

Quality of Medical Care and Excess Mortality in Older Patients With Mental Disorders

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Background: This study investigated whether differences in quality of medical care might explain a portion of the excess mortality associated with mental disorders in the year after myocardial infarction.

Methods: This study examined a national cohort of 88 241 Medicare patients 65 years and older who were hospitalized for clinically confirmed acute myocardial infarction. Proportional hazard models compared the association between mental disorders and mortality before and after adjusting 5 established quality indicators: reperfusion, aspirin, β -blockers, angiotensin-converting enzyme inhibitors, and smoking cessation counseling. All models adjusted for eligibility for each procedure, demographic characteristics, cardiac risk factors and history, admission characteristics, left ventricular function, hospital characteristics, and regional factors.

Results: After adjusting for the potential confounding factors, presence of any mental disorder was associated

with a 19% increase in 1-year risk of mortality (hazard ratios [HR], 1.19; 95% confidence interval [CI], 1.04-1.36). After adding the 5 quality measures to the model, the association was no longer significant (HR, 1.10; 95% CI, 0.96-1.26). Similarly, while schizophrenia (HR, 1.34; 95% CI, 1.01-1.67) and major affective disorders (HR, 1.11; 95% CI, 1.02-1.20) were each initially associated with increased mortality, after adding the quality variables, neither schizophrenia (HR, 1.23; 95% CI, 0.86-1.60) nor major affective disorder (HR, 1.05; 95% CI, 0.87-1.23) remained a significant predictor.

Conclusions: Deficits in quality of medical care seemed to explain a substantial portion of the excess mortality experienced by patients with mental disorders after myocardial infarction. The study suggests the potential importance of improving these patients' medical care as a step toward reducing their excess mortality.

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MUCH LITERATURE has demonstrated that patients with mental disorders are at risk for elevated rates of cardiovascular mortality.¹⁻⁸ Authors have postulated that arrhythmogenic, neuroendocrine, or other direct physiological mechanisms mediate this excess mortality,^{9,10} and thus previous studies of mortality in mental disorders have generally not examined the quality of these patients' medical care. However, patterns of cardiac procedures after acute myocardial infarction (AMI) have been found to differ substantially for patients with and without mental disorders,¹¹ raising the question as to whether there may also be a gap in quality of medical care. If quality of care does vary, such differences might play a role in mediating excess cardiovascular mortality in patients with mental disorders.

This study uses a national sample of older adults to examine the association between mental disorders, quality of cardiac care, and mortality in the first year after hospitalization for myocardial

infarction. We test the hypotheses that (1) mental disorders are associated with decreased quality of care, (2) that these conditions predict excess mortality in the year after hospital discharge, and (3) that differences in quality may account for a portion of the differences in mortality.

RESULTS

CHARACTERISTICS AND ELIGIBILITY STATUS FOR PATIENTS WITH AND WITHOUT MENTAL DISORDERS

Of a total of 88 241 patients in the study sample (ie, clinically confirmed AMI and no exclusion criteria), 4664 (5.3%) had a secondary diagnosis of a mental disorder. The "other" group was largely composed of transient or mild depressive conditions; 2037 individuals (61.0% of that group) were diagnosed as having depression not otherwise specified, adjustment reaction, "neurotic" depression, or dysthymia.

MATERIALS AND METHODS

SAMPLE

The Cooperative Cardiovascular Project (CCP) is part of an ongoing national Health Care Financing Administration program developed to improve the quality of care for Medicare beneficiaries with AMI.¹² The methods have been outlined in detail in previous studies.^{12,13} The CCP sampled randomly selected Medicare fee-for-service beneficiaries who were hospitalized with AMI from February 1994 through July 1995 with a primary discharge diagnosis of AMI (*International Classification of Diseases, Ninth Revision [ICD-9]* code 410) with the exception of AMI readmissions (*ICD-9* code 410.x2).¹⁴

Medical records for each sampled hospitalization were forwarded to 1 of 2 national clinical data abstraction centers and data for each hospitalization, including patient medical history, signs and symptoms on arrival, electrocardiographic and laboratory examination, in-hospital treatment and events, discharge treatment, and disposition, were collected. Data quality was ensured through the use of technicians trained in prespecified record abstraction rules using computerized abstraction modules with embedded prompts. Abstraction reliability was monitored by random record re-abstraction; κ values ranged from 0.88 to 0.95.¹⁵

