Usual Source of Care and Outcomes Following Acute Myocardial Infarction

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BACKGROUND: The quality of the relationship between a patient and their usual source of care may impact outcomes, especially after an acute clinical event requiring regular follow-up.

OBJECTIVE: To examine the association between the presence and strength of a usual source of care with mortality and readmission after hospitalization for acute myocardial infarction (AMI).

DESIGN: Prospective Registry Evaluating Myocardial Infarction: Event and Recovery (PREMIER), an observational, 19-center study.

PATIENTS: AMI patients discharged between January 2003 and June 2004.

MAIN MEASURES: The strength of the usual source of care was categorized as none, weak, or strong based upon the duration and familiarity of the relationship. Main outcome measures were readmissions and mortality at 6 months and 12 months post-AMI, examined in multivariable analysis adjusting for socio-demographic characteristics, access and barriers to care, financial status, baseline risk factors, and AMI severity.

KEY RESULTS: Among 2,454 AMI patients, 441 (18.0 %) reported no usual source of care, whereas 247 (10.0 %) and 1,766 (72.0 %) reported weak and strong usual sources of care, respectively. When compared with a strong usual source of care, adults with no usual source of care had higher 6-month mortality rates [adjusted hazard ratio (aHR)=3.15, 95 % CI, 1.79–5.52; $p<0.001$] and 12-month mortality rates (aHR=1.92, 95 % CI, 1.19–3.12; $p=0.01$); adults with a weak usual source of care trended toward higher mortality at 6 months (aHR=1.95, 95 % CI, 0.98–3.88; $p=0.06$), but not 12 months ($p=0.23$). We found no association between the usual source of care and readmissions.

Electronic supplementary material The online version of this article (doi:10.1007/s11606-014-2794-0) contains supplementary material, which is available to authorized users.

Received April 7, 2013

Revised October 1, 2013

Accepted January 6, 2014

Published online February 20, 2014

CONCLUSIONS: Adults with no or weak usual sources of care have an increased risk for mortality following AMI, but not for readmission.

KEY WORDS: doctor and patient relationship; usual source of care; myocardial infarction.

J Gen Intern Med 29(6):862–9

DOI: 10.1007/s11606-014-2794-0

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INTRODUCTION

A usual source of care (USOC) is defined as a place where an individual most often goes if he or she is sick or needs personal health advice, such as a doctor's office, clinic, or health center.¹ Approximately 85 % of Americans self-report having a USOC,² which has been associated with higher quality care.^{3,4} Having a USOC is associated with greater receipt of preventive services,^{5,6} less use of emergency department visits,^{7,8} and less engagement in risky behaviors.⁹ Furthermore, a USOC is associated with improved management of chronic diseases such as HIV,¹⁰ diabetes,¹¹ hypertension,¹² and hypercholesterolemia.¹² In contrast, individuals living in the community without a USOC are more likely to be hospitalized, less likely to see a physician when symptomatic, and delay seeking needed care.¹³ Following an acute clinical event, one might expect having a USOC to be important, yet this has not been studied. Moreover, prior studies have lacked data to explore the quality of the relationship between a patient and their USOC and whether there is an association with outcomes.

To date, most studies have evaluated the presence of a USOC without accounting for potentially critical characteristics of the individual's relationship with the doctor or other health professional, hereafter referred to as clinician,

or health center. Validated measures of communication and trust have been critical to informing the quality of the relationship between a patient and clinician and have been associated with medication adherence and overall satisfaction; however, from a policy level, they are difficult to promote.^{14,15} While no validated scales exist to evaluate the strength of the relationship with a USOC, further investigation may help us understand quality between a patient and a provider at the system level, which may be more conducive to change. A more detailed assessment of USOC may reveal important differences in the health system-patient relationship that may impact patient outcomes such as rehospitalization and mortality, particularly after an acute clinical event that requires regular follow-up.

In this study, we examine the presence and strength of the USOC relationship on a continuum and assess its association with outcomes following acute myocardial infarction (AMI), a common medical condition that is thought to require close follow-up care after discharge. Using data from the Prospective Registry Evaluating Myocardial Infarction: Event and Recovery (PREMIER), a prospective registry of patients hospitalized with myocardial infarction, we were able to develop a novel, more detailed definition of USOC, taking into account the duration of the relationship, along with the patient's perspective of how well the USOC knew them and communicated with them.¹⁶ Specifically, we compare the association between the strength of the USOC relationship and mortality and readmission following hospitalization.

