

The Effects of Clinical Case Management on Hospital Service Use Among ED Frequent Users

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This study examined the impact of case management on hospital service use, hospital costs, homelessness, substance abuse, and psychosocial problems in frequent users of a public urban emergency department (ED). Subjects were 53 patients who used the ED five times or more in 12 months. Utilization, cost, and psychosocial variables were compared 12 months before and after the intervention. The median number of ED visits decreased from 15 to 9 ($P < .01$), median ED costs decreased from \$4,124 to \$2,195 ($P < .01$) and median medical inpatient costs decreased from \$8,330 to \$2,786 ($P < .01$). Homelessness decreased by -57% ($P < .01$), alcohol use by -22% ($P = .05$) and drug use by -26% ($P = .05$). Linkage to primary care increased 74% ($P < .01$). Fifty-four percent of medically indigent subjects obtained Medicaid ($P < .01$). There was a net cost savings, with each dollar invested in the program yielding a \$1.44 reduction in hospital costs. Thus, case management appears to be a cost-effective means of decreasing acute hospital service use and psychosocial problems among frequent ED users. (*Am J Emerg Med* 2000;18:603-608. Copyright © 2000 by W.B. Saunders Company)

It has been extensively documented that a small number of emergency department (ED) patients make disproportionate use of emergency services and are difficult to link to primary care providers.¹ These high users tend to be poor, homeless, socially isolated, lack insurance entitlements, and have drug and alcohol problems.² These characteristics, crucial environmental factors, and the way emergency care is typically provided result in these patients receiving episodic, discontinuous, and inadequate care.³ In an increasingly cost-conscious health care system, these patients represent a large financial burden to hospitals.⁴

Several investigators have questioned whether changing the services these patients receive could alter the pattern of their ED use.⁵ There has been only one experimental attempt to evaluate this approach. Spillane et al, using a randomized

design and using systematic, individualized patient care plans for ED high users, failed to find a significant difference in ED utilization between the intervention and usual care groups.⁶

Intensive comprehensive clinical case management has been successfully used for patients with serious mental illness to stabilize their lives and reduce their use of acute, expensive psychiatric services.⁷ The present study investigated whether a similar service for high users of an urban ED could: (1) reduce use of ED and medical inpatient services, (2) reduce hospital service cost and produce a cost offset, and (3) decrease psychosocial problems such as homelessness and substance abuse, which may contribute to hospital service utilization.

METHODS

This pilot case management intervention study based at San Francisco General Hospital (SFGH) was a prospective study that followed high users for 12 months. Data analyses were conducted using a pre-post design where each subject served as his/her own historical control. The "pre" period was the 12 months before case management intervention, the "post" period was the 12 months after enrollment onto case management. The study was reviewed and approved by the Institutional Review Board at the University of California, San Francisco.

Subject Selection and Recruitment

Between June 30, 1995 and June 30, 1996, a convenience sample of 174 patients was referred by SFGH ED staff and screened for study admission by clinical case managers. Inclusion criteria were: Five or more visits to the SFGH ED during the previous 12 months, 18 years of age or older, ability to give informed consent and willingness to receive case management services. Patients who were too intoxicated, acutely confused, or acutely psychotic to give informed consent were excluded, as were individuals who were already receiving case management services. Fifty-three subjects met study criteria and were enrolled onto the program. Of those not meeting criteria for inclusion, 39% ($n = 47$) refused to participate, 35% ($n = 42$) were inappropriate referrals (ie, had less than five ED visits, were already receiving case management services, and so on), and 26% ($n = 32$) were not able to give informed consent.

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Case Management Intervention

Once enrolled, subjects were assigned to a master's level psychiatric social worker who used a comprehensive, intensive case management model. The case manager was responsible for providing and coordinating all needed services including: crisis intervention, individual and group supportive therapy, arrangement of stable housing and financial entitlements (ie, Medicaid, Social Security Income), linkages to primary care providers (PCP), harm reduction services and referral to substance abuse treatment, liaison with other community agencies and extensive, persistent outreach (home visits, "tracking" and finding patients, accompanying patients to medical appointments, and so on). The primary goals were to: decrease homelessness, decrease alcohol and substance use, improve linkages to primary care providers, reduce health care utilization, and to enroll patients without medical insurance into Medicaid.

Measures

We examined change on three sets of variables from the 12 months before to the 12 months after initiation of case management: hospital service utilization, hospital service cost, and psychosocial variables.