A total of 166348 patients in the CCP sample were 65 years or older and had a confirmed AMI. The current study used the following exclusion criteria to arrive at a final study cohort: patients who died during the index admission ($n=31301$); whose records indicated that they were terminally ill or had do-not-resuscitate orders ($n=35782$), as their medical care most likely emphasized palliation rather than prolongation of life; who were transferred to another facility or whose index admission represented a transfer from another hospital ($n=40120$), since data on their discharge quality of care were incomplete; and who had dementia and/or delirium ($n=6465$), since these conditions imply a medical etiology and are associated with uniquely high rates of mortality.¹⁶ (The numbers add to greater than 100% of excluded candidates, since some individuals may have met more than 1 exclusion criterion). A total of 88241 eligible individuals who met these inclusion criteria constituted the final study sample.

INDEPENDENT VARIABLES

Mental Illness

In addition to the abstracted clinical variables, administrative elements, including admission diagnosis codes, are part

of the CCP data set. These diagnoses are based on conditions listed by the primary attending physician for the hospitalization. Any secondary admission diagnosis between codes 295.00 and 319.99, other than dementia and delirium, was considered a mental disorder. To determine whether patients with particular psychiatric diagnoses showed differing patterns of quality or mortality, separate analyses were also conducted for the following mental disorders, comparing each group with patients without a secondary mental diagnosis: schizophrenia (*ICD-9* codes 295.00-295.99); major affective disorder (*ICD-9* codes 296.00-296.99); and substance abuse and dependence disorders (*ICD-9* codes 303.00-305.99).

Covariates

Table 1 outlines a series of variables identified in the literature as clinically relevant to, or predictive of, mortality post-AMI.¹⁷⁻²⁰ These variables include demographic characteristics, cardiac risk factors, cardiac history, admission characteristics, and left ventricular function, and were obtained from the record abstraction database. The Medicare Mortality Predictor Score, a summary score constructed using demographic and clinical data,²¹ was used to compare the overall medical morbidity between patients with and without mental disorders.

Previous work has demonstrated an important link between socioeconomic status and cardiovascular mortality,²²⁻²⁴ as well as an association between mental disorders and lower socioeconomic status.²⁵⁻²⁷ Therefore, as a proxy for socioeconomic status, county-level per capita income and educational attainment were merged from the Area Resource File.²⁸

A series of other regional and hospital-level covariates were also included in all multivariate models. The following county-level data were obtained from the Area Resource File: state, mean number of physicians in the county, and number of hospitals in the county. Hospital-level data were obtained from the 1994 American Hospital Association Annual Survey of Hospitals.²⁹ Number of beds, presence of on-site catheterization, percutaneous transluminal coronary angioplasty and open-heart surgical facilities, academic affiliation, for-profit status, total number of physicians, nurses, residents, and other staff.

DEPENDENT VARIABLES

Quality Indicators

For the CCP, the Health Care Financing Administration developed a set of measures of quality for treatment of AMI,

The summary Medicare Mortality Predictor Score score indicated an extremely small but significantly lower risk of mortality at baseline for patients with mental disorders than for the rest of the population (0.14 vs 0.15) ($P=.007$). Other baseline demographic and clinical differences between the groups are outlined in Table 1. Table 2 outlines the differences in eligibility/idealness status between the groups. As previously described, all significant differences were included as covariates in mortality models.

QUALITY OF CARE FOR PATIENTS WITH AND WITHOUT MENTAL DISORDERS

Among ideal candidates, after adjusting for potential demographic, clinical, hospital and regional confounding factors, presence of any secondary mental disorder predicted a 13% decreased likelihood of reperfusion therapy (RR, 0.87; 95% confidence interval [CI], 0.79-0.95). Within this ideal subgroup, there were no significant differences between patients with and with-

based on clinical research findings and practice guidelines.³⁰ Four indicators were included in the current study based on evidence from randomized trials of a link between them and improved mortality: reperfusion therapy,³¹ aspirin prescribed at hospital discharge,³² β -blockers prescribed at hospital discharge,³³ and angiotensin-converting enzyme inhibitors at hospital discharge.^{34,35} A fifth indicator, smoking cessation counseling documented during the index hospitalization, was also included, based on wide inclusion in clinical guidelines for cardiac patients.³⁶

For each indicator of quality, the Health Care Financing Administration defined "ideal" candidates for therapy; that is, patients with clear indications for and without contraindications for the treatment. For any particular treatment, this cohort should have received the intervention. A second group of patients with potential relative but without absolute contraindications for each therapy was also identified. For instance, in the case of aspirin therapy, a patient might be considered eligible but not ideal if there was a history of peptic ulcer disease, renal insufficiency, or anemia. **Table 2** presents the eligibility/idealness criteria for each procedure, for patients with and without secondary mental diagnoses.