METHODS

Sample and Study Design

We used data from all patients enrolled in PREMIER, a prospective registry of patients hospitalized with myocardial infarction.¹⁶ Patients with a suspected AMI because of positive troponin or creatinine kinase-MB levels were screened for eligibility at 19 purposefully selected, nationally representative hospitals in the US between January 2003 and June 2004.¹⁶ Consecutive patients meeting the following inclusion criteria were eligible for participation: greater than 18 years of age, presented directly to an enrolling institution or were transferred within 24 h of the onset of symptoms, had supporting evidence of AMI (ischemic signs and symptoms, including ST segment changes and elevation of cardiac enzymes), and consented to follow-up. Patients with elevated cardiac biomarkers secondary to medical complications and those admitted from penal facilities were not enrolled. Among eligible patients ($n=10,911$), nearly one-fourth ($n=2,498$) consented to the study. Differences between participants and non-participants have been reported elsewhere.¹⁶ Enrollees had a complete chart abstraction, a baseline interview within 24 to

72 h of admission, and follow-up interviews at 1, 6, and 12 months. For these analyses patients were excluded if USOC could not be defined ($n=23$), if they expired in the hospital ($n=17$), or if they were discharged to hospice ($n=4$), leaving a cohort of 2,454 patients.

Usual Source of Care

As there is no gold-standard or validated definition of USOC relationships, we created a continuum categorization scheme. We first conceptualized USOC using the single, standard question, "Do you currently have a doctor or care provider who you feel is primarily responsible for your health care?" dichotomizing responses into yes/no. The strength of the relationship was further assessed among adults reporting having a USOC using three additional questions. First, "How long have you been seeing this doctor/care provider?" (in years); responses of <2 years were assigned a score of 0 and ≥ 2 years a score of 1. The following two questions, "Does your doctor/care provider seem to know you and your medical condition well?" and "Is your doctor/care provider or his/her staff good at following up with you on appointments and test results?" were graded on a 5-point Likert scale. We assigned a score of 0 to a response of "not at all"/"not very well"/"somewhat" and a score of 1 to a response of "fairly well"/"extremely well." If patients did not answer any of the three questions further quantifying the strength of their USOC, they were assigned a score of 0 for that question. Aggregate scores from these three questions were used to qualify the relationship. In our first iteration, a sum score of 0 was categorized as "weak," 1 as moderate, and 2–3 as strong. Given sample size concerns, we combined the "weak" and "moderate" categories (scores 0–1) and labeled the USOC as "weak."

Construct Validity and Reliability. We conducted exploratory analyses to determine whether our definition for USOC strength measured a distinct aspect that reflected the quality of the relationship, not the mere presence or accessibility of a USOC, or frequency of visits with a USOC. We examined the proportion of patients who followed up with a USOC and the frequency of visits in the 6 months following hospitalization. As hypothesized, attendance to follow-up visits at 6 months (no USOC 33 %; weak USOC 56 %, strong USOC 55 %) and frequency of follow-up (mean visits: no USOC=2.2; weak USOC=2.6; strong USOC=2.6) differed by the presence of a USOC, but not by the strength of the relationship, suggesting that USOC relationships capture more than visit history and are indicative of the quality of the interactions at those visits. We also examined access and financial barriers to establishing a USOC, to determine their independence from the association between USOC strength and the main outcomes. Access and financial barriers are further described below.

In a sensitivity analysis, we tested other definitions of USOC to determine whether a consistent dose-response relationship exists between USOC strength and mortality. For these analyses, we first examined the standard USOC definition of present versus not present. In a second iteration, the USOC relationship was categorized as “weak” or “strong” by summing the Likert scores of the above two questions on a scale of 2–10, assigning scores of 2–4 as “weak USOC” and scores of 5–10 as “strong USOC.” In a third iteration, we used the previously mentioned four-level categorization of USOC—none/weak/moderate/strong.

Main Outcome Measures

We assessed all-cause mortality within 6 months and 12 months of hospitalization. We also assessed all-cause readmission to any hospital within 6 months and 12 months of hospital discharge. Readmission was assessed through a phone interview with the patient 6 months and 12 months after index hospitalization. Mortality was assessed by cross-referencing patients’ Social Security numbers with the Social Security Master Death File.¹⁷

