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Depression and health-care costs during the first year following myocardial infarction

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Abstract

Objective: Depression in the hospital after myocardial infarction (MI) has been associated with a substantial increase in the long-term risk of cardiac mortality, but little is known about other outcomes. This study uses Quebec Medicare data to examine the relationship between post-MI depression and physician costs, including both out-patient care and hospital readmissions. **Methods:** The sample consists of 848 1-year survivors of an acute MI who had completed the Beck Depression Inventory (BDI) in hospital. Two hundred sixty subjects had BDI scores of ≥10 (30.7%), indicative of mild to moderate symptoms of depression. Quebec Medicare data during the index admission for an acute MI and during the year following discharge were compared for the patients with elevated BDI scores and those with normal scores. **Results:** Total costs, in Canadian dollars (out-patient physician charges plus physician costs during admissions plus estimates of associated direct costs), were about 41% higher ($p = 0.004$) for patients with elevated BDI scores. The difference was primarily related to out-patient and emergency room visits and readmission costs associated with longer stays in hospital wards, and was not accounted for by use of psychiatric services or readmissions for revascularization. **Conclusion:** Results suggest that, in addition to the survival risks associated with post-MI depression, there are increased health care costs linked to both readmissions and out-patient contacts among depressed patients who survive the first post-MI year. The extent to which the increased use of health care may have reduced depression and enhanced survival remains unclear.

Keywords: Costs; Depression; Myocardial infarction

Introduction

Although recent research has implicated depression and other psychological factors in the prognosis of patients recovering from acute myocardial infarction (MI) [1–6], the impact of psychological variables on health care costs following MI has not been explored. In fact, to our knowledge, only one publication has examined the relationship between psychological variables and health care costs in patients with cardiac disease. Allison et al. [7] studied 381 patients with established coronary artery disease who were enrolled in a cardiac rehabilitation program. Those with high scores on a measure of psychological distress were more likely to be readmitted for cardiac problems within 6 months than patients with less distress. Hospitalization costs were also significantly higher in the distressed group. The differences remained after control for baseline measures of disease severity. Although the psychological index used in their study did not distinguish depression from global psychological distress, Allison's group speculated that depression might have been the major factor accounting for readmission and cost differences.

In contrast to the lack of information about the impact of psychological variables on health care costs in cardiac patients, there is an increasing body of literature

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documenting the relationship between depression and costs in general medical populations [8]. For example, Unützer's group recently demonstrated that elevated scores on a self-report measure of depressive symptoms were associated with increased health care costs over a 2-year period in a sample of more than 2500 elderly HMO patients [9]. Control for comorbid conditions did not change this relationship.

All physician payments in Canada are made through provincial Medicare systems. Quebec Medicare billing records include virtually complete information on the dates and costs for medical acts carried out in the province. By linking data from Medicare files with information about patient baseline characteristics collected in two previously reported studies of psychosocial factors and prognosis following MI, we were able to explore the relationship between depression and physician utilization. More specifically, we examined Quebec Medicare data during the index admission for an acute MI and during the year following discharge to assess the relationship between depression in hospital and physician costs, including both out-patient care and hospital readmissions.

Method

Sample

This sample includes patients hospitalized for an acute MI who completed baseline psychosocial interviews in hospital while participating in two separate studies, who survived to 1 year postdischarge, and for whom Medicare data were received from the Régie de l'assurance-maladie du Québec, the universal third-party payer in Quebec. Patients took part in either the Emotions and Prognosis Post-Infarct Study (EPPI) [4,5] or the Montreal Heart Attack Readjustment Trial (M-HART) [10]. EPPI was a prospective study of psychosocial risk following MI. All patients received usual medical care. M-HART was a randomized, controlled trial of 1 year of psychosocial intervention for post-MI patients. The current study combines patients in the control group from the randomized trial with those in the EPPI study. Because it is clear that the patterns of physician utilization surrounding death may be quite different from utilization for surviving patients [11], and that patients who die have no utilization after their deaths, varying survival times create major logical and practical complications in data analyses on medical costs. For these reasons, we restricted the current analyses to patients who survived at least 1 year following discharge. The data on the impact of depression on 1-year mortality in the combined samples from the two studies have been reported previously [12].