Mortality

Death within 1 year of discharge from the index hospitalization was determined by linking the CCP database with the Medicare Enrollment Database using unique patient identifiers. The Medicare Enrollment Database is derived from Social Security information, which is used as a basis for Social Security payments. Death data are regularly validated against the National Death Index,³⁷ and have been demonstrated to correlate highly with other sources of mortality information.³⁸

MISSING DATA

For variables in which a coder could report that data were missing (as opposed to a simple "yes/no" response), the only variable with greater than 1% missing data was left ventricular function; missing information for this variable was treated as a separate dummy variable for multivariate analyses. For other variables, pilot tests showed a high correlation between data collected by medical record abstractors and gold standard physician reviewers.³⁹

STATISTICAL METHODS

After conducting bivariate analyses on the independent and dependent variables of interest, multivariable models

were constructed to model the association between mental disorders and the outcomes of interest (quality indicator compliance and 1-year mortality) while taking into account patient characteristics that are potential confounding factors. Each analysis first used a dichotomous "any mental disorder" variable and then a separate equation comparing the disaggregated mental disorder (schizophrenia, major affective disorder, substance use disorder, and other disorder) variable to a group with no mental disorder.

First, logistic regression was used to model each quality measure as a function of presence of a mental disorder, adjusting for the demographic and clinical variables outlined in Table 1, and the hospital and regional characteristics outlined above. As described previously, separate analyses were conducted among ideal patients, all of whom should have received the intervention, and eligible but not ideal patients, who had indications for the intervention, but who also had some potential contraindications.

Relative risk (RR) is the most clinically appropriate indicator of effect size for associations between dichotomous variables.⁴⁰ For this study, the RR represents the ratio of the likelihood of receipt of a given quality indicator among those with mental disorders to the likelihood among the remainder of the population. Because odds ratios, which are output from logistic regression models, may not provide accurate estimates of RR when an outcome of interest is relatively common (ie, greater than 10%),⁴¹ RRs were derived from adjusted odds ratios using the method described by Zhang and Yu.⁴²

Next, to assess the association between mental disorders and mortality, a set of Cox proportional hazard equations modeled days until death in the year after discharge as a function of presence of a mental disorder. Models adjusted for the demographic, clinical, and hospital and regional factors are outlined in Table 1. Models also adjusted for all the eligibility/idealness parameters in Table 2 that differed significantly at a $P < .05$ level. Effect size for proportional hazard models is expressed as a hazard ratio (HR), which reflects the excess risk of death over time.

Finally, to determine to what degree quality of care explained differences in mortality for patients with mental disorders, multivariate Cox proportional hazard equations modeled days until death in the year after hospital discharge as a function of presence of a mental disorder, adding the 5 quality measures to the demographic, clinical, hospital, regional, and eligibility/idealness factors included in the previous models.

All tests of significance were 2-tailed and used a critical value of $\alpha = .05$.

out mental disorders on the other 4 quality measures (**Table 3**).

Among "eligible but not ideal" candidates—those with indications but with some potential contraindications—more pronounced differences in patterns of care were evident between patients with and without mental disorders. After adjusting for potential confounding factors, patients with mental disorders were 26% less likely to have reperfusion therapy (RR, 0.74; 95% CI, 0.56-0.95), 9% less likely to receive

aspirin (RR, 0.91; 95% CI, 0.82-0.99), 10% less likely to receive β -blockers (RR, 0.90; 95% CI, 0.81-0.99), and 12% less likely to receive angiotensin-converting enzyme inhibitors (RR, 0.88; 95% CI, 0.76-0.99).