Other Variables of Interest

Additional information was collected on all participants during the baseline interview. Socio-demographic characteristics included age, sex, race/ethnicity, education level, and marital status. We categorized monthly financial situation as: “some money left over,” “just enough to make ends meet,” or “not enough to make ends meet” (instead of income level, for which 29 % of the sample was missing data due to patients’ refusal to answer the question). We also assessed other aspects of the financial situation related to utilization of health care, including: “avoided medications due to cost,” “avoided getting health care due to cost,” and “medication costs have become an economic burden.” Health care coverage referred to primary payor type. We specifically asked about insurance coverage for medications and difficulty getting care when needed. Clinical characteristics included family history of coronary artery disease along with prior angina, AMI, percutaneous coronary intervention, coronary artery bypass graft, and congestive heart failure. Non-cardiac clinical characteristics included smoking status, chronic lung disease, hypertension, hyperlipidemia, chronic renal failure, peripheral arterial disease, and diabetes mellitus. We assessed AMI severity using a validated 6-month mortality prediction scale, the GRACE score.¹⁸

We assessed five performance measures of in-patient quality of care that were captured through chart abstraction: aspirin at arrival, aspirin at discharge, beta-blocker at arrival, beta-blocker at discharge, and ACE inhibitor/angiotensin receptor blocker for left ventricular systolic function upon discharge. We also assessed discharge

planning among the three groups including whether the patient indicated he/she received instructions for cardiac rehabilitation, diet and exercise counseling, lipid assessment, and smoking cessation counseling.

To distinguish the quality of relationships with a care provider from issues related to barriers and access, we explored utilization of care in the month following hospitalization using data from 1-month follow-up phone interviews. We looked at attendance to follow-up appointments with a cardiologist, cardiac surgeon, and/or primary care physician. We additionally analyzed whether patients experienced difficulty getting needed medical care and whether finances played a role in their follow-up care at 1 month, assessing: reasons patients had difficulty getting medical care, whether the patient had insurance coverage for medications, whether they were not taking a medication because of cost, and whether the costs of medical care had become a burden, which we hypothesized may have been different from baseline responses because of the potential increased medical needs after having suffered an AMI.

Statistical Analysis

We compared baseline characteristics among participants with USOC (categorized as none, weak, or strong) using the Mantel-Haenszel trend test for categorical variables and the linear trend test for continuous variables. Cox proportional hazard models were used to assess the association between USOC and 6- and 12-month mortality and readmission. All models were adjusted for patients’ baseline health status and accounted for clustering of observations by site using site-stratified proportional hazard regression. In the calculation of the hazard ratio, we used strong USOC as the reference.

To assess the independent association between USOC and outcomes, multivariable models were built, first unadjusted, and then fully adjusting for patient characteristics. Variables were considered as candidates for inclusion in the model if they differed significantly across USOC levels, were not highly correlated with one another, and had a sufficient number of events per variable (≥ 20).^{19,20} The final variables adjusted for in the model included demographic variables (age, sex, race/ethnicity, education level, marital status), socioeconomic factors (financial situation, avoided medication due to cost, insurance payor), and clinical characteristics (family history of CAD, prior angina, AMI, PCI, CABG, CHF, smoker, chronic lung disease, hypertension, hyperlipidemia, chronic renal failure, peripheral arterial disease, diabetes mellitus, and GRACE score). We report results from the unadjusted and fully adjusted analyses. As a secondary analysis to examine the robustness of our results, we conducted a propensity score analysis, estimating the propensity of having no USOC, a weak USOC relationship, or a strong USOC relationship. Propensity scores were used as covariates of adjustment in our models.

Missing information for one or more covariates was minimal, with only 1.2 % missing more than one value for analysis. All analyses were performed using SAS version 9.2 (SAS Institute Inc., Cary, NC) and R version 2.11.1 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Baseline Characteristics

In our sample of 2,454 patients admitted for AMI, 441 (18.0 %) reported no USOC, 247 (10.0 %) reported a weak USOC, and 1,766 (72.0 %) reported a strong USOC (Table 1). In general, those with no USOC and lower quality USOC were younger, non-Caucasian, less often married, less educated, poorer, and had fewer cardiac and non-cardiac comorbidities. As compared with patients with a strong USOC, patients with weak USOC and no USOC were less likely to have prior PCI or CABG (35.4 % vs. 25.9 % vs. 14.5 %, $p<0.001$, respectively), CHF (13.3 % vs. 10.1 % vs. 7.0 %, $p<0.001$), diabetes (32.1 % vs. 24.3 % vs. 17.9 %, $p<0.001$), chronic lung disease (14.7 % vs. 9.3 % vs. 8.8 %, $p<0.001$), and peripheral artery disease (8.8 % vs. 7.3 % vs. 3.6 %, $p<0.001$). In addition, they had lower GRACE scores, indicative of less severe AMIs. There were no differences in five quality of care measures, including receipt of aspirin on arrival (98.1 % vs. 95.0 % vs. 96.2 %, $p=0.11$) and at discharge (93.2 % vs. 94.4 % vs. 93.4 %, $p=0.98$), receipt of beta-blocker on arrival (92.8 % vs. 93.8 % vs. 91.1 %, $p=0.17$) and at discharge (90.5 % vs. 92.7 % vs. 91.8 %, $p=0.51$), and receipt of ACE inhibitors/angiotensin receptor blockers at discharge for patients with left ventricular systolic dysfunction (84.9 % vs. 83.9 % vs. 79.0 %, $p=0.13$).

