

An Intervention Connecting Low-Acuity Emergency Department Patients With Primary Care: Effect on Future Primary Care Linkage

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Study objective: Our objective is to determine whether a point-of-care intervention that navigates willing, low-acuity patients from the emergency department (ED) to a Primary Care Clinic will increase future primary care follow-up.

Methods: We conducted a quasi-experimental trial at an urban safety net hospital. Adults presenting to the ED for select low-acuity problems were eligible. Patients were excluded if arriving by emergency medical services, if febrile, or if the triage nurse believed they required ED care. We enrolled 965 patients. Navigators escorted a subset of willing participants to the Primary Care Clinic (in the same hospital complex), where they were assigned a personal physician, were given an overview of clinic services, and received same-day clinic care. The primary outcome was Primary Care Clinic follow-up within 1 year of the index ED visit among patients having no previous primary care provider.

Results: In the bivariate intention-to-treat analysis, 50.3% of intervention group patients versus 36.9% of control group patients with no previous primary care provider had at least 1 Primary Care Clinic follow-up visit in the year after the intervention. In the multivariable analysis, the absolute difference in having at least 1 Primary Care Clinic follow-up for the intervention group compared with the control group was 9.3% (95% confidence interval 2.2% to 16.3%). There was no significant difference in the number of future ED visits.

Conclusion: A point-of-care intervention offering low-acuity ED patients the opportunity to alternatively be treated at the hospital's Primary Care Clinic resulted in increased future primary care follow-up compared with standard ED referral practices. [Ann Emerg Med. 2012;xx:xxx.]

Please see page XX for the Editor's Capsule Summary of this article.

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INTRODUCTION

Background

Nearly 1 in 5 adults aged 18 to 64 years in the United States lacks a usual source of health care.¹ Emergency department (ED) patients may be even less likely to have a usual source of care, with up to one third reporting no usual source or identifying the ED as that source.² Recognizing this as a high-priority problem, Healthy People 2020 identifies "persons with a usual primary care provider" as one of the leading health indicators to address in the next 10 years.³ Moreover, the success of new care delivery models such as patient-centered medical homes hinges on patients having a usual source of care.

Having a usual source of primary care has well-established health benefits. People with a usual source of care are more likely to receive preventive services,⁴ including blood pressure screening,^{5,6} vaccinations,⁷ mammograms,⁵⁻⁷ Papanicolaou smears,^{5,6} colorectal cancer screening,⁸ and prenatal care.⁹ It is commonly accepted that regular attention to chronic illness may prevent more severe, costly problems. Previous studies support

this notion; for example, patients without a primary care provider have higher odds of presenting to the ED for severe, uncontrolled hypertension,¹⁰ and ED patients without a usual source of care have worse diabetes control, even after adjusting for potentially confounding factors.¹¹

Importance

Despite the health benefits of having a usual source of primary care, the best way to establish such care is unknown and efforts to improve this process have proven difficult to realize. Given its position as the point of entry into the health care system for many underserved patients, the ED may be an ideal place for interventions to improve access to primary care. Previous ED-based interventions have attempted to encourage primary care follow-up, with various levels of success.¹²⁻²² Most interventions occurred after the ED visit through enhanced referral systems or assistance in making appointments. There may be an opportunity to intervene earlier, even before the ED visit is completed, to connect a select group of low-acuity

Editor's Capsule Summary*What is already known on this topic*

Many emergency department (ED) patients lack a usual source of primary care, which may lead to poor follow-up and greater ED utilization.

What question this study addressed

Does offering low-acuity ED patients without a primary care provider immediate access to an onsite Primary Care Clinic improve future primary care follow-up?

What this study adds to our knowledge

Primary care follow-up rates were 9% higher in patients diverted from the ED to the Primary Care Clinic. Subsequent ED utilization was similar for both groups.

How this is relevant to clinical practice

This study demonstrates the feasibility of one method for encouraging patients to engage in continuing primary care. The effects were modest, however, and did not appreciably decrease future ED utilization.

patients with primary care. Nationwide, 8% of ED visits are classified as nonurgent, defined as requiring care within 2 to 24 hours,²³ and this number may be higher in certain settings such as safety net hospitals.²⁴ Same-day, closely observed care in a Primary Care Clinic, which more proactively connects ED patients with a usual source of primary care, could be a safe option for a subset of these ED visitors.

Goals of This Investigation

We aimed to determine whether a point-of-care intervention that navigated willing, low-acuity patients from the ED to a Primary Care Clinic would increase future primary care follow-up. We hypothesized that such an intervention could create successful primary care follow-up among patients with no previous usual source of care.

MATERIALS AND METHODS**Study Design and Setting**

We conducted a quasi-experimental trial at an urban public safety net hospital. The study hospital's Primary Care Clinic is located in the same building complex as the ED. The outpatient clinics have more than 500,000 visits yearly and another 100,000 patients are treated yearly in the ED. The adult ED consists of 2 treatment areas: the main adult emergency service and the urgent care area.

The study was approved by the institutional review boards of the study hospital and its affiliated academic institution.

Written informed consent was obtained from all patients. Also, the study was discussed extensively with hospital administrators and legal staff to ensure that Emergency Medical Treatment and Active Labor Act (EMTALA) requirements were being met. The study intervention did not violate EMTALA because it was completely voluntary and no patients were denied emergency care.

Selection of Participants

Patients were eligible for inclusion if they presented to the ED for selected problems that a layperson would be expected to identify as nonemergency: specifically, symptoms consistent with a simple urinary tract infection; sore throat; medication refill request; nontraumatic joint or back pain; symptoms typical for "a cold" or upper respiratory infection; or patients requesting to be treated for a known chronic illness, including headache, hypertension, or diabetes without an acute complication. Patients were aged 23 years or older because younger patients attend a separate pediatric ED. We excluded patients if their temperature was greater than 101°F (38.3°C) or they arrived by ambulance. Also, patients were excluded if the triage nurse judged that they required care in the ED for any reason (for example, patients with complex medical histories, abnormal vital signs, or concerning additional complaints). Patients could be enrolled only once in the study.

A research specialist identified eligible patients in coordination with the triage nurse. Enrollment occurred from January 2007 to 2008, 9 AM to 3 PM, on weekdays when the Primary Care Clinic was open. Patients with a personal physician outside the study hospital's system were enrolled but not eligible for the intervention because it would be poor patient care to assign them a new physician. However, data were collected for their use as a secondary comparison group.