Similar patterns were evident in multivariable models examining quality indicators for specific psychiatric disorders. Among ideal candidates, patients with schizophrenia were 52% as likely (RR, 0.52; 95% CI, 0.26-0.90) and those with affective disorders 71% as likely (RR, 0.71; 95% CI, 0.45-0.99) to undergo reperfusion therapy as those

Table 1. Characteristics of Sample (n = 88 241)*

	Any Mental Disorder (n = 4664)	No Mental Disorder (n = 83 577)	Difference, χ^2 (P)†
Demographics			
Age, y, mean \pm SD	76.0 (7.3)	76.1 (7.1)	$t_{5,169} = 0.72$ (.47)
Female	2472 (47.0)	44 009 (52.7)	56.7 (<.001)
Race			
Black	300 (6.4)	5709 (6.8)	1.1 (.29)
Hispanic	94 (2.0)	2577 (2.5)	5.1 (.02)
Mean income in county, \$ (in thousands)	20.5 (5.1)	20.8 (5.1)	$t_{6,370} = 2.85$ (.004)
Percentage of high school graduates in county (mean \pm SD)	0.74 (0.08)	0.75 (0.08)	$t_{6,358} = 3.29$ (.001)
Cardiac Risk Factors and History			
Hypertension	1972 (42.2)	33 964 (40.6)	4.9 (.02)
Diabetes mellitus	1028 (22.0)	21 897 (26.2)	39.7 (.001)
Smoking	1018 (21.8)	12 281 (14.7)	175.6 (.001)
Angina	112 (2.4)	1997 (2.4)	0.0 (.96)
Previous myocardial infarction	221 (4.7)	4908 (5.9)	10.3 (.001)
PTCA in past year	457 (9.8)	11 199 (13.7)	48.5 (<.001)
CABG in past year	261 (5.6)	6268 (7.5)	23.3 (<.001)
Admission Characteristics			
Pulse >100/min	1254 (26.9)	20 928 (25.0)	8.00 (.005)
Systolic blood pressure <125 mm Hg	3474 (74.5)	62 260 (74.5)	0.0 (.98)
Congestive heart failure	1762 (37.8)	33 010 (39.5)	5.4 (.02)
Urea nitrogen level >14.3 mmol/L (40 mg/dL) or creatine level >177 μ mol/L (20 mg/dL)	440 (9.4)	9216 (11.0)	11.5 (<.001)
Shock	78 (1.7)	2930 (3.5)	45.1 (<.001)
Anterior infarction	2094 (44.9)	37 628 (45.0)	0.0 (.86)
Total ST elevation >6 mm	783 (16.8)	14 428 (17.3)	0.7 (.40)
Left Ventricular Function			
Normal (\geq 55%)	647 (13.9)	12 188 (14.6)	14.2 \pm (.003)
Mildly depressed (40%-54%)	1353 (29.0)	24 386 (29.2)	
Moderately to severely depressed (<40%)	773 (16.6)	14 807 (17.7)	
Unmeasured	1558 (33.4)	25 748 (30.8)	
Medicare Mortality Prediction Score (mean \pm SD)§	0.14 (0.13)	0.15 (0.14)	$t_{5,299} = 2.71$ (.007)

*Values are expressed as number (percentage) unless otherwise specified. PTCA indicates percutaneous transluminal coronary angioplasty; CABG, coronary artery bypass graft surgery.

†Values are χ^2 , with 1 df, unless otherwise indicated.

‡Has 3 df.

§Medicare Mortality Prediction Score represents a summary score derived from demographic and clinical admission data. The score represents the predicted likelihood of mortality, and thus a higher score indicates greater morbidity.

without psychiatric disorders, although differences in the other quality measures were not significantly different.

Among those considered eligible but not ideal, specific psychiatric disorders were consistently associated with deficits on the quality measures. As compared with those without a psychiatric disorder, patients with schizophrenia were less likely to have reperfusion (RR, 0.48; 95% CI, 0.30-0.72), β -blockers (RR, 0.75; 95% CI, 0.56-0.99), and angiotensin-converting enzyme inhibitors (RR, 0.91; 95% CI, 0.83-0.99). Patients with affective disorders were less likely to have reperfusion (RR, 0.69; 95% CI, 0.53-0.87) and aspirin (RR, 0.86; 95% CI, 0.75-0.98), and those with substance use disorders were less likely to be given angiotensin-converting enzyme inhibitors (RR, 0.79; 95% CI, 0.64-0.96).

ASSOCIATION BETWEEN QUALITY INTERVENTIONS AND MORTALITY IN PATIENTS WITH MENTAL DISORDERS

A total of 22 118 patients (25.1% of the sample) died during the year after hospital discharge. In proportional

hazards models, adjusting for all variables in Tables 1 and 2, as well as the hospital and regional characteristics outlined in the "Materials and Methods" section, patients with mental disorders had a 19% increased likelihood of mortality as compared with the rest of the population during the year after hospital discharge (HR, 1.19; 95% CI, 1.04-1.36). In a model comparing patients with specific psychiatric disorders with the rest of the population, patients with schizophrenia had a 34% increase in likelihood of mortality (HR, 1.34; 95% CI, 1.01-1.66), and those with affective disorders had an 11% increase in likelihood of mortality (HR, 1.11; 95% CI, 1.03-1.18).

Adding quality measures significantly improved the explanatory ability of the proportional hazards model for 1-year mortality (difference for -2 log likelihood of models: $\chi^2_5 = 114$, $P < .001$). In this model, each of the 5 quality measures was strongly associated with reduced mortality across the entire sample: reperfusion therapy (HR, 0.84; 95% CI, 0.81-0.88); use of aspirin (HR, 0.42; 95% CI, 0.40-0.43); β -blockers (HR, 0.51; 95% CI, 0.49-0.53); angiotensin-converting enzyme inhibitors

Table 2. Eligibility for Interventions (n = 88 241)

	Mental Disorder (n = 4664)	No Mental Disorder (n = 83 577)	Difference, χ^2 (P)
Reperfusion			
Total eligible			
Chest pain within 12 h and ST-segment elevation on first ECG	1208 (27.8)	23 230 (26.3)	1.8 (.19)
Ideal	561 (13.9)	11 255 (12.0)	1.9 (.17)
Absence of risk for hemorrhage	3376 (72.4)	62 517 (74.8)	13.7 (<.001)
Absence of bleeding within past 48 hours	4540 (97.3)	81 303 (97.3)	0.0 (0.8)
No use of warfarin	4436 (95.1)	77 485 (92.7)	38.3 (<.001)
No history of stroke	3962 (84.5)	73 033 (87.4)	23.6 (<.001)
Age <80 y	3318 (71.1)	60 259 (72.1)	2.0 (.16)
Aspirin			
Total eligible	4664 (100)	83 577 (100.0)	...
Ideal	2554 (54.8)	45 568 (54.5)	.01 (.75)
Absence of bleeding within past 48 h	4540 (97.3)	81 303 (97.3)	0.0 (.80)
No bleeding risk	4567 (97.9)	82 142 (98.3)	3.4 (.06)
No history of peptic ulcer disease	3967 (85.1)	72 243 (86.7)	10.0 (.002)
No anemia	4357 (93.4)	77 366 (92.6)	4.7 (.03)
No use of warfarin	4436 (95.1)	77 485 (92.7)	38.3 (<.001)
No history of allergy to aspirin	4444 (95.3)	79 966 (95.7)	2.6 (.20)
No renal insufficiency	4496 (96.4)	78 879 (94.4)	34.6 (<.001)
ACE Inhibitors			
Total eligible	4664 (100)	83 577 (100.0)	...
Ideal	669 (14.3)	12 319 (14.7)	0.1 (.46)
Left ventricular ejection fraction <40%	773 (16.6)	14 807 (17.7)	3.9 (0.5)
No history of aortic stenosis	4385 (94.0)	77 817 (93.1)	5.7 (.02)
No history of allergy to ACE inhibitors	4628 (99.2)	82 852 (99.1)	0.47 (.49)
Creatinine <2 μ mol/L (20 mg/dL) during hospitalization	4184 (89.7)	71 761 (85.9)	54.5 (<.001)
Systolic blood pressure >100 mm Hg	4328 (92.8)	75 664 (90.5)	26.7 (<.001)
β-Blockers			
Total eligible	4664 (100)	83 577 (100.0)	...
Ideal	662 (14.2)	19 308 (23.1)	200 (.001)
No major affective disorder	4393 (94.2)	83 577 (100.0)	All excluded
No shock/hypotension	3526 (75.6)	61 011 (73.0)	15.2 (.001)
No history of COPD	3540 (75.9)	64 605 (77.3)	4.9 (.03)
No bradycardia	3134 (67.2)	56 330 (67.4)	0.88 (.77)
No history of conduction disorder	3810 (81.7)	67 363 (80.6)	3.4 (.07)
Left ventricular ejection fraction >34%	4044 (86.7)	72 211 (86.4)	0.35 (.55)
No pulmonary edema/CHF	3004 (64.4)	52 213 (62.5)	6.8 (.01)
Not receiving insulin	4293 (92.1)	75 823 (90.7)	9.3 (.002)
Smoking Cessation			
Ideal			
Smoker	966 (20.7)	11 296 (13.5)	191 (<.001)