The sampling procedures and data collection methods for the two studies were almost identical, and have been described in detail elsewhere [4,6,10]. In brief, patients were recruited from consecutive admissions for an acute non–procedure-related MI in ten Montreal-area hospitals between 1991 and 1994. Institutional review boards in participating hospitals approved both studies. The diagnosis of MI was based on specific symptom, enzyme, and electrocardiographic criteria. Patients were excluded if they had other life-threatening conditions; if they were unable to speak English or French; if they were cognitively impaired or too physically unstable to complete the baseline interview; if they lived too far to return to the hospital for follow-up; and for administrative reasons (physician refusal, participation in other research, early discharge). Those meeting selection requirements were asked to participate as soon as possible after transfer from coronary care to medical wards. Overall, 63.6% of patients meeting study criteria provided informed consent, including 906 patients in the combined EPPI and M-HART control group sample. In both studies, women and those $\geq$65 years were significantly more likely to refuse to participate than men and younger patients, a pattern similar to that reported in other recent studies of cardiac disease [13].

A total of 862 of the 906 patients in the combined sample survived through the end of the first year. Medicare data on costs were received for 856 of these patients. Some 848 of the surviving patients with cost data also completed the baseline measure of depression, the Beck Depression Inventory (BDI) [14].

Procedures

Baseline psychosocial interviews were conducted in hospital between 5 and 15 days post-MI. These interviews assessed a variety of demographic, medical history, behavioral, and psychosocial variables including age, gender, education, smoking at the time of the MI, previous MI, previous treatment for hypertension, current marital status, and whether or not the patient was living alone. The 21-item self-report BDI was used to assess symptoms of depression. BDI scores $\geq$10 are considered to indicate at least mild to moderate levels of depression symptoms [15]. We will refer to these patients as "depressed."

Medical data were obtained from hospital charts and included Killip class (a clinical measure of left ventricular dysfunction [16]); left ventricular ejection fraction (n = 823); whether or not the patient was treated with a thrombolytic agent at the time of admission; whether or not the patient was prescribed hypoglycemic medications or insulin at discharge; and whether or not the patient had a cardiac catheterization, angioplasty, or bypass during the admission.

All patients or their family members were contacted 12 months after the MI to assess patient survival status and to obtain preliminary information about readmissions. The Commission d'accès à l'information du Qué-

bec provided study investigators with the right to access Medicare data for study participants, all of whom had provided informed consent for use of Medicare records. The following data were provided in computerized form for each patient by the Régie de l'assurance-maladie du Québec: the date; cost in Canadian dollars; place (in the hospital/out-patient); type of medical act (including procedures); International Classification of Disease diagnostic code; and physician's specialty for each medical act for which payment was made during the index admission or the 365 days following the patient's discharge from hospital. Because there is little private medical care available in Quebec, virtually all fee-for-service payments are processed and documented through the Régie de l'assurance-maladie. The Québec Medicare billing data were coded to yield the following variables: physician costs during the index admission; number of days in intensive care and number of ward days during admission; number of cardiac catheterizations, angioplasties, and bypass surgeries during admission; physician costs during readmissions that took place in the 365 days following discharge; the number of days readmitted in intensive care and hospital wards during the first postdischarge year; the number of emergency room visits during the year; out-patient physician costs; and the number of out-patient physician visits. In 1993, $1.00 Canadian was equal to approximately US$0.77.

Causes of readmissions were classified as cardiac or noncardiac based on information from patient reports, Medicare diagnoses, and hospital chart searches. Classification of out-patient physician visits as psychiatric was based on Medicare data concerning physician specialties as well as the diagnostic codes included on billing slips. All visits to psychiatrists were considered psychiatric. Visits to other physicians were considered psychiatric if the billing code indicated a psychiatric diagnosis. All contacts in which the physician's act was billed as psychotherapy were also considered psychiatric regardless of the diagnosis or physician's specialty.

Quebec Medicare data are limited to physician payment information. Other hospitalization costs, including nursing and technician costs, equipment for procedures, laboratory tests, and room and board, are absorbed by each hospital's global budget and not accounted for on a per-patient basis. No overall averages are available for Quebec. Therefore, we used averages based on direct cost accounting data from the Montreal Heart Institute to estimate these costs. The procedures for which average costs were available included angioplasty ($968), cardiac catheterization ($310), and bypass surgery ($3166). The average cost of an emergency room contact was $120.85. The per-diem average for ward care was $216.21, and for intensive care was $454.24.