Assignment to usual care in the ED Urgent Care ("ED Urgent Care group") versus the Primary Care Clinic intervention ("Primary Care Clinic group") was based on where care was expected to result in the least delay. If patients completed their baseline survey before an ED Urgent Care provider was ready to treat them, they were taken to the Primary Care Clinic if a timely open clinic slot was available. These patients formed the Primary Care Clinic group. If an ED Urgent Care provider became available at any time while patients completed a baseline survey, or if no timely slots were available in the Primary Care Clinic, patients remained in the ED Urgent Care and formed the ED Urgent Care group. ED Urgent Care providers treat patients in the order in which they arrive; thus, patient characteristics did not affect group assignment. Patients assigned to the Primary Care Clinic group could refuse transfer and instead be treated in the ED Urgent Care but were still considered part of the Primary Care Clinic group in an intention-to-treat analysis.

Available Primary Care Clinic slots were tracked by the Primary Care Clinic patient navigator, who communicated this information to the ED navigator by using an Intranet voiceover IP system (Vocera Communications, Inc., San Jose, CA). The

Primary Care Clinic has a certain number of walk-in slots per day. The patient navigator could estimate the wait for care in the Primary Care Clinic according to the number of patients already on the walk-in list. Given long wait times at our hospital's ED Urgent Care, if there was an open Primary Care Clinic slot with an estimated wait less than 2 to 4 hours, it was almost always deemed faster for patients to be treated there. To ensure that the intervention did not result in delayed patient care, patients taken to the Primary Care Clinic were kept on the ED Urgent Care patient list, and if their name was called to be treated while they were still in the Primary Care Clinic waiting room, they would be returned to the ED Urgent Care for care. This never actually occurred, meaning that patient navigators performed well at estimating when care would be most timely in the Primary Care Clinic versus the ED Urgent Care.

Interventions

A patient navigator escorted patients from the ED waiting room to the Primary Care Clinic. Patients received an orientation to clinic resources and were assisted with registration. Individuals who already had a physician at our study hospital consulted that physician if he or she was available. New patients were assigned a personal physician (generally a resident supervised by an attending physician). The provider addressed the patient's current problem(s) and established a plan of care, including follow-up visits, referrals, and prescriptions as needed. Patients were given a card with their personal physician's name and clinic telephone numbers. Uninsured patients were assisted with public insurance applications or enrolled in our hospital's fee-scaling plan.

Control group patients received care as they usually would in the ED Urgent Care. Treating physicians were not informed that patients were part of a research study. When the study was conducted, most ED Urgent Care patients were given Primary Care Clinic follow-up appointments at discharge. Those who did not receive an actual appointment were given a telephone number to call for one. Patient navigators remained with patients in both the Primary Care Clinic and ED Urgent Care to ensure that they were able to consult a medical provider (ie, that no patients were turned away from the Primary Care Clinic or had other problems receiving care in either location). Some patients in both groups decided to leave without being seen, which was also tracked by the patient navigators.

Methods of Measurement

Trained patient navigators administered a baseline survey to all patients, which included basic demographic and health-related questions. Patients completed satisfaction surveys after their care was finished. Surveys were administered verbally in the patient's preferred language. A dual-headset translation telephone system was used for non-English-speaking patients. A follow-up telephone survey was conducted 6 months after the index visit. Data on ED and Primary Care Clinic patient visits 12 months before and after the index visit were obtained from

our hospital's billing database, which captures all visits made to the ED and clinics.

Outcome Measures

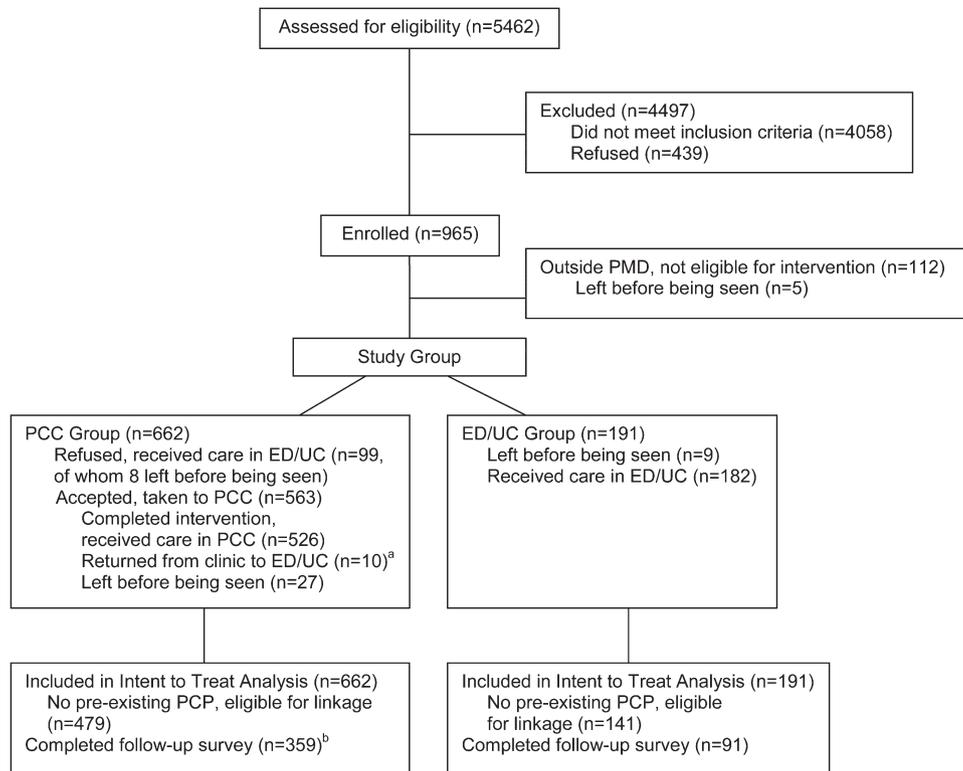
The primary outcome was primary care follow-up among patients who previously did not have a usual source of care. We defined primary care follow-up as having made at least 1 visit to the study hospital's Primary Care Clinic, as tracked with our hospital's administrative database, in the year after the intervention for patients who previously had no personal physician. Thus, for patients in the intervention group, this would represent having at least some degree of continuity of care, as represented by having a follow-up visit after the index clinic visit. Secondary outcomes included the number of ED and Primary Care Clinic visits in the 12 months before and after enrollment, patient satisfaction, and self-report of having a personal physician at 6-month follow-up.

Primary Data Analysis

An intention-to-treat analysis was conducted; patients assigned to the Primary Care Clinic group but who refused to go and instead received care in the ED Urgent Care were still included in the Primary Care Clinic group. Patient characteristics were analyzed as simple means or proportions. Multiple imputation methods²⁵⁻²⁸ were used when missing data exceeded 5% of the sample, which occurred only for the secondary outcomes patient satisfaction and the 6-month follow-up surveys used to corroborate hospital billing data findings (see methods in Appendix E1, available online at <http://www.annemergmed.com>).