*Values are expressed as number (percentage) unless otherwise specified. ECG indicates electrocardiogram; ellipses, not applicable, all included; ACE, angiotensin-converting enzyme; COPD, chronic obstructive pulmonary disease; and CHF, congestive heart failure.

(HR, 0.86; 95% CI, 0.83-0.88); and smoking cessation counseling (HR, 0.67; 95% CI, 0.62-0.72).

In the model adjusting for quality measures as well as all covariates in the previous model, the association between mental disorders and 1-year mortality was no longer significant ($P = .17$), and overall mortality was reduced by 9%, or almost half of the original value for excess mortality (HR, 1.10; 95% CI, 0.96-1.26). A similar pattern was seen in models examining mortality in specific psychiatric disorders. The excess mortality seen in schizophrenia and affective disorders was reduced in magnitude and became nonsignificant after adding the 5 quality measures (schizophrenia [HR, 1.23; 95% CI, 0.86-1.60] and major affective disorders [HR, 1.05; 95% CI, 0.87-1.23]) (**Table 4**).

COMMENT

Among patients with indications for cardiac treatment but for whom there was a possible justification for not treating, a substantial gap was evident between patients with and without mental disorders. Differences in quality seemed to explain a substantial portion of the excess mortality associated with mental disorders.

The results confirm previous authors' observation that practice pattern variation is highest in situations where there is less consensus on the need for treatment.⁴³ Within "ideal" subgroups, presence of practice guidelines and clear outcome data likely lead to greater uniformity of treatment across patients with and with-

Table 3. Quality of Care for Patients With and Without Mental Disorders*

Quality Indicator	Eligible but Not Ideal†			Ideal‡		
	Total No. of Candidates Who Received Intervention, %	Relative Risk§ (95% CI)	χ^2 (P)	No. of Candidates Who Received Intervention, %	Relative Risk§ (95% CI)	χ^2 (P)
Reperfusion	31.2	0.74 (0.56-0.95)	13.9 (<.001)	61.0	0.87 (0.79-0.95)	10.0 (.002)
Aspirin	58.8	0.91 (0.82-0.99)	4.7 (.03)	78.0	1.00 (0.98-1.02)	0.0 (.99)
β -Blockers	39.1	0.90 (0.81-0.99)	4.9 (.03)	48.8	0.94 (0.80-1.08)	0.16 (.69)
ACE inhibitors	40.3	0.88 (0.76-0.99)	5.9 (.01)	66.9	0.95 (0.87-1.08)	0.77 (.38)
Smoking cessation counseling	40.9	1.03 (0.95-1.12)	0.74 (.39)

*CI indicates confidence interval; ACE, angiotensin-converting enzyme; and ellipses, not applicable.

†Numbers for analyses of "eligible but not ideal" candidates are as follows: reperfusion, 12 622 patients; aspirin, 40 119 patients; ACE inhibitors, 75 253 patients; and β -blockers, 68 271 patients.

‡Numbers for analyses of "ideal" candidates are as follows: reperfusion, 11 816 patients; aspirin, 48 122 patients; ACE inhibitors, 12 988 patients; and β -blockers, 19 970 patients.

§Relative risk of receiving the medication or counseling as a function of presence of a mental disorder, adjusting for demographics, cardiac risk factors and history, admission characteristics, left ventricular function, access to technology; number of beds, academic affiliation, for-profit status, total number of physicians, nurses, residents, and other staff; and state in which the hospital occurred, population, per capita income, and per capita physicians and hospitals in the county where the hospital is located. The comparison group for each of these analyses is individuals without a secondary diagnosis of a mental disorder. Relative risk calculated from odds ratios (ORs) using the following equation: $OR / [(1 - P_0) + (P_0 \times OR)]$, where P_0 is the probability of the receipt of the intervention in patients without a diagnosis of mental disorder.

||df = 1 for all tests.

Table 4. Mental Disorders and Mortality

Adjusted Models	Excess Risk of Mortality Associated With Mental Disorder (n = 88 241)	
	Hazard Ratio	χ^2 (P)
Demographics, clinical presentation, eligibility for interventions, and hospital and regional characteristics		
Any mental disorder (n = 4664)	1.19 (1.04-1.36)	6.2 (.01)
Schizophrenia (n = 161)	1.34 (1.01-1.67)	3.9 (.04)
Affective disorder (n = 271)	1.11 (1.02-1.20)	5.4 (.02)
Substance use disorder (n = 882)	0.96 (0.81-1.10)	0.4 (.55)
Demographics, clinical presentation, eligibility for interventions, hospital and regional characteristics, and quality measures		
Any mental disorder (n = 4664)	1.10 (0.96-1.26)	1.9 (.17)
Schizophrenia (n = 161)	1.23 (0.86-1.60)	2.1 (.15)
Affective disorder (n = 271)	1.05 (0.87-1.23)	0.2 (.68)
Substance use disorder (n = 882)	0.91 (0.77-1.05)	1.7 (.19)

*Each value has 1 df.

out mental disorders. In contrast, for patients for whom there may be some benefit, but who also have relative contraindications that may attenuate that benefit (the eligible but not ideal group), substantially more variation in these treatments becomes evident. Among quality measures, the variation is greatest for reperfusion therapy, where clinical uncertainty is compounded by higher treatment risks. An even wider gap between patients with and without mental disorders exists in use of cardiovascular procedures, interventions with high levels of uncertainty, risks, and costs.¹¹

It is reassuring that under ideal conditions, there were relatively few differences in quality of care. However, clinical uncertainty may be more the rule than the exception in medical care; for this study, more patients were classified in the eligible but not ideal category than the ideal group for most of the interventions. These findings speak to the importance of ongoing research to better understand the use and out-

comes of these treatments in patient cohorts not yet examined in randomized controlled trials.

The study's findings indicate that excess mortality in mental disorders (ie, the mortality that could not be explained by the measured clinical factors) clustered in patients who did not receive the cardiac guideline-based interventions. A growing body of literature in the general population has demonstrated the link between process and outcomes of care after myocardial infarction.^{17-20,44-46} Such a link may be mediated both by the interventions themselves and by the fact that these quality performance measures may serve as a marker for quality in other domains of care that also affect mortality.

The 1.19-times increase in mortality associated with mental disorders (and 1.11-times increase associated with major affective disorders) is considerably smaller than the 3.4-times increase in mortality in the most widely cited study of depression after AMI,⁴

although similar to the 1.09 RR^{47,48} reported in 2 more recent reports using similar techniques. In at least 3 other studies, associations between depressive symptoms that were significant in bivariate models became insignificant after controlling for demographic and clinical covariates.⁴⁹⁻⁵¹ Such findings speak to the importance of large sample sizes and robust adjustment for medical comorbidity in isolating the specific impact of mental disorders on excess cardiovascular mortality.

Several limitations of the study design should be noted. First, the method of case definition for mental conditions relied on medical provider diagnosis, and there were no data on current psychotropic medications, treatment status (including psychiatric consultation during the hospitalization), or severity of mental illness. This almost certainly resulted in an underestimate of the true prevalence of mental disorders in the population. If some patients with psychiatric disorders in remission were included as cases, then it might underestimate the association between mental disorders and poor outcomes; alternatively, the misclassification of "difficult" cardiac patients as having psychiatric disorders could lead to an overestimate of this relationship. Second, because the medical history was also drawn from medical record reviews, it is possible that incomplete documentation could have led to bias. Third, our proxies for socioeconomic status were limited to county-level measures of income and education. Finally, the observational nature of the study cannot definitively rule out the possibility that an unmeasured factor, such as persons with mental illness being treated by lower-quality providers or facilities, is mediating the relationship between mental disorders and mortality. Randomized trials would be needed to more definitively establish a causal link.

Perhaps the most important question left unanswered by the study is whether differences in quality of care are primarily a function of patient or provider factors. If patients' fears, cognitive limitations, or socioeconomic disadvantage, then initiatives to improve patient education and case management programs may be needed. If physician discomfort in treating these patients is the main factor impeding treatment, then similar initiatives may need to be targeted toward providers. Whatever the source, the results suggest that improving quality of medical care may be an important step in reducing excess mortality for this vulnerable population.

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