Hospital service utilization data were obtained from SFGH administrative databases, specifically the hospital's inpatient and outpatient utilization databases, the physicians' professional fee database, and the Department of Psychiatry's billing and utilization database. Costs of medical and psychiatric inpatient, outpatient and emergency services were calculated by multiplying charges for each service episode obtained from the hospital's financial database by the department-specific SFGH Medicare cost-to-charge ratio for the year of service. Costs of physicians' professional services were computed at the amount allowed for each service according to the local 1998 Medicare Physician Fee Schedule.⁸ Ambulance costs were calculated by multiplying an administratively computed average ambulance charge by the SFGH Medicare cost-to-charge ratio for ambulance services. Because the costs of the experimental case management program were not included in the hospital's financial databases, program costs were calculated as the total wage and fringe costs for the program's clinical, supervisory and support staff plus a standard local 29% overhead rate charged for contracted clinical services. For comparability, all costs were adjusted for inflation to 1997 dollars using the Medical Care Consumer Price Index.⁹

For the psychosocial variables, the case managers collected baseline and 12-month follow up data on demographic variables, homelessness status, and information on alcohol and substance use. Homelessness was defined as "living on the streets, in shelters, in abandoned buildings, or living in nonpermanent transient hotels for the majority of time, within the last month." "Problem alcohol and substance abuse" were coded as present (apparent problem use) or absent (no problem use) by case managers based on their clinical assessment of the patient, including their observation of the patient, patient self-report of alcohol and drug use and reports of collateral contacts.

Data Analysis Procedures

Statistical Procedures

Because hospital utilization and cost data were nonnormally and nonsymmetrically distributed, we used resampling procedures to examine change from the year before case management enrollment to the year after enrollment. Resampling procedures yield robust tests using the empirical distribution of the data and are particularly useful in contexts where the data do not meet the distributional assumptions of standard statistical procedures.^{10,11} We used permutation tests to obtain *P* values and the bootstrap percentile method to obtain confidence intervals. For the continuous utilization and cost variables, we used permutation tests, resampling 1,000 times, to estimate the statistical significance of observed values for median change against the null hypothesis of no pre-post change. For the dichotomous psychosocial variables we used permutation tests, again resampling 1,000 times, to estimate the statistical significance of the observed value of the McNemar test (computed using SAS PROC UNIVARIATE)^{12,13} against the null hypothesis of no change. We estimated 95% confidence intervals for all variables by resampling from our data 1,000 times with replacement. Data for all subjects were included for the entire study period, regardless of how long they were enrolled on case management because the hospital incurred the costs of their care regardless of their enrollment status.

Economic Analyses

Our analyses examine the economic costs of hospital services. The economic cost is an estimate of the true value of the resources used to provide hospital services. Although it is not a perfect estimate of resource value, economic cost is a much more generalizable estimate of value than other available financial data, such as hospital charge, billing or revenue figures, which tend to be very hospital-specific because of unique combinations of patient mix, payer mix, and institutional mission. Because this was a pilot study with limited resources, these analyses are limited to costs of services at SFGH. Future analyses of the full range of societal costs outside of the hospital, such as housing costs, social service costs, and indirect costs such as lost productivity, would clearly be desirable if the case management intervention appears cost-effective at the hospital level.

RESULTS

Sample Characteristics

This sample of 53 case management patients was predominantly male (87%). Forty-nine percent were African American, 23% were Caucasian, 19% Hispanic, 6% Native American, and 4% Asian. The mean age at time of enrollment was 45 years (SD = 14.4, ranging in age from 19 to 82 years). The majority of the sample was homeless (67%), 100% were unemployed, and many were without medical insurance (45%). The remaining 55% were on Medicaid and/or Medicare.

As shown in Table 1, in the 12 months before case management enrollment the median number of ED visits was 15 (ranging from 5 to 47 visits), the median number of

TABLE 1. Hospital Service Use 12 Months Before and 12 Months After Case Management (n = 53)

Type of Use	Medians			P (Median Change = 0)	95% Confidence Interval for Median Change
	Pre	Post	Pre-Post Change		
ED visits	15	9	-5	<.01	-7 to -3
Medical inpatient admissions	1	1	0	=.99	-1 to 0
Medical inpatient days	5	2	0	=.95	-4 to 0
Medical outpatient visits	2	4	1	<.01	0 to 3
Psychiatric inpatient admissions	0	0	0	=.99	0 to 0
Psychiatric inpatient days	0	0	0	=.99	0 to 0
Psychiatric emergency visits	0	0	0	=.99	0 to 0

Note. The statistical test evaluates the hypothesis that the median change from pre to post is equal to zero. Because the median pre, post, and change values represent the midpoints of three distinct distributions, median change is not necessarily equal to the mathematical difference between the median prevalue and the median postvalue.

inpatient admissions was one (range = 0 to 11) and the median number of inpatient days was five (range = 0 to 63). Seventy-four percent of these patients were without a primary care provider. The most common medical disorders included cardiovascular, alcohol or substance abuse diagnoses, chronic pulmonary disorders (especially asthma) and neurologic disorders (especially seizure disorders).

Service Utilization

As hypothesized, patients made fewer visits to the ED in the year after case management enrollment than in the preceding year (median change = -5, $P < .01$, 95% CI = -7 to -3) (see Table 1). This decrease in ED visits was accompanied by a statistically significant increase in the number of medical outpatient clinic visits (median change = +1, $P < .01$, 95% CI = 0 to 3), reflecting a desirable increase in utilization of appropriate outpatient care. There was no appreciable change in utilization of medical inpatient services or psychiatric inpatient or emergency services.

Service Costs

As hypothesized, hospital service costs were lower after case management enrollment (see Table 2). The median total hospital service cost decreased from \$21,022 in the year

before case management enrollment to \$14,910 in the year after enrollment (median change = \$-2,406, $P = .06$, 95% CI = \$-6,361 to \$-430) (Because the pre, post, and change values each have their own distributions, the median change value is not necessarily equal to the mathematical difference between the median prevalues and the median postvalues). As anticipated, the greatest reductions were seen in acute service costs. Median medical emergency service costs decreased from \$4,124 before case management to \$2,195 after case management (median change = \$-1,938, $P < .01$, 95% CI = \$-2,459 to \$-1,013). Median medical inpatient costs decreased from \$8,330 to \$2,786 (median change = \$-1,082, $P < .01$, 95% CI = \$-8,330 to \$0). Physicians' professional fee costs also decreased significantly (median change = \$-270, $P = .03$, 95% CI = \$-464 to \$-113). There was no apparent change in the cost of medical outpatient, psychiatric inpatient, psychiatric emergency, or ambulance services.

These reductions in hospital costs appear to have produced a cost offset. When the total cost of case management services to the 53 patients, calculated at \$296,738, is subtracted from the \$429,464 savings realized in other hospital services, there is a net cost saving of \$132,726, indicating that for each dollar invested in the case management program, there was a \$1.44 reduction in other hospital costs.

TABLE 2. Hospital Service Cost 12 Months Before and 12 Months After Case Management (n = 53)

Type of Cost	Medians			P (Median Change = 0)	95% Confidence Interval for Median Change
	Pre	Post	Pre-Post Change		
Total (all hospital services)	\$21,022	\$14,910	\$-2,406	=.06	\$-6,361 to \$-430
ED	\$ 4,124	\$ 2,195	\$-1,938	<.01	\$-2,459 to \$-1,013
Medical inpatient	\$ 8,330	\$ 2,786	\$-1,082	<.01	\$-8,330 to \$0
Medical outpatient	\$ 476	\$ 612	\$ 94	=.38	\$-101 to \$273
Psychiatric inpatient	\$ 0	\$ 0	\$ 0	=.99	\$0 to \$0
Psychiatric emergency	\$ 0	\$ 0	\$ 0	=.99	\$0 to \$0
Physicians' professional fees	\$ 1,330	\$ 1,149	\$ -270	=.03	\$-464 to \$-113
Ambulance	\$ 2,269	\$ 1,135	\$ 0	=.93	\$-1,135 to 0

Note. The statistical test evaluates the hypothesis that the median change from pre to post is equal to zero. Because the median pre, post, and change values represent the midpoints of three distinct distributions, median change is not necessarily equal to the mathematical difference between the median prevalue and the median postvalue.

Psychosocial Outcomes

As can be seen in Table 3, there were significant decreases in all of the primary targets of case management intervention. In the year after case management enrollment, homelessness decreased by 57% (McNemar Test = 10, $P < .01$, 95% CI for percent change = -73% to -42%), problem alcohol use decreased by 22% (McNemar Test = 4.0, $P = .05$, 95% CI for percent change = -37% to -10%), and problem drug use decreased by 26% (McNemar Test = 3.5, $P = .05$, 95% CI for percent change = -44% to -11%). The percentage of patients without Medicaid decreased by 54% (McNemar Test = -7.0 , $P < .01$, 95% CI for percent change = -76% to -33%). At baseline, 39 patients (74%) were without a primary care provider, but 1 year after case management, only 10 patients were without a provider, yielding a decrease in need of 74% (McNemar Test = 14.5, $P < .01$, 95% CI for percent change = -87% to -61%).

We were particularly interested in determining whether living situation or change in homelessness status was related to cost savings. A post hoc analysis suggested that the 18 patients who were not homeless at baseline and who remained not homeless after case management realized a median reduction in hospital costs of \$4,903 (range = $-\$164,366$ to $\$179,702$). The 20 patients who were homeless at baseline, but no longer homeless at 12 month follow-up, realized a median reduction of \$2,474 (range = $-\$69,593$ to $\$64,649$) in hospital costs. The 15 patients who were homeless at baseline and remained homeless at follow-up had the least amount of reduction in hospital costs (median change = $-\$430$, range = $-\$26,809$ to $\$9,425$). While these differences are not statistically significant (perhaps because of the great variability in individual patient costs) these data would suggest that maintaining or obtaining stable housing may be positively associated with hospital cost savings.

Mortality

Nine patients died during the course of the study. Three patients died from accidental drug overdoses, one from burns in a hotel fire, one death was a suicide, the four remaining deaths were from complications related to a variety of chronic medical problems (end-stage liver disease, cardiac arrest, cardiomyopathy, and an arteriovenous malformation).

It is possible that the nine deaths that occurred in the post

period could artificially contribute to decreases in service costs or utilization. Therefore, we excluded the patients who died after case management enrollment and reanalyzed the utilization, cost, and psychosocial outcome data. The pattern of results was unchanged. The loss of power that accompanied the reduction in sample size did decrease statistical significance of some tests, but not alter the magnitude of pre-post differences.

DISCUSSION

In this pilot study of ED high users, the introduction of intensive clinical case management was associated with statistically significant reductions in utilization and cost of acute hospital services and reductions in psychosocial problems. The intervention appears to be both cost-efficient and cost-effective. It appears cost-efficient because there was a net savings in hospital costs for treated patients after the initiation of case management and cost-effective because cost reductions were accompanied by improved psychosocial outcomes, such as increased linkages to primary care providers, and decreased homelessness and substance use. These results are encouraging, especially given the demographic characteristics of this sample. The overwhelming majority of patients were poor, medically indigent, medically complex, and homeless, with significant histories of drug and alcohol use.

Differences Between the Intervention and Traditional ED Treatment

The case management intervention described here is based on a model of continuous, integrated medical and psychosocial care. This is markedly different from the episodic and reactive treatment emergency patients typically receive. A case manager, in coordination with a primary care provider, assumed ongoing responsibility for the whole person, and attempted to address the broad spectrum of problems related to the patient's medical problems. This proactive, assertive approach emphasized prevention and health promotion as well as acute treatment. Moreover, the locus of intervention was limited not to the walls of the hospital, but extended to the entire city, and included all of its natural community settings which patients frequented. For example, linkage with primary care providers was undertaken, not just through referral, but also by actually "collecting" patients on the street, in their apartments, or in bars, and taking them to their medical appointments.

TABLE 3. Psychosocial Problems and Needs 12 Months Before and 12 Months After Case Management

Type of Outcome	Patients Before EDCM	Patients After EDCM	Pre-Post Change (%)	95% Confidence Interval for Percent Change	McNemar Test	<i>P</i>
Is homeless	35	15	-20 (-57%)	-73% to -42%	10.0	<.01
Has problem alcohol use	37	29	-8 (-22%)	-37% to -10%	4.0	.05
Has problem drug use	27	20	-7 (-26%)	-44% to -11%	3.5	.05
Does not have medical insurance	24	10	-14 (-58%)	-76% to -38%	-7.0	<.01
Does not have medicaid	26	12	-14 (-54%)	-73% to -33%	-7.0	<.01
Needs primary care provider	39	10	-29 (-74%)	-87% to -61%	14.5	<.01
Needs social services	50	35	-15 (-30%)	-44% to -18%	7.5	<.01

It has been assumed that the primary challenge with high users of the ED is to simply link them with primary care providers. In practice, linkage proves to be a more complex and continuous endeavor. These patients have great difficulty keeping appointments. They tend to lose appointment slips, are too preoccupied with the dangers and challenges of living on the streets to make health care a priority, are submerged in the chaos of their substance abuse and/or emotional problems. In many cases patients are so cognitively impaired that they forget they have appointments. Many of these patients have difficulty trusting people and are so frustrated with past attempts to access health care that the case managers needed to maintain constant vigilance and exert vigorous efforts to facilitate the connection of their patients to medical providers. Although the frequency of outpatient visits increased dramatically, as a result, such linkage was probably only one of the factors that accounted for the outcomes described earlier.