Statistical analysis

Statistical analyses were carried out with SPSS for WINDOWS (version 9.0) [17] using two-tailed tests. Analyses examining the distribution of each outcome variable revealed that all were skewed, as is often the case with utilization data. The usual solution is to base statistical analysis on log-transformed data. However, log-transformed data are not easy to interpret clinically, and the actual means are not always informative because of the skewed distribution. However, Duan's smearing estimate [18] can be used to retransform log-transformed data into estimates of the means for the original data. Therefore, all statistical analyses of the cost data were carried out on log-transformed data, and the tables include the means of the smearing estimates of the log-transformed data as well as the raw means.

To examine utilization in relation to depression, as well as other clinical and psychosocial factors, baseline measures were dichotomized at the points used in our previous research, and analysis of variance was used to assess the bivariate relationship between each baseline variable and each log-transformed continuous measure of cost or physician utilization. Categorical utilization variables were compared for the depressed and nondepressed patients using chi-square statistics.

To examine the importance of depression above and beyond the cost-related importance of the baseline characteristics of depressed patients, all variables with at least a marginal ($p < 0.10$) relationship to both depression and estimated costs were selected as potential confounders [19]. These variables were entered together in the first step of a hierarchical regression analysis followed by the addition of depression on the second step, to assess the impact of depression after control for the potentially confounding variables. Finally, multiple linear regression analyses of log-transformed data followed by calculation of Duan's smearing estimated means were also carried out to calculate mean costs associated with depression after adjustment for baseline factors.

Results

Index admission costs

During hospitalization, some 30.7% of patients had BDI scores of $\geqslant$10, indicative of at least mild to moderate symptoms of depression. As Table 1 shows, during the index admission, both physician costs and estimated overall costs (based on physician costs plus accounting estimates of other direct costs for procedures and per-diem stays at the Montreal Heart Institute) were significantly higher for patients with BDI scores $\geqslant$10. Inspection of the smeared means shows that patients with elevated BDI scores cost, on average, 11% more than nondepressed patients [(6995 − 6291)/6291) = 0.11]. There were no depression-related differences for major procedures during the index admission, and the difference was primarily due to the fact that depressed pa-

Table 1
Physician costs and health care utilization in depressed and nondepressed patients during admission for an acute MI and during the first postdischarge year

	Nondepressed (BDI < 10), n = 588	Depressed (BDI ⩾ 10), n = 260	*p*-Value
Index Admission for an acute MI			
Cardiac catheterization (%)	45.4	48.5	0.41
Angioplasty (%)	17.3	17.3	1.00
Coronary bypass surgery (%)	8.7	10.8	0.33
Days in intensive care			
Mean ± SD	5.6 ± 3.1	5.7 ± 3.1	
Smoothed mean	5.6	5.7	0.75[a]
Days on ward			
Mean ± SD	9.2 ± 10.3	11.2 ± 11.0	
Smoothed mean	9.2	11.3	0.001[a]
Quebec medicare MD costs			
Mean ± SD	$1174 ± 987	$1325 ± 1086	
Smoothed mean	$1172	$1330	0.012[a]
Estimated cost of index admission[b]			
Mean ± SD	$6288 ± 4242	$7006 ± 4745	
Mean ± SD	$6292	$6996	0.007[a]
First year postdischarge: readmissions and procedures			
Cardiac catheterization (%)	14.6	14.6	1.00
Angioplasty (%)	8.2	9.6	0.49
Coronary bypass surgery (%)	6.0	4.2	0.31
Number of cardiac readmissions			
1 (%)	23.1	20.8	0.014
2 (%)	7.1	9.2	
⩾3 (%)	4.1	9.2	
Days in coronary intensive care			
Mean ± SD	1.3 ± 3.7	1.5 ± 4.1	
Smoothed mean	1.3	1.4	0.49[a]
Days on ward for cardiac readmissions			
Mean ± SD	3.7 ± 9.5	5.8 ± 12.6	
Smoothed mean	4.0	5.1	0.021[a]
Quebec Medicare MD costs during cardiac readmissions			
Mean ± SD	$474 ± 1187	$545 ± 1056	
Smoothed mean	$445	$645	0.13[a]
Estimated cost of cardiac readmissions[b]			
Mean ± SD	$2192 ± 5126	$2796 ± 5360	
Smoothed mean	$2064	$3252	0.13[a]
Noncardiac readmissions (%)	11.7	15.8	0.11
Days in Hospital for Noncardiac readmissions			
Mean ± SD	1.3 ± 6.6	1.5 ± 6.2	
Smoothed mean	1.3	1.5	0.17[a]
Quebec Medicare MD costs during noncardiac readmissions			
Mean ± SD	$90 ± 413	$105 ± 361	
Smoothed mean	$88	$111	0.14[a]
Estimated cost of noncardiac readmissions[b]			
Mean ± SD	$371 ± 1811	$438 ± 1653	
Smoothed mean	$358	$479	0.12[a]

(*continued*)

tients spent longer in hospital (more ward days) than nondepressed patients (Table 1).