Because assignment to study groups was not randomized but rather a quasi-random process based on clinic availability, we used multiple logistic regression to control for potential confounders. Modeling was based on theory, including the following potential confounders regardless of statistical significance: age, sex, race, insurance, education, previous Primary Care Clinic use, previous ED use, and self-reported health. Model goodness of fit was assessed with Hosmer-Lemeshow testing and receiver operating characteristic (ROC) curve analysis (see results in Appendix E2, available online at <http://www.annemergmed.com>). Sensitivity analysis also included isolation of treatment effects whereby subjects were assigned according to actual treatment location and those who left without being seen were removed.

Graphic analysis²⁹ and differences-in-differences multivariate linear regression modeling³⁰ accounting for potential confounders as described above were used to assess changes in pre- and postintervention ED and Primary Care Clinic visits among the groups. Model assumptions were tested with multiple methods (see results in Appendix E2, available online at <http://www.annemergmed.com>). Analyses were conducted with Stata (version 12; StataCorp, College Station, TX).



^aIncludes 7 patients who PCC providers sent back to the ED/UC for a higher level of care (3 were discharged and 4 were admitted to hospital) and 3 patients who chose to return to ED/UC after having initially been taken to the PCC (all were discharged by ED providers). Details on these patients are in Table E1 and Table E2.

^b6-month patient telephone follow-up surveys. The 12 month pre- and post-intervention ED and clinic visit data, including that used to determine the primary outcome of primary care follow-up, were taken from the hospital administrative database and were available for all patients in each group.

Figure 1. Consolidated Standards of Reporting Trials patient flow diagram.

RESULTS

Of 1,404 eligible patients, 439 refused and 965 were enrolled (Figure 1). Overall, 191 patients were assigned to the ED Urgent Care group and 662 to the Primary Care Clinic group. Ninety-nine Primary Care Clinic group patients refused the intervention and remained in the ED Urgent Care. Reasons for refusal included needing medication refills (at our hospital's pharmacy, prescriptions are free only if originating from the ED), believing that care would be quicker in the ED, and fearing extra charges for Primary Care Clinic care. Rates of leaving without being seen were 5.3% for the Primary Care Clinic group (4.8% among those who actually went to the Primary Care Clinic) and 4.7% for the ED Urgent Care group, which compare favorably to the overall rate of 5.7% at our hospital's ED Urgent Care.

Ten patients were admitted to the hospital during their study visit, 4 from the Primary Care Clinic group and 6 who remained in the ED Urgent Care (Table E1, available online at <http://www.annemergmed.com>). In brief, the ED Urgent Care patient admissions included elective substance abuse treatment, community-acquired pneumonia, stress fracture, gout/pain control, "failure to care for self," and fever evaluation. The 4 Primary Care Clinic admissions included a patient with a 1-day

admission for drug intoxication and fatty liver, 1 who complained of homicidal thoughts and was admitted to psychiatry (with a discharge diagnosis of "opiate abuse, rule out malingering"), 1 with a septic knee, and 1 ultimately receiving a diagnosis of endocarditis who had presented with fever and was incorrectly enrolled in the study. Medical record review revealed that none of these admitted patients experienced adverse outcomes because of the short delay from being transferred to the Primary Care Clinic. In addition, Primary Care Clinic providers returned 3 patients to the ED for further testing who were subsequently discharged by ED providers (Table E2, available online at <http://www.annemergmed.com>). To explore other potential adverse outcomes from transfer to the Primary Care Clinic, we followed patient hospitalizations and ED revisits for 2 weeks after the study visit. Primary Care Clinic group patients were no more likely than ED Urgent Care group patients to experience these events (see results in Appendix E2, available online at <http://www.annemergmed.com>).

Characteristics of Study Subjects

The sample population was racially and ethnically diverse, was often uninsured, and had low levels of education (Table 1). ED Urgent Care and Primary Care Clinic group patients were

Table 1. Baseline patient characteristics by group.

Variables	No. (%)		
	ED/UC (n=191)*	PCC (n=662)	Outside Personal Physician (n=112)
Age, mean y	46.3	47.3	44.5
Male patients	110 (57.9)	383 (58.2)	65 (58.0)
Uninsured	98 (51.6)	344 (52.4)	33 (29.5)
Unemployed	124 (64.9)	448 (67.7)	56 (50.0)
No personal physician	141 (74.6)	479 (72.4)	0 (N/A)
Ethnicity			
Black	50 (26.3)	164 (24.9)	27 (24.1)
Latino	82 (43.2)	288 (43.8)	35 (31.3)
White	26 (13.7)	76 (11.6)	30 (26.8)
Asian	23 (12.1)	96 (14.6)	17 (15.2)
Other	9 (4.7)	34 (5.2)	3 (2.7)
Education			
Less than 8th grade	44 (23.5)	172 (26.4)	14 (12.5)
Some high school	25 (13.4)	105 (16.1)	13 (11.6)
High school or equivalent	53 (28.3)	208 (31.9)	35 (31.3)
Some college	35 (18.7)	79 (12.1)	19 (17.0)
College and beyond	30 (16.0)	88 (13.5)	31 (27.7)
Primary language			
English	81 (42.6)	285 (43.4)	65 (58.0)
Spanish	67 (35.3)	224 (34.1)	26 (23.2)
Other or bilingual	42 (22.1)	148 (22.5)	21 (18.8)
Self-rated health			
Poor	26 (13.6)	110 (16.6)	14 (12.5)
Fair	55 (28.8)	200 (30.2)	32 (28.6)
Good	61 (31.9)	250 (37.8)	37 (33.0)
Very good/excellent	49 (25.7)	102 (15.4)	29 (25.9)
Chief complaint			
Back pain	67 (36.2)	242 (37.7)	43 (39.8)
Medication refill	41 (22.2)	155 (24.1)	22 (20.4)
Sore throat	19 (10.3)	50 (7.8)	9 (8.3)
Chronic condition	17 (9.2)	69 (10.8)	10 (9.3)
Urinary complaint	16 (8.7)	40 (6.2)	9 (8.3)
Upper respiratory infection	25 (13.5)	86 (13.4)	15 (13.9)

UC, Urgent Care; PCC, Primary Care Clinic; N/A, not applicable.

*Percentages do not always correspond to total group n because of variable response rates to some questions (missing data <5%).

similar across all measures, except that more ED Urgent Care group patients reported “very good” or “excellent” health and ED Urgent Care group patients had a trend toward more education. Compared with the ED Urgent Care and Primary Care Clinic groups, patients having a personal physician outside our hospital were more educated, were less likely to be Latino, were more likely to be insured and employed, and more often spoke English at home (Table 1).

Primary Care Clinic group patients were more likely to achieve successful primary care follow-up than ED Urgent Care group patients in both unadjusted and adjusted models (Table 2). The adjusted risk difference for primary care follow-up between the Primary Care Clinic group and ED Urgent Care group, using an intention-to-treat analysis, was 9.3% (95% confidence interval [CI] 2.2% to 16.3%), with a number needed to treat of 11 patients to have 1 additional patient achieving primary care follow-up. Treatment effect

results were larger, as would be expected (Table 2). Multiple logistic regression (see results in Appendix E2, available online at <http://www.annemergmed.com>) using intention-to-treat group assignment showed that Primary Care Clinic group patients had 1.72 times the odds of achieving primary care follow-up compared with the ED Urgent Care group (95% CI 1.12 to 2.64). All models exhibited good fit (see results in Appendix E2, available online at <http://www.annemergmed.com>).

Results were corroborated with 6-month telephone follow-up survey data, which in adjusted intention-to-treat analyses yielded similarly increased odds of Primary Care Clinic group patients having a self-reported personal physician versus the ED Urgent Care group (odds ratio 1.58; 95% CI 0.95 to 2.63). This finding suggests that our hospital billing data parameter for follow-up within 1 year of the index visit was a reasonable proxy for establishing a primary care provider.

Figure 2 presents histograms showing patients’ numbers of ED and clinic visits in the 12 months before and after the study visit, with patients who had preexisting outside personal physicians (the personal physician outside group) serving as an additional comparison group. Graphic analysis shows that ED visits did not significantly change after the intervention. Patients in the Primary Care Clinic and personal physician outside groups trended toward having more Primary Care Clinic visits after the intervention compared with patients in the ED Urgent Care group.

Difference-in-differences modeling of postintervention versus preintervention visits for the Primary Care Clinic group versus ED Urgent Care group yielded adjusted mean difference-in-differences of -0.23 (95% CI -0.61 to 0.16) for ED visits and 0.40 (95% CI -0.22 to 1.02) for Primary Care Clinic visits (Table 3). Thus, though results were not statistically significant, there was a trend toward Primary Care Clinic group patients having decreased ED visits and increased Primary Care Clinic visits in the year after the intervention compared with the ED Urgent Care group. Unadjusted results were similar. Full models, regression tables, and regression diagnostics are presented in the results in Appendix E2 (available online at <http://www.annemergmed.com>).

Satisfaction surveys were completed by 686 (71%) patients; missing data were imputed as described earlier. In unadjusted models, Primary Care Clinic group patients rated their care as “very good” more often than those in the ED Urgent Care and outside personal physician comparison groups (66.7% [95% CI 62% to 71%], 52.2% [95% CI 44% to 61%], and 49.4% [95% CI 39% to 60%], respectively). Results from multiple logistic regression modeling confirmed the unadjusted observations because the odds of an individual in the Primary Care Clinic group rating care as “very good” was 1.85 (95% CI 1.23 to 2.77) times the odds of someone in the ED Urgent Care group (see results in Appendix E2, available online at <http://www.annemergmed.com>).

Table 2. Primary care follow-up.*

	ED/UC Group	PCC Group
Unadjusted, n (% , 95% CI)		
Intention to treat	n=141	n=479
Patient follow-up	52 (36.9, 28.9–45.4)	241 (50.3, 45.7–54.9)
Risk difference (PCC vs ED/UC group), %		+13.4 (4.3–22.6)
Treatment effect†	n=201	n=387
Patient follow-up	70 (34.8, 28.3–41.8)	216 (55.8, 50.7–60.8)
Risk difference (PCC vs ED/UC group), %		+19.8 (11.8–27.8)
Adjusted, % (95% CI)†		
Intention to treat		
Patient follow-up	37.9 (30.4–46.0)	47.2 (43.5–50.9)
Risk difference (PCC vs ED/UC group), %		+9.3 (2.2–16.3)
Treatment effect		
Patient follow-up	35.9 (29.8–42.3)	47.2 (43.5–50.8)
Risk difference (PCC vs ED/UC group), %		+11.3 (6.0–16.5)

*Among patients who had no previous PCP and thus were eligible for the primary outcome.

†In treatment effect analysis, patients were analyzed according to where they actually received care.

‡Estimated risks adjusting for age, sex, race, education, insurance, previous PCC and ED/UC visits, and self-reported health.

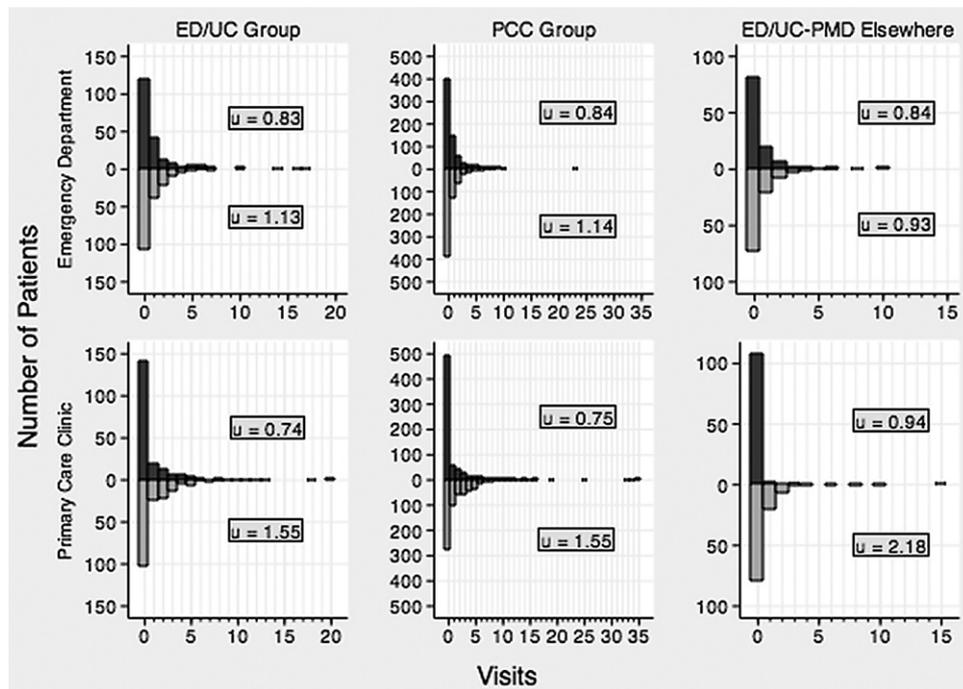


Figure 2. Adjacent histograms by study group for ED and Primary Care Clinic visits 1 year before and after receiving the intervention. Dark grey bars above the 0 point (y axis) indicate total visits in the 12 months before receiving the intervention. Light grey bars indicate total visits in the 12 months after the intervention. The index visit is excluded. Axes differ between study groups to maintain clarity for assessing outliers having more than 10 visits in either period. Means are indicated (u).

LIMITATIONS

This study was conducted at one safety net hospital and the findings may not be generalizable to other hospitals. However, we are encouraged that our intervention resulted in increased primary care follow-up, even considering the challenges inherent in working with our high-risk patient population. Additionally, 31% of eligible patients refused study enrollment, and thus our findings may not be generalizable to all users of the ED.

We could track health care use only at our hospital, and it is possible that patients received care elsewhere. We have no reason to believe this would occur differentially in the study groups, and corroboration of the primary outcome with the follow-up surveys makes this scenario less likely. It is also possible that we missed some adverse events such as patients presenting to other hospital EDs after the index study visit.

Finally, this was not a randomized trial. Though the Primary Care Clinic and ED Urgent Care groups were similar in

Table 3. ED and Primary Care Clinic visits.*

	ED/UC Group	PCC Group
	n=191	n=662
ED visits		
Mean difference ED visits, unadjusted (95% CI)	0.30 (0.03 to 0.58)	0.09 (−0.04 to 0.23)
Mean difference ED visits, adjusted (95% CI)	0.31 (0.27 to 0.34)	0.08 (0.07 to 0.10)
Differences in differences ED visits, unadjusted (95% CI)		−0.21 (−0.61 to 0.18)
Differences in differences ED, adjusted (95% CI)		−0.23 (−0.61 to 0.16)
PCC visits		
Mean difference PCC visits, unadjusted (95% CI)	0.80 (0.48 to 1.1)	1.2 (0.99 to 1.5)
Mean difference PCC visits, adjusted (95% CI)	0.81 (0.72 to 0.89)	1.2 (1.1 to 1.3)
Differences in differences PCC visits, unadjusted (95% CI)		0.44 (−0.22 to 1.1)
Differences in differences PCC adjusted (95% CI)		0.40 (−0.22 to 1.0)

*Differences in ED and PCC visits 12 months postintervention versus 12 months preintervention and differences in differences for the PCC group versus ED/UC group.

baseline characteristics and known differences were controlled for in multivariable models, there may be unmeasured confounders. We believe this is unlikely because there were clearly outlined protocols for study group assignment based on factors external to the patient, and regression diagnostics suggest no omitted variable bias. Though random assignment would likely have led to balanced treatment groups with respect to potential confounders, the downside of ethical and legal issues such as potential delays to patients' care outweighed the benefits.

DISCUSSION

An intervention navigating low-acuity ED patients to the Primary Care Clinic resulted in significant improvement in future primary care follow-up compared with usual ED referral practices. For Primary Care Clinic group patients, this meant at least 2 visits to the same Primary Care Clinic within 1 year: the index study visit and at least 1 follow-up visit. In contrast, most previous ED-based interventions used the outcome of a single follow-up visit after the ED visit. We believe the initial continuity of care shown in our study is a first step toward linkage with a usual source of primary care.

Only one third of our patients identified having a personal physician at baseline, well below national averages.^{1,2} Healthy People 2020 proposes that 84% of patients have a usual source of care; much work is needed for high-risk ED populations to meet this goal. Previous studies have found differing

proportions of ED patients reporting a usual source of care. One national community-based telephone survey found that 83% of respondents who self-reported an ED visit in the previous year also self-reported having a usual source of care.³¹ However, this may be a significant overestimation, given a low response rate (56%) and the likelihood that many of the highest-risk ED users may be difficult to reach by telephone.³¹ A national study of ambulatory patients in 56 EDs (primarily urban teaching hospitals) found that 67% reported having a usual source of care other than the ED.² As suggested in our study, this number may be even lower at certain safety net EDs.

Previous studies found sparse primary care follow-up after an ED visit, with rates as low as 1% among safety net ED patients.³² Even after interventions such as enhanced referral and appointment systems, patient support, and reminders, follow-up rates after an ED visit peak at approximately 65%, with most between 20% and 50%.^{13,15-19,21,22,33,34} Evidence suggests that ED patients who have 1 follow-up visit with primary care may be more likely to have subsequent visits,^{17,19} and thus we hypothesized that immediate interaction with a Primary Care Clinic provider at an ED visit would facilitate successful future follow-up. Our intervention also removed a known barrier to primary care access, lack of health insurance,^{16,21} by enrolling patients in our hospital's fee-scaling plan or public insurance when eligible. The intervention resulted in a 9.3% absolute improvement in primary care follow-up, with a number needed to treat of 11 patients.

Though intervention patients trended toward having reduced postintervention ED visits, results were not statistically significant. In addition, the numbers of visits were small and of unclear clinical significance. Our intervention targeted all visitors, who mostly had low levels of ED use at baseline. Attempts to decrease nonurgent ED use, particularly among patients who are already infrequent users of EDs, are unlikely to significantly decrease ED crowding or costs.³⁵⁻⁴¹ On the other hand, increased primary care linkage might result in improved care for chronic health conditions affecting millions of people, which could lead to long-term cost savings. As future health reforms begin financially rewarding hospitals for care coordination and quality of services rather than quantity, there will be increasing incentives for programs like ours that connect ED patients to a primary care home. In addition, as more Americans obtain health insurance, there will be a need to link these newly insured—who may initially seek ED care for lack of another option—with usual sources of primary care.

Others considering similar programs should acknowledge some unique aspects of our study. Because of the geographic proximity of the ED and Primary Care Clinic at our hospital, we could ensure timely same-day care for patients under close supervision from patient navigators. Also, the triage nurse could overrule study enrollment and patients themselves could choose to remain in the ED for their care. Despite numerous studies examining the issue, no consensus exists on how to define “nonurgent” and, in brief, such determinations are fraught with

difficulty.⁴²⁻⁴⁴ Therefore, we were careful to avoid the dangers inherent in interventions whereby patients referred out of the ED are not guaranteed to consult a physician the same day.⁴⁵⁻⁴⁸ The positive results of our study do not imply the advisability of such programs. Despite careful screening, 10 of our study patients were ultimately admitted to the hospital. This finding underscores the danger of cost-cutting measures proposed by state Medicaid agencies and other insurers that would restrict “nonemergency” ED use,⁴⁹ as well as hospital practices to triage “nonemergency” patients away from the ED.⁵⁰

Though patients were eligible for the study if they presented with diagnoses we believed a layperson would most likely identify as nonemergent, we do not mean to imply that patients alone can make accurate and safe determinations about the urgency of their conditions. We also observed in our study that the admission rate was slightly higher for patients treated in the ED Urgent Care versus those treated in the Primary Care Clinic (1.5% versus 0.7%). We believe the most likely explanation is that emergency physicians at our hospital have a lower threshold for admitting patients than Primary Care Clinic physicians, though others attempting similar interventions should conduct patient follow-up to ensure that inappropriate discharges of sick patients are not occurring from the clinic, where physicians may not be as attuned to subtle, life-threatening illnesses.

Connecting patients with primary care is just the first step. In some clinics, patients are shuffled from provider to provider, rather than establishing a relationship with a single provider. Evidence suggests that having a usual provider is beneficial above and beyond having access to primary care.⁵¹ Even with a usual source of care, patients face barriers such as the inability to obtain timely appointments, not being able to get through on the telephone, and lack of transportation.^{52,53} In addition, patients sometimes call their physicians’ offices and are directed to the ED.² Clinics are often closed on evenings or weekends. Patients may continue to preferentially use EDs, and reasonably so, unless these and other barriers to accessing primary care are addressed.

EDs are the safety net for vulnerable populations, caring for patients who are unable to receive care elsewhere. Therefore, the definition of what constitutes an emergency must remain in the hands of patients and they must not be turned away without care. It is this vulnerable patient population that also positions EDs as important points of intervention for patients who might not have other contact with the health care system.^{54,55} EDs can be ideal places to initiate public health interventions such as linking patients to primary care, and the current study demonstrated success with such an intervention. Future studies should examine whether improvements in primary care follow-up such as those shown in this study result in sustained linkage with a usual source of care and whether this ultimately translates to better health outcomes for patients.

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Author contributions: ACC, RAH, ABW, MT, MHA, and LRG conceived of the study and designed the trial. RAH, MHA, and LRG obtained funding. RAH and LRG provided study supervision. KMD, ACC, and CKN participated in data acquisition and management. KMD, ACC, NDW, and SPW analyzed and interpreted the data. SPW performed statistical analysis. KMD and SPW drafted the article, and all authors provided critical revision of it. SPW had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. SPW takes responsibility for the paper as a whole.

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e-Appendix 1: Methods**Multiple imputation for missing data.**

Of the 965 enrolled patients, 509 (52.7%) answered the six-month follow up question as to whether they had a personal physician at the time of the telephone survey; 686 (71.1%) answered the overall satisfaction question at the time of the index study visit. Few patients reported care as being “very poor,” leading to the category to be dropped in some imputed data sets. Consequently, overall satisfaction categories were combined into “poor,” “good,” and “very good” prior to multiple imputation procedures. We used a Markov Chain Monte Carlo method to generate 20 multiply-imputed datasets using 100 burn-in iterations, each analyzed independently and combined using Rubin’s rules to appropriately account for within- and between-dataset variance. Multiple imputation models included all relevant variables in the dataset for which there were no missing data including outcomes and demographics. Trace plots for all missing variables showed no apparent trends in the summaries of the imputed values, so the number of burn-in iterations, 100, seemed adequate. Chain plots for each imputed variable showed oscillations around the observed mean estimates, providing some evidence of algorithm convergence.

e-Appendix 2: Results

ED revisits and hospitalizations after the study visit. To explore other potential adverse outcomes from transfer to the PCC, we followed patient hospitalizations and ED-revisits for two weeks after the index study visit. Two weeks was selected as a period of time during which patient ED visits might potentially be related to the presenting problem at or care received during the index study visit. Of patients receiving care in the PCC or leaving without being seen from the PCC, 0.7% had a hospitalization and 3.8% had a treat and release ED visit within two weeks after the index study visit. This compares favorably to the group of patients who received care in the ED/UC or left without being seen from the ED/UC, of whom 1.0% were hospitalized and 6.8% returned to the ED within two weeks after the index study visit. Using the more commonly used three-day “bounce back” period we found that, among patients transferred to the PCC for care, no patients were hospitalized and 0.5% returned for a treat-and-release ED visit. Among patients remaining in the ED/UC for care, 0.5% were hospitalized and 2.4% returned for a treat-and-release ED visit within three days of the index study visit.

Logistic regression for primary outcome. Below are the full results for the logistic regression for the primary study outcome of having at least one follow-up visit in the Primary Care Clinic after the index study visit for patients with no prior usual care doctor. Below the logistic regression results are the results of the diagnostic tests indicating model suitability including the Hosmer-Lemeshow goodness of fit test and the receiver operating characteristic (ROC) curve.

```

Logistic regression, intention to treat analysis
Number of obs      =          617
Wald chi2(12)     =          67.52
Prob > chi2       =          0.0000
Pseudo R2        =          0.0916

Log pseudolikelihood = -387.61316
    
```

linkage	Odds Ratio	Robust Std. Err.	z	P> z	[95% Conf. Interval]
newgroup	1.72486	.3748113	2.51	0.012	1.126648 2.640703
edbefore	.9644656	.072857	-0.48	0.632	.8317368 1.118375
clinicbefore	1.755284	.3571373	2.77	0.006	1.178035 2.615389
sex	1.423707	.2573189	1.95	0.051	.9990232 2.028924
age	1.044453	.0074755	6.08	0.000	1.029904 1.059208
Asian	1.006618	.459634	0.01	0.988	.4113347 2.463392
AfAm	1.057092	.2250452	0.26	0.794	.6964658 1.604448
Latino	1.024621	.0794526	0.31	0.754	.8801533 1.192802
ltHS	1.044619	.2316374	0.20	0.844	.6764091 1.613267
HS	1.174579	.2616421	0.72	0.470	.7590558 1.817568
New_Health	.9462	.0910495	-0.57	0.565	.7835646 1.142592
New_Insured	1.843894	.3463893	3.26	0.001	1.275944 2.664652
_cons	.0478331	.026047	-5.58	0.000	.0164519 .1390723

Total number of observations used: 617

Asymmetric 95% CIs for the untransformed proportions under Scenario 0 and Scenario 1 and for the untransformed population attributable risk (PAR)

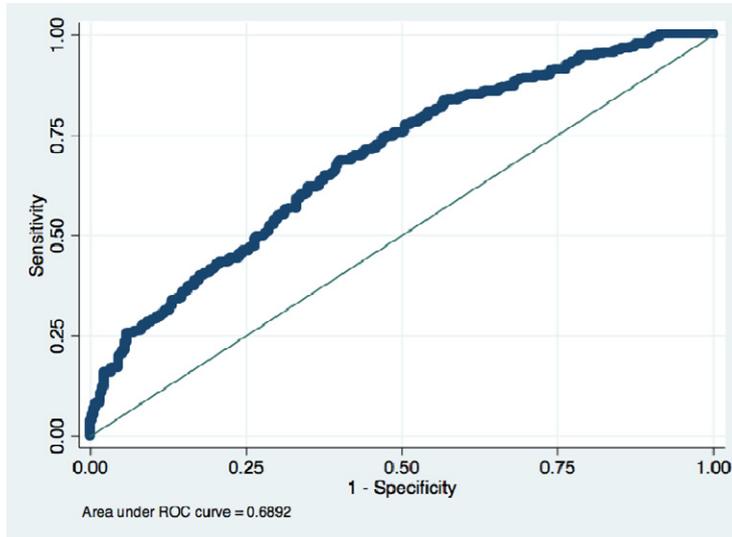
	Estimate	Minimum	Maximum
Scenario_0	.47163695	.43478073	.50880501
Scenario_1	.37891314	.30365027	.4604944
PAR	.09272381	.02167058	.16284507

Logistic model for linkage, goodness-of-fit test
 number of observations = 617

```

number of covariate patterns =      601
      Pearson chi2(588) =      598.68
      Prob > chi2 =      0.3711
. lroc

Logistic model for linkage
number of observations =      617
area under ROC curve =      0.6892
    
```



Logistic regression, Treatment Effect

```

Number of obs =      617
Wald chi2(12) =      74.38
Prob > chi2 =      0.0000
Pseudo R2 =      0.1044
Log pseudolikelihood = -382.14843
    
```

linkage	Odds Ratio	Robust Std. Err.	z	P> z	[95% Conf. Interval]
newgroup	2.182315	.4148911	4.10	0.000	1.503457 3.167698
edbefore	.9709078	.0726873	-0.39	0.693	.8384024 1.124355
clinicbefore	1.776113	.3614859	2.82	0.005	1.191869 2.646748
sex	1.386631	.2556301	1.77	0.076	.9661381 1.990137
age	1.044489	.0075854	5.99	0.000	1.029727 1.059462
Asian	.9856506	.447722	-0.03	0.975	.404644 2.400893
AfAm	1.064838	.2283874	0.29	0.770	.6993858 1.62125
Latino	1.017313	.0789365	0.22	0.825	.87379 1.184409
ltHS	1.021285	.227895	0.09	0.925	.6594854 1.581571
HS	1.14408	.2578073	0.60	0.550	.7356076 1.77937
New_Health	.9479228	.0920038	-0.55	0.582	.7837125 1.14654
New_Insured	1.783747	.3389221	3.05	0.002	1.229137 2.588609
_cons	.0454458	.0243189	-5.78	0.000	.0159221 .1297141

Asymmetric 95% CIs for the untransformed proportions
 under Scenario 0 and Scenario 1
 and for the untransformed population attributable risk (PAR)

	Estimate	Minimum	Maximum
Scenario_0	.47163695	.43512233	.50845763
Scenario_1	.35868583	.29839401	.42380128
PAR	.11295112	.06015729	.16511478

Logistic model for linkage, goodness-of-fit test

number of observations =	617
number of covariate patterns =	605
Pearson chi2(592) =	599.38
Prob > chi2 =	0.4079

Logistic model for linkage

number of observations =	617
area under ROC curve =	0.7048

Difference-in-Differences Models and Regression Tables. Model assumptions were tested through assessing linearity (augmented component plus residual plots for variables), normality (standardized normal probability plot and quantiles of a variable against the quantiles of a normal distribution plot), homoscedasticity (residuals plotted against the fitted values), independence (errors associated with one observation are not correlated with the errors of any other observation), model specification (regression specification error test - RESET for omitted variables), influence (stem-and-leaf plot for studentized residuals & leverage by residual squared plot), and multicollinearity (variance inflation factors for variables). Regression diagnostics showed model assumptions held aside from there being influential cases identified as frequent users and a deviation from normality, as difference data was heavily centered around having zeros, given known visit data patterns. A decision was made to retain the influential data to report the programmatic effect on visit behavior, and the deviation from normality likely leads to widened confidence intervals, biasing the results towards having no effect. Full results of the difference-in-differences regression models for ED visits and clinic visits are presented below. The “pt” variable is the differences-in-differences estimator for each regression.

Emergency Visits diff in diff regression

Source	SS	df	MS	Number of obs =	1696
Model	253.739422	12	21.1449518	F(12, 1683) =	7.39
Residual	4816.81659	1683	2.86204194	Prob > F =	0.0000
Total	5070.55601	1695	2.99147847	R-squared =	0.0500
				Adj R-squared =	0.0433
				Root MSE =	1.6918

Evisit	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
pt	-.2254199	.1970431	-1.14	0.253	-.6118952 .1610553
newgroup	-.0035761	.1397845	-0.03	0.980	-.2777457 .2705936
postx	.3105263	.1735706	1.79	0.074	-.0299107 .6509633
sex	-.2022375	.0848541	-2.38	0.017	-.3686681 -.0358069
age	.0082434	.0031734	2.60	0.009	.0020191 .0144677
Asian	.1663121	.218583	0.76	0.447	-.2624111 .5950353
AfAm	.1852973	.1031869	1.80	0.073	-.0170907 .3876854
Latino	-.0348039	.0371777	-0.94	0.349	-.1077234 .0381156
ltHS	-.0522495	.1045213	-0.50	0.617	-.257255 .1527559
HS	.0836529	.1078902	0.78	0.438	-.1279603 .2952661
New_Health	-.0491902	.0445666	-1.10	0.270	-.1366021 .0382216
New_Insured	-.5721367	.0849405	-6.74	0.000	-.7387368 -.4055366
_cons	.9248131	.2605843	3.55	0.000	.4137097 1.435916

Clinic Visits diff in diff regression

Source	SS	df	MS	Number of obs =	1695
Model	1961.94652	12	163.495543	F(12, 1682) =	22.11
Residual	12436.5349	1682	7.39389708	Prob > F =	0.0000
Total	14398.4814	1694	8.49969387	R-squared =	0.1363
				Adj R-squared =	0.1301
				Root MSE =	2.7192