A high degree of collaboration between the case managers and the ED, inpatient and primary care providers, and a common vision were essential to the success of the intervention. A similar degree of cooperation was essential from providers, participants, and services in other parts of the community such as shelters, police, paramedics, Social Security administration staff, coffee shop employees, hotel managers, and substance abuse services.

The case managers had to persevere in obtaining assisted housing for these patients and in advocating with residential substance abuse providers each of which had its own restrictive conditions for admission. These restrictions often served to exclude our multiproblem patients with multiple diagnoses and complicated medical regimens. In certain cases, case managers were unable to find stable, affordable housing except in drug infested, impoverished neighborhoods where patients were tempted to resume their drug use and criminal behavior, with its various negative consequences for their health status and quality of life.

Limitations of the Study

Notwithstanding the encouraging results of this study, there are important limitations to consider. The most important is the limitation of any pretest posttest design in which patients are used as their own controls. Whenever subjects are selected because they have extreme values on any parameter, such as high ED utilization, there is the possibility that their utilization will decline naturally without intervention.¹⁴ Anecdotal evidence from this study mitigates concern about this regression to the mean. Many patients were quite ill at enrollment and the progressive nature of their illnesses makes regression to the mean relatively unlikely. Only a randomized controlled trial can resolve this question and we are currently undertaking such a study.

Selection bias is also a concern. First, patients were referred at the discretion of the ED staff and may not be representative of all patients having five or more visits in a year. Secondly, some potentially eligible patients were not enrolled, either because they refused participation or were unable to give informed consent. Although these caveats are important in generalizing the results of this study, and patient selection needs to be further studied, the enrolled

sample was clearly a highly complex and difficult group of patients.

We were not able to measure the complete array of relevant cost and outcome variables in this preliminary study. The ideal analysis would examine costs and outcomes from a societal perspective, including all costs and effects experienced by all segments of society as a result of participating patients' illness or treatment. This would include all hospital and other health care costs, social service costs, law enforcement and legal costs, and any other costs incurred by patients or the community at large. Such a data collection effort was beyond the scope of this pilot study. Similarly, we were unable to obtain direct measures of key outcomes, such as health status, functioning or quality of life. Clearly, a complete societal cost analysis would give a more detailed picture of the cost-effectiveness of the case management intervention. However, there is no reason to assume that the intervention would appear less cost-effective if it were evaluated from a societal perspective because a more comprehensive analysis would include both additional costs (such as medical care at other facilities, substance abuse treatment and social services) and additional benefits (such as decreased use of the legal and law enforcement systems and improved health status and quality of life).

Implications and Future Directions

Many hospitals provide care for a subgroup of patients who use the hospital disproportionately in part because of a variety of psychosocial problems. It is often assumed that these patients use the hospital inappropriately. Based on this study, it might be more accurate to describe the care EDs provide to this complicated population as inappropriate, rather than the patients themselves. Our study suggests that a new model of care, using intensive case management, can help high users reduce their utilization of the ED and the medical/surgical inpatient services by increasing their use of primary care services and decreasing alcohol and substance abuse and homelessness. Hospital service costs declined substantially even when the cost of the intervention was considered. This intervention may be even more desirable under capitated financing where each service episode carries with it a cost, but not an associated reimbursement.

Although the number of patients in this study was relatively modest, the percentage with psychosocial problems which appear to complicate their medical problems is staggering, particularly, if the impact of substance abuse, psychological disturbance, and homelessness is considered. We postulate that our positive results were caused by the characteristics of the case management intervention with its emphasis on continuous care, the establishment of a single point of responsibility, the proactive approach of the intervention, and attention to integrating psychosocial and medical aspects of care.

One of the most provocative implications of our study is that unless health care systems address the psychosocial aspects of their multiproblem patients, it will be very difficult to appropriately manage their medical problems. For these patients, health systems must embrace a broader human service model rather than maintaining their tradi-

tional and comparatively narrow medical model. Perhaps the most fundamental question raised by this study revolves around the proper mission of the public health care system. Should it confine itself solely to the treatment of disease or even more broadly the promotion of health for poor, multiproblem patients, or should it also use its considerable organizational infrastructure to seek to improve these patients' functioning and quality of life, not just as the necessary means of dealing with their medical status, but as independent outcomes for their own sake?

Future studies need to include a randomized design, to include more comprehensive measurement of both costs and outcomes. The characteristics of subgroups for whom this intervention is most effective should also be examined so that it can be deployed more selectively.

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