Costs during first postdischarge year

During the first year after discharge, overall estimated costs were also significantly higher for depressed than for nondepressed patients, with a difference of about 41%. Similar to during the index admission, there were no differences in major procedures including bypass surgery, angioplasty, and cardiac catheterization. However, the depressed were more likely to be readmitted on more than one occasion and spent more total

Table 1
(*continued*)

	Nondepressed (BDI < 10), n = 588	Depressed (BDI ⩾ 10), n = 260	*p*-Value
First year postdischarge: emergency room visits			
Total emergency room visits			
Mean ± SD	0.9 ± 1.5	1.3 ± 2.0	
Smoothed mean	0.9	1.2	<0.0001[a]
Estimated cost of emergency room visits[b]			
Mean ± SD	$106 ± 184	$158 ± 239	
Smoothed mean	$100	$191	0.001[a]
First year postdischarge: out-patient visits			
Total out-patient MD visits			
Mean ± SD	13.1 ± 8.7	15.7 ± 10.6	
Smoothed mean	13.1	15.7	<0.0001[a]
Cardiologist visits			
Mean ± SD	4.2 ± 3.6	4.1 ± 3.1	
Smoothed mean	4.2	4.2	0.99[a]
Psychiatrist visits			
Mean ± SD	0.2 ± 1.2	0.5 ± 2.8	
Smoothed mean	0.3	0.4	<0.0001[a]
Other MD visits			
Mean ± SD	8.6 ± 7.6	11.0 ± 9.4	
Smoothed mean	8.5	11.3	<0.0001[a]
Quebec Medicare out-patient MD costs			
Mean ± SD	$447 ± 315	$546 ± 387	
Smoothed mean	$445	$553	<0.0001[a]
Estimated total cost of care in first year postdischarge			
Mean ± SD	$3116 ± 5687	$3938 ± 5964	
Smoothed mean	$3021	$4246	0.004[a]

[a] Comparison based on log-transformed data.

[b] Estimates based on Medicare data for physician costs plus accounting-based average direct costs for cardiac catheterizations, coronary angioplasties, coronary bypass surgeries, emergency room visits, and per-diem charges for intensive care and ward stays at the Montreal Heart Institute.

days in hospital during the year than the nondepressed. Again, as during the index admission, the difference was primarily due to more ward days among the depressed. Nonetheless, their estimated average readmission cost was not very different from that of the nondepressed. The major source of the depression-related increase in postdischarge costs was the depressed patients' greater use of emergency rooms and more frequent out-patient visits to physicians, other than cardiologists. Although depressed patients were more likely to have seen psychiatrists, psychiatric contacts were rare even among the depressed. On average, depressed patients had about two extra physician visits for nonpsychiatric problems.

Table 2 shows the percentage increases in estimated postdischarge costs associated with other baseline variables besides depression. Percentage increases are based on smeared means, and *p*-values are based on comparisons using natural log-transformed data. Age, gender, and all measures of disease severity and cardiac history were associated with significant increases in postdischarge costs (Table 2).

Comparison of the background characteristics of depressed and nondepressed patients reveal that the depressed were more likely to be female ($p < 0.0001$), to have <8 years of education ($p = 0.018$), to be unmarried ($p = 0.002$), to live alone ($p = 0.037$), and to have a Killip class ⩾2 ($p = 0.003$). They were also marginally more likely to smoke ($p = 0.069$), and to have a history of treatment for hypertension ($p = 0.075$). Except for marital status and living alone, all of these variables were significantly associated with estimated costs during the year following discharge, and constitute possible confounders of the relationship between depression and estimated costs. Therefore, we used hierarchical multiple linear regression analysis to calculate the degree to which depression had an impact on health care costs independent of these characteristics. