportional hazard model (hospitalizations for appendicitis, appendiceal rupture) or using a logistic regression model (appendiceal rupture given hospitalization). The RR were adjusted for year, month, and for age, gender, socioeconomic status (SES), comorbidity, prior utilization (ED, office, hospital), having a regular primary care provider, drug cost-sharing level, and medical center using a propensity score. We defined the low SES neighborhoods as areas with low income (≥ 20 percent of residents have household incomes below the federal poverty level) or low educational attainment (≥ 25 percent of residents ≥ 25 years old have less than a high-school education). There were a total of 4,896 hospitalizations for appendicitis between 1999 and 2001, of which 1,342 hospitalizations had a principle diagnosis of appendiceal rupture.

there also was no detectable association between the copayment amount and having a ruptured appendix in subjects with commercial insurance; there also were no significant differences in the odds of rupture given a hospitalization.

Figure 2: Adjusted Relative Rates of Sentinel Diagnoses

Similarly in subjects with commercial insurance, higher ED copayments were not associated with statistically significant increases in either the pneumonia hospitalization or ICU admission rates; there also were no significant differences in the odds of an ICU admission given a hospitalization. Among Medicare subjects, however, larger copayments were associated with larger, although statistically insignificant pneumonia ICU admission rates (RR = 1.10 for \$1–15 copayments, 95 percent CI: 0.96–1.27; RR = 1.13 for \$20–50 copayments, 95 percent CI: 0.96–1.33). There was a significant increase in the odds of an ICU admission given hospitalization with the lower copayment level (copayment = \$1–15; RR = 1.24; 95 percent CI: 1.02–1.51) compared with no copayment; however, we did not observe increased odds with the higher copayment level (\$20–50), compared with no copayment.

DISCUSSION

To our knowledge, this is the largest natural experiment that addresses the impact of cost-sharing on mortality and on other potentially unfavorable clinical events. Similar to previous studies, we found that having to pay a portion of emergency care costs was associated with reduced use of the ED. Despite the very large sample size, we found no evidence that cost-sharing, in the amounts imposed during this study period, led to higher rates of death or of potentially unfavorable clinical events including hospitalizations and ICU admissions on average, for subjects with either commercial or Medicare insurance. As we discuss below, it is important to view these findings within the context of the population studied, both in terms of the availability of alternative sources of care within this health system, and their clinical and socioeconomic characteristics. This study suggests that the modest ED copayments implemented within an IDS among generally well-insured and nonpoor people, did not have a substantial adverse effect on health outcomes.

Our findings are in general agreement with previous studies on emergency care. In a fee-for-service (FFS) commercial insurance environment, O'Grady et al. (1985) found that subjects with cost sharing had expenditures 14 percent lower than subjects with free care. Overall, the HIE found no adverse clinical effects that were associated with higher medical cost-sharing for the average person. This work, however, did not examine the effect of only varying cost sharing for ED services. During the initial introduction of ED copayments, from 1992 to 1993, in the same IDS as studied here, Selby et al. (1996) found that a \$25–35 copayment reduced visits by 15 percent, with greater reductions

for less severe diagnoses. Magid et al. (1997) found that patients with ED copayments who had a diagnosis of myocardial infarction did not appear to delay care after onset of chest pain using data from 1989 through 1994.

Our study extends the previous work by assessing cost-sharing effects on ED visits in the current environment using more recent data (1999–2001), and by evaluating potential unintended adverse effects of cost-sharing within a large, natural experiment. The absence of clinical harm on average associated with these levels of ED cost-sharing is also consistent with our previous telephone interview findings that many patients sought care from other delivery sites in the IDS when they changed their care seeking behavior in response to ED copayments, and that fewer than 2 percent of patients avoided care altogether (Reed et al. 2005). We also found a reduction in clinical events such as hospitalizations and ICU admissions associated with higher ED copayments and lower ED use.