At the time of discharge, patients reporting no, weak, and strong USOC had similar outpatient care plans for follow-up (Table 1). In addition, patients reporting no USOC were as likely as patients with a weak or strong USOC to receive referrals for cardiac rehabilitation, a lipid assessment, and diet counseling. They were less likely to receive exercise counseling but more likely to receive smoking cessation counseling.

Follow-up Care

At 1-month follow-up (Table 2), a similar percentage of patients reporting no, weak, and strong USOC had attended an appointment with a cardiologist (31.8 %, 34.3 %, and 32.7 %, $p=0.85$), though patients with no USOC were less likely to attend a scheduled visit with a primary care provider than patients with weak or strong USOC (31.5 %, 44.8 %, and 49.8 %, $p<0.001$). Additionally, patients with no USOC were more likely than patients with weak or strong USOC to report avoiding medical care because of cost, to have less insurance

coverage for medications, and to report that medical costs were becoming an economic burden.

Mortality Post-Discharge After AMI

Among patients reporting no, weak, and strong USOC, 6-month mortality rates were 5.9 %, 5.7 %, and 4.4 %, respectively (Table 3). In unadjusted analyses, the 6-month mortality rates were higher, but not significantly different, among patients with no USOC [hazard ratio (HR)=1.36, 95 % CI, 0.88–2.13, $p=0.17$] and with a weak USOC (HR=1.30, 95%CI, 0.74–2.29, $p=0.37$) when compared with patients with a strong USOC. In multivariable analysis, when compared with self-reporting a strong USOC, self-reporting no USOC was associated with higher 6-month mortality rates [adjusted HR (aHR)=3.15, 95 % CI, 1.79–5.52; $p<0.001$], while a weak USOC trended toward being associated with higher 6-month mortality rates (aHR=1.95, 95 % CI, 0.98–3.88; $p=0.06$).

Among patients reporting no, weak, and strong USOC, 12-month mortality rates were 6.9 %, 7.3 %, and 7.1 %, respectively. In unadjusted analyses, the 12-month mortality rates were no different among patients with no USOC (HR=0.98, 95 % CI, 0.66–1.46, $p=0.93$) and with a weak USOC (HR=1.04, 95 % CI, 0.64–1.71, $p=0.87$) when compared with patients with a strong USOC. In multivariable analysis, when compared with self-reporting a strong USOC, self-reporting no USOC was associated with higher 12-month mortality rates (aHR=1.92, 95 % CI, 1.19–3.12; $p=0.01$), whereas self-reporting a weak USOC was not significantly associated with higher 12-month mortality rates (aHR=1.43, 95 % CI, 0.80–2.55; $p=0.23$). In a sensitivity analysis examining several different definitions of USOC strength, we found similar trends (Appendix 1; available online). Additional secondary analyses adjusting for propensity scores for presence and strength of USOC relationship were also not substantively different (Appendix 2; available online).

Readmission Post-Discharge After AMI

Among patients reporting no, weak, and strong USOC, 6-month readmission rates were 27.5 %, 32.6 %, 29.4 %, respectively (Table 4). In unadjusted analyses, the 6-month readmission rates were no different among patients with no USOC (HR=0.90, 95 % CI, 0.72–1.11, $p=0.32$) and with a weak USOC (HR=1.16, 95% CI, 0.90–1.49, $p=0.25$) when compared with patients with a strong USOC. In multivariable analysis, when compared with self-reporting a strong USOC, self-reporting no USOC was not associated with higher 6-month readmission rates (aHR=1.05, 95 % CI, 0.82–1.35; $p=0.71$); similarly, there was no association between self-reporting a weak USOC and higher 6-month readmission rates (aHR=1.15, 95 % CI, 0.87–1.53; $p=0.32$).