Cvisit	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
pt	.4023467	.3167358	1.27	0.204	-.2188911 1.023584
newgroup	.0989609	.224677	0.44	0.660	-.3417149 .5396368
postx	.8052632	.2789812	2.89	0.004	.2580764 1.35245
sex	.4595829	.136417	3.37	0.001	.192018 .7271478
age	.0558052	.0051007	10.94	0.000	.0458009 .0658096
Asian	-.3535604	.3513409	-1.01	0.314	-1.042672 .3355511
AfAm	-.0865874	.1658538	-0.52	0.602	-.411889 .2387143
Latino	.0229642	.059781	0.38	0.701	-.0942889 .1402172
ltHS	-.0956612	.1680032	-0.57	0.569	-.4251786 .2338561
HS	.3747802	.1735048	2.16	0.031	.0344722 .7150881
New_Health	-.1218997	.07164	-1.70	0.089	-.2624126 .0186132
New_Insured	-.5028311	.1365414	-3.68	0.000	-.77064 -.2350222
_cons	-1.46818	.418906	-3.50	0.000	-2.289812 -.6465479

Logistic Regression for Patient Satisfaction. PCC Group and PMD Outside Group compared to ED/UC Group as reference.

```

Multiple-imputation estimates          Imputations =          20
Logistic regression                   Number of obs =         959
                                       Average RVI   =         0.3415
                                       Largest FMI   =         0.3632
DF adjustment:  Large sample          DF:    min    =         150.93
                                       avg      =         666.97
                                       max      =        3293.51
Model F test:      Equal FMI          F( 13, 3754.2) =          3.04
Within VCE type:   OIM                Prob > F    =         0.0002
    
```

New_Satisfy	Odds Ratio	Std. Err.	t	P> t	[95% Conf. Interval]	
PCCdum	1.849837	.378994	3.00	0.003	1.235291	2.770113
EDpmdoutdum	1.083142	.3075244	0.28	0.779	.6197076	1.893146
edbefore	.9934219	.0596453	-0.11	0.913	.882367	1.118454
clinicbefore	1.012434	.036507	0.34	0.732	.943224	1.086722
sex	.8154779	.1375276	-1.21	0.228	.5848888	1.136975
age	1.006525	.0062905	1.04	0.299	.9942199	1.018982
Asian	1.411252	.5770515	0.84	0.400	.6330321	3.146177
AfAm	.9763716	.208699	-0.11	0.911	.6402371	1.488982
Latino	.9015967	.0620508	-1.51	0.132	.7877687	1.031872
ltHS	1.498892	.287573	2.11	0.035	1.028283	2.18488
HS	1.517471	.3028492	2.09	0.037	1.025134	2.24626
New_Health	1.179099	.1054265	1.84	0.067	.9885081	1.406437
New_Insured	1.912335	.3489329	3.55	0.001	1.333505	2.742416
_cons	.3362146	.1604402	-2.28	0.023	.1315241	.8594643

Table E1. Patients admitted to the hospital at their study enrollment visit.**PCC Group (n=4)**

Patient 1: Chief complaint at ED triage was back pain. At clinic he complained of abdominal pain for one month and requested detoxification services. While labs being drawn patient noted to have "altered mental status," felt likely secondary to drug intoxication. Sent back to ED for further workup, found to have elevated liver function enzymes and ultrasound showed only fatty liver. Patient was admitted to hospital for "altered mental status," but had positive opiate drug screen and was discharged the next day without further intervention.

Patient 2: Chief complaint at ED triage was back pain. While waiting to see doctor decided to return to ED. Was seen in psychiatric ED complaining of being bipolar and having homicidal thoughts, and requesting medications including Xanax. Patient was admitted to psychiatric floor, discharged one week later with diagnosis of "opiate abuse, rule-out malingering" and was felt not to be a danger to self or others.

Patient 3: Chief complaint right knee pain for one week, afebrile. Seen in clinic where physician had concern for septic joint and returned patient to ED. Patient admitted, and found to have purulence in prepatellar area necessitating IV antibiotics and wash-out in operating room (this all occurred during his inpatient stay, not while in the ED). He was discharged one week later.

Patient 4^a: 77-year-old woman whose chief complaint in ED triage was back pain. When patient arrived at clinic she was noted to be febrile (101.9°F/38.8°C) and tachycardic (114), and was complaining of malaise and body aches. She was sent back to the ED where she was admitted for a fever workup, developed cellulitis in her arm and septic arthritis in her knees, and was ultimately diagnosed with endocarditis. She was discharged to a nursing home three weeks after admission.

ED/UC Group (n=5)

Patient 1: Chief complaint at ED triage was foot pain. When saw provider requested detoxification from opiates and cocaine, and he was admitted to the detoxification service.

Patient 2: Chief complaint productive cough. On further history patient had one week of subjective fevers, weight loss, and night sweats. He was admitted and received antibiotics for community acquired pneumonia and was tested for tuberculosis. He was discharged five days later.

Patient 3: Chief complaint atraumatic right hip pain. X-rays showed a stress fracture of right femoral neck, for which he received closed reduction and percutaneous pinning and was discharged in two days.

Patient 4: Chief complaint was medication refill. He had a history of chronic gout and medication noncompliance and was admitted for a gout flare of his left wrist and hand, which was treated with indomethacin and colchicine until his discharge four days later.

Patient 5: Chief complaint was medication refill. On further history, found that patient had a recent admission where parasellar and intrasellar masses were diagnosed and patient had not kept any of his follow-up appointments or taken his medications. He was homeless and also noted to be "disorganized" by shelter staff. He was therefore admitted for "failure to care for himself." He was discharged back to the shelter one month later when it was determined that he had capacity to care for himself.

Outside PMD Group (n=1)

Patient 1^a: Chief complaint was fever for two weeks. Admitted to be worked-up for possible endocarditis given history of mitral valve prolapsed and recent dental work. Blood cultures and echocardiogram were negative and she never developed a fever while in the hospital. She was discharged one week later.

^aDid not meet eligibility criteria and were incorrectly enrolled in study.

Table E2. Intervention patients who were returned to the ED by Primary Care Clinic physicians and not admitted to the hospital.

Patient 1: Patient complained of headache and was sent to the ED for a head CT. ED physicians did not order a head CT. They diagnosed the patient with strep pharyngitis and she was discharged.

Patient 2: Patient was complaining of knee pain and was sent to the ED to receive an x-ray. The x-ray was normal and patient was discharged with instructions to take naproxen as needed.

Patient 3: Patient complained of headache (intermittent for two weeks) and was sent to the ED for a head CT. The CT scan was done and was negative. The patient was diagnosed with a migraine headache.