While we might expect to find some clinical harm associated with not seeking ED care (perhaps because of a copayment), there also may be harm associated with medical interventions (iatrogenic harms); some of these interventions might not be necessary and iatrogenic harms might be reported infrequently. The observed pattern in this study would be consistent with a greater probability of hospitalization if the patient were seen in the ED rather than in the office for the same condition. It is also consistent with possible overuse of hospital services in the absence of copayments (Reid et al. 1998; Fisher and Welch 1999; Zhao et al. 2001). The HIE also found a similar reduction in hospitalization rates associated with higher cost-sharing for office visits and fewer such visits (Newhouse and The Insurance Experiment Group 1993). In fact, there is growing evidence that both overuse and underuse of health care exist in the United States, and that both represent poor quality (Siu et al. 1986; Wennberg et al. 1989; Fisher et al. 2003).

We also found that the magnitude of the copayment effects on ED visits generally was smaller in Medicare subjects, and larger in subjects living in low SES neighborhoods. Given that Medicare subjects tend to have higher rates of ED visits, hospitalizations, and deaths compared with younger, commercially insured subjects, it is possible that the less pronounced copayment effect on ED visits reflects a higher proportion of appropriate emergency care, but this determination is beyond the scope of this study.

Importantly, this study focused on the association between ED copayment amounts and clinically significant event rates on average for the study population; these findings should not be interpreted as demonstrating that copayments created no barriers to care for every individual with any

condition. We also did not have the ability to determine whether patients knew their copayment level or believed that they actually had to pay this amount when making the decision to seek emergency care. To the degree patients did not know, our results might understate potential cost-sharing effects. In addition to waiving ED copayments for subjects who are subsequently hospitalized, the IDS also did not collect all ED copayments during the study period, also suggesting a potential understatement of the effect relative to full collection. Nevertheless, it is unlikely that subjects would know before receiving emergency care whether they would benefit from incomplete collection of copayments or a waiver because of hospitalization; moreover, we also found a sizable, monotonically increasing copayment effect on ED visits in this study, which was similar in magnitude to that of other studies. Although copayments were allocated nonrandomly in the study, allocation was by employer rather than individual patient choice. Concerns about selection biases may, therefore, be attenuated. In addition, we found similar results in analyses using several complementary approaches, including adjusting for sociodemographic, clinical, insurance, and organizational covariates both with and without propensity scores. Nevertheless, we cannot rule out completely the possibility of selection bias.

In addition, the study had limited power to detect any effect on ICU admissions for sentinel diagnoses or on deaths for vulnerable subpopulations, e.g., subjects living in low SES neighborhoods. The absence of adverse effects on nonelective and ICU admissions reduces the likelihood of any adverse effect on mortality; however, it is concerning that there were increased ICU admission rates for pneumonia among Medicare subjects and a suggestion of an increasing trend for appendiceal rupture with higher copayments among commercially insured subjects, although these patterns either were not monotonic with copayment increases or did not reach statistical significance. Studies over longer time frames or using data from multiple sites may be needed to address this concern fully.

In addition, our census-based measures of neighborhood SES are not equivalent to potentially important individual-level and situation-specific characteristics, including knowledge of the specific clinical condition, alternatives to the ED for care, or ability to pay when deciding where to seek care. Nevertheless, these measures are available for the entire population, have been previously validated in this population, and provide some information about other potentially important factors such as wealth, especially for non-working older and younger subjects. Finally, persons receiving care in other health systems might not have the same range of alternative sources of care

available to them: clinical effects of copayments could differ when alternative care is less available. It is possible that the copayment effects might increase over time as subjects become more aware of the ED copayments, have to pay the copayments a greater percentage of the time, acquire cumulative clinical effects, or increase their level of knowledge. Evaluating these possibilities are beyond the scope of this study.

In conclusion, these findings suggest that modest levels of cost-sharing for emergency care can reduce ED visit rates without leading to more significant unfavorable clinical events, on average, for patients with either Medicare or commercial insurance. It is important to view these findings within context: the findings are valid within populations with comparable levels of morbidity, and health systems with comparable types, availability, and relative costs of alternate sources of care. These findings may not be applicable to more indigent populations, e.g., the Medicaid-eligible, patients with more complex or severe clinical conditions, or to less integrated systems. Future studies are needed to examine effects within high-risk populations and conditions, over longer time periods in all groups, of higher amounts of cost-sharing, and in other settings.

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