Table 1. Description of Baseline Socio-demographic and Clinical Characteristics, and Hospital Care Stratified by Strength of Relationship with Usual Source of Care

	Usual source of care			Overall P-value
	No (n=441)	Weak (n=247)	Strong (n=1,766)	
Demographics				
Age, mean (SD), years	54.5 (12.3)	56.7 (11.6)	62.9 (12.7)	<0.001
Male, n (%)	313 (71.0)	171 (69.2)	1,170 (66.3)	0.046
Race/ethnicity, n (%)				
White/Caucasian	281 (64.0)	175 (71.1)	1,353 (77.0)	<0.001
Black/African American	131 (29.8)	54 (22.0)	337 (19.2)	
Hispanic	15 (3.4)	7 (2.8)	34 (1.9)	
Asian	3 (0.7)	1 (0.4)	3 (0.2)	
Other	9 (2.1)	9 (3.7)	30 (1.7)	
Education ≥ grade 12, n (%)	309 (70.1)	193 (78.1)	1,399 (79.2)	<0.001
Married, n (%)	201 (45.8)	145 (59.2)	1,112 (63.6)	<0.001
Finances				
Monthly financial situation, n (%)				
Some money left over	184 (43.2)	119 (50.6)	942 (55.4)	<0.001
Just enough to make ends meet	139 (32.6)	74 (31.5)	530 (31.2)	
Not enough to make ends meet	103 (24.2)	42 (17.9)	229 (13.5)	
Medical costs economic burden, n (%)				
A little or no burden	303 (70.5)	172 (70.5)	1,257 (71.6)	0.458
Somewhat of a burden	32 (7.4)	30 (12.3)	156 (8.9)	
Moderate or severe burden	95 (22.1)	42 (17.2)	343 (10.5)	
Avoided care because of cost (yes, %)	121 (27.9)	57 (23.2)	260 (15.0)	<0.001
Not taking medications because of cost, n (%)				
Rarely or never	353 (81.3)	214 (87.3)	1,550 (88.5)	<0.001
Occasionally	30 (6.9)	16 (6.5)	117 (6.7)	
Frequently or always	51 (11.8)	15 (6.1)	84 (4.8)	
Health care coverage and access				
Primary payor, n (%)				
Commercial/PPO	134 (31.6)	99 (41.8)	734 (43.4)	<0.001
HMO	30 (7.1)	44 (18.6)	224 (13.2)	
Medicare	71 (16.7)	37 (15.6)	459 (27.1)	
Medicaid	32 (7.5)	18 (7.6)	86 (5.1)	
Other	33 (7.8)	7 (3.0)	64 (3.8)	
None/self-pay	124 (29.2)	32 (13.5)	125 (7.4)	
Coverage for medications (yes, %)	241 (55.0)	191 (78.3)	1,400 (80.0)	<0.001
Difficulty getting care when needed, n (%)				
Not very or not at all difficult	325 (74.2)	199 (80.6)	1,588 (90.5)	<0.001
Somewhat difficult	49 (11.2)	22 (8.9)	94 (5.4)	
Moderately or extremely difficult	64 (14.6)	26 (10.5)	72 (4.1)	
Cardiac clinical history				
Family history of CAD, n (%)	159 (36.1)	90 (36.4)	593 (33.6)	0.261
Prior angina, n (%)	54 (12.2)	40 (16.2)	329 (18.6)	0.001
Prior AMI, n (%)	78 (17.7)	65 (26.3)	384 (21.7)	0.176
Prior PCI, n (%)	44 (10.0)	38 (15.4)	355 (20.1)	<0.001
Prior CABG, n (%)	20 (4.5)	26 (10.5)	270 (15.3)	<0.001
CHF, n (%)	31 (7.0)	25 (10.1)	234 (13.3)	<0.001
Non-cardiac clinical history				
Smoker, n (%)	245 (55.6)	97 (39.4)	491 (27.9)	<0.001
Chronic lung disease, n (%)	39 (8.8)	23 (9.3)	260 (14.7)	<0.001
Hypertension, n (%)	210 (47.6)	143 (57.9)	1,207 (68.3)	<0.001
Hyperlipidemia, n (%)	129 (29.3)	117 (47.4)	959 (54.3)	<0.001
Chronic renal failure, n (%)	37 (8.4)	19 (7.7)	190 (10.8)	0.082
Peripheral arterial disease, n (%)	16 (3.6)	18 (7.3)	155 (8.8)	<0.001
Diabetes mellitus, n (%)	79 (17.9)	60 (24.3)	567 (32.1)	<0.001
AMI severity				
GRACE score* (SD)	97.5±31.5	111.0±31.4	106.6±32.1	<0.001
Follow-up appointment scheduled				
Yes, with cardiologist, n (%)	315 (71.4 %)	178 (72.1 %)	1,313 (74.3 %)	0.179
Yes, with cardiac surgeon, n (%)	51 (11.6 %)	28 (11.3 %)	185 (10.5 %)	0.475
Yes, with internist, n (%)	91 (20.6 %)	31 (12.6 %)	313 (17.7 %)	0.383
Yes, with family physician, n (%)	26 (5.9 %)	16 (6.5 %)	88 (5.0 %)	0.344
Discharge instructions/referrals				
Cardiac rehabilitation, n (%)	225 (51.0 %)	124 (50.2 %)	828 (46.9 %)	0.092
Diet counseling, n (%)	342 (77.6 %)	186 (75.3 %)	1,375 (77.9 %)	0.733
Exercise counseling, n (%)	176 (39.9 %)	113 (45.7 %)	900 (51.0 %)	<0.001
Lipid assessment, n (%)	69 (15.6 %)	35 (14.2 %)	250 (14.2 %)	0.455
Smoking cessation, n (%)	195 (44.2 %)	88 (35.6 %)	422 (23.9 %)	<0.001

Numbers may not sum to column total because of missing data, and percentages may not sum to 100 % because of rounding
SD standard deviation, PPO preferred provider organization, HMO health maintenance organization, CAD coronary artery disease, AMI acute myocardial infarction, PCI percutaneous coronary intervention, CABG coronary artery bypass graft, CHF congestive heart failure, ARB angiotensin receptor blocker, LVSD left ventricular systolic dysfunction

*GRACE Score associated with 6-month mortality risk. The higher the score, the greater the risk

Table 2. Access to and Utilization of Medical Care as Reported by Patients at 1-Month Follow-up Interviews

	Usual source of care status on admission			P value
	None	Weak	Strong	
	n=441	n=247	n=1,766	
	n (%)	n (%)	n (%)	
Difficulty getting medical care when needed				<0.001
Not very or not at all difficult	283 (81.1)	174 (87.9)	1,358 (90.3)	
Somewhat difficult	29 (8.3)	15 (7.6)	65 (4.3)	
Moderately or extremely difficult	37 (10.6)	9 (4.5)	81 (5.4)	
Reasons for difficulty getting care				0.003
Cost	23 (23.5)	13 (31.0)	62 (21.3)	
Finding a doctor	7 (7.1)	5 (11.9)	14 (4.8)	
Lacking insurance	34 (34.7)	6 (14.3)	33 (11.3)	
Travel time	6 (6.1)	4 (9.5)	53 (18.2)	
Other	28 (18.6)	14 (33.3)	129 (44.3)	
Insurance coverage for medications, yes (%)	206 (60.2)	151 (79.1)	1,138 (76.6)	<0.001
Not taking medications because of cost				0.285
Rarely or never	329 (95.9)	187 (97.4)	1,441 (96.9)	
Occasionally	6 (1.7)	2 (1.0)	14 (0.9)	
Frequently or always	8 (2.3)	3 (1.6)	32 (2.2)	
Medical costs have become an economic burden				<0.001
A little or no burden	211 (61.5)	134 (68.7)	1,050 (71.3)	
Somewhat of a burden	99 (28.9)	33 (16.9)	267 (18.1)	
Moderate or severe burden	33 (9.6)	28 (14.4)	156 (10.6)	
Avoided getting health care due to costs, yes (%)	43 (12.6)	16 (8.4)	94 (6.3)	
Attendance to medical visits post hospitalization				
Cardiologist	113 (31.8)	69 (34.3)	498 (32.7)	0.849
Cardiac surgeon	19 (5.4)	7 (3.5)	54 (3.5)	0.14
Primary care provider	112 (31.5)	90 (44.8)	758 (49.8)	<0.001

Numbers may not sum to 100 % because of missing data

Among patients reporting no, weak, and strong USOC, 12-month readmission rates were 38.1 %, 40.3 %, and 40.3 %, respectively. In unadjusted analyses, the 12-month readmission rates were no different among patients with no USOC (HR=0.92, 95 % CI, 0.76–1.10, $p=0.35$) and with a weak USOC (HR=1.05, 95 % CI, 0.84–1.32, $p=0.68$) when compared with patients with a strong USOC. In multivariable analysis, when compared with self-reporting a strong USOC, self-reporting no USOC was not associated with higher 12-month readmission rates (aHR=1.04, 95 % CI, 0.83–1.29; $p=0.74$); likewise, adults self-reporting a weak USOC did not have higher 12-month readmission rates (aHR=1.08, 95 % CI, 0.84–1.38; $p=0.56$). Again, secondary analyses adjusting for propensity scores for the presence and strength of the USOC relationship were not substantively different (Appendix 2; available online).

DISCUSSION

In our prospective, multicenter study of patients hospitalized with AMI in 2003 and 2004, we observed a significant association between the presence and strength of a USOC relationship at the time of admission and mortality after AMI, as there was a two-fold greater adjusted mortality observed among patients with a weak USOC and a statistically significant three-fold greater adjusted-mortality at 6 months among patients with no USOC. This pattern persisted at

1 year, although the strength of the relationship diminished, potentially reflecting patient's establishment of regular care and changes in the strength of this relationship following AMI.

We did not observe an association between USOC and readmission. This is contrary to our hypothesis that patients with no or weak USOC would have more hospitalizations than patients with strong USOC, having fewer opportunities to treat symptoms or prevent disease progression.^{21,22} It may have been the case, however, that patients with strong USOC utilize greater amounts of health care overall, including more hospitalizations.^{23,24} Nonetheless, our data suggest that weaker USOC is associated with worse mortality and can help identify higher risk patients warranting increased efforts to establish a higher quality USOC, although this hypothesis will need to be tested in future studies.

Nearly 20 % of patients in our study did not have a USOC, and these patients had the highest mortality risk. There are several potential explanations for this observation, including differences in baseline risk, in-hospital AMI care, and post-discharge follow-up care. Our data suggest that in-hospital care was similar across USOC groups and that the increased mortality risk may be incurred either before or after hospitalization. We know from prior literature that patients with no USOC are less likely to receive preventive care and effective disease management.^{10–12} In our population, with the exception of smoking, patients with no or weak USOC were less likely to have traditional risk factors for coronary artery disease,

Table 3. Association of Usual Source of Care with All-Cause Mortality

Usual source of care	Total N	6-month mortality					12-month mortality				
		Mortality %	Unadjusted hazard ratio (95 % CI)	P-Value	Adjusted hazard ratio (95 % CI)	P-Value	Mortality %	Unadjusted hazard ratio (95 % CI)	P-Value	Adjusted hazard ratio (95 % CI)	P-Value
None	441	5.9	1.36 (0.88–2.13)	0.17	2.99 (1.71–5.23)	<0.001	6.9	0.98 (0.66–1.46)	0.93	1.86 (1.15–3.02)	0.01
Weak	247	5.7	1.30 (0.74–2.29)	0.37	1.92 (0.97–3.80)	0.06	7.3	1.04 (0.64–1.71)	0.87	1.48 (0.84–2.63)	0.18
Strong	1,766	4.4	1.00		1.00		7.1	1.00		1.00	

Adjusted for age, marital status, sex, race/ethnicity, education level, financial situation, avoided medication because of cost, payor, family history of CAD, prior angina, prior AMI, prior PCI, prior CABG, CHF, smoker, chronic lung disease, hypertension, hyperlipidemia, chronic renal failure, peripheral arterial disease, diabetes mellitus, and GRACE score

which may reflect a true lower prevalence of disease or under-diagnosis and hence missed opportunities for risk factor control. It is also interesting to note that among patients with a strong USOC, 35 % had prior PCI or CABG, as compared with only 15 % of patients with no USOC and 26 % of patients with a weak USOC. While this seems intuitive, as patients with more complex disease and prior interventions have more opportunities to establish relationships with a provider, our data also demonstrate that patients with no USOC reported greater difficulty getting needed medical care. Thus, it remains unknown whether the lower prevalence of revascularization among patients with no or weak USOC again reflects a lower prevalence of prior coronary artery disease or less detection and poorer access to needed revascularization procedures. These important differences in baseline risk stratification and treatment may explain the increased mortality associated with patients with no or weak USOC.

Post-discharge care may also have been very different for these USOC groups, despite having similar discharge plans. During the most vulnerable time, 1-month following AMI, only one-third of patients with no prior USOC attended a visit with a primary care provider as compared with nearly half in the weak and strong USOC groups. Interestingly, among all groups, only one-third attended a visit with a cardiologist in the month following AMI despite over 70 % of the patients having scheduled appointments. While there are no absolute guidelines on the timing and frequency of follow-up care after AMI, it seems reasonable to assume that this was not sufficient, at least for some patients. Specifically, patients with no and weak USOC were more

likely to report difficulty getting care when needed and avoiding medical care because of cost. Collectively, these data suggest that access to affordable health care remains a significant problem even after having a major event such as an AMI and may result in fewer opportunities for prevention and intervention.

There are some potential limitations to consider in the interpretation of this study. First, our objective was to determine the association of baseline USOC with long-term outcomes following AMI. In doing so, we developed a definition to qualify the strength of the relationship, which has not been validated. However, in sensitivity analyses using different cutpoints to distinguish weak from strong USOC relationships, we found similar ‘dose-response’ relationships with 12-month mortality. Second, patients reporting a strong USOC had more comorbid disease at baseline. Although we adjusted our analyses for these differences in comorbidities, illness burden may have been underdiagnosed in patients without a USOC and thus may have underestimated the true burden of disease in this group. Nonetheless, this would have biased our results to the null. Finally, unmeasured differences between patients can confound all observational analyses. However, in this unique registry, we had very rich data on access to care and financial barriers, factors that would be expected to impact our findings and for which we were able to adjust using both multivariable and propensity score analyses.

In conclusion, having a strong USOC was associated with lower mortality after AMI, while a weak USOC had only slightly lower mortality than patients with no USOC. These

Table 4. Association of Usual Source of Care and All-Cause Readmission

Usual source of care	Total N	6-month readmission					12-month readmission				
		Readmission %	Unadjusted HR (95 % CI)	P-Value	Adjusted HR (95 % CI)	P-Value	Readmission %	Unadjusted HR (95 % CI)	P-Value	Adjusted HR (95 % CI)	P-Value
None	441	27.5	0.90 (0.72–1.11)	0.32	1.04 (0.81–1.39)	0.75	38.1	0.92 (0.76–1.10)	0.35	1.03 (0.83–1.29)	0.78
Weak	247	32.6	1.16 (0.90–1.49)	0.25	1.16 (0.88–1.53)	0.30	40.3	1.05 (0.84–1.32)	0.68	1.08 (0.84–1.38)	0.56
Strong	1,766	29.4	1.00		1.00		40.3	1.00		1.00	

Adjusted for age, marital status, sex, race/ethnicity, education level, financial situation, avoided medication because of cost, payor, family history of CAD, prior angina, prior AMI, prior PCI, prior CABG, CHF, smoker, chronic lung disease, hypertension, hyperlipidemia, chronic renal failure, peripheral arterial disease, diabetes mellitus, and GRACE score

findings suggest that clinical care relationships exist on a continuum and have an association with outcomes proportional to the strength of these relationships. Identifying high-risk groups with no or weak USOC can provide important opportunities for intervention. System level efforts targeting the quality of follow-up care may ultimately impact the patient-clinician/health center relationship. Improved care transitions with effective communication and use of patient navigators may help to fortify the relationship between patients and providers. Office staff and other non-clinicians may go under-recognized as key components to effective communication. Additionally, greater awareness among providers and payors of the impact of no or weak USOC may spur new incentives to align patients at risk for AMI, and post-AMI patients, with high-performing health care systems and providers. More studies are needed, however, to understand the nature of this association and whether supporting high-quality relationships with clinicians/health centers will lead to improved outcomes for patients following AMI.

Acknowledgments: Contributors: None.

Funders: We gratefully acknowledge support from the grant U01-HL105270-03 (Center for Cardiovascular Outcomes Research at Yale University) from the National Heart, Lung, and Blood Institute. Dr. Krumholz was supported by grant U01 HL105270-03 (Center for Cardiovascular Outcomes Research at Yale University) from the National Heart, Lung, and Blood Institute. Dr. Ross is supported by the National Institute on Aging (K08 AG032886) and by the American Federation for Aging Research through the Paul B. Beeson Career Development Award Program. CV Therapeutics and CV Outcomes, a 501(c)(3) corporation funded the PREMIER registry.

Prior Presentations: American Heart Association: Quality of Care and Outcomes Research, Poster Presentation, 2011.

Conflict of Interests: Drs. Krumholz and Ross work under contract with the Centers for Medicare & Medicaid Services to develop and maintain performance measures and are the recipients of a research grant from Medtronic, Inc., through Yale University. Dr. Krumholz is chair of a cardiac scientific advisory board for UnitedHealth, and Dr. Ross is a member of a scientific advisory board for FAIR Health. Dr. Spertus reports funding from NIH, AHA, ACCF, Gilead, Genentech, Amorycyte, Eli Lilly and Abbott Vascular. He serves as a consultant to United Healthcare, Genentech, Gilead, Novartis, Janssen, and Amgen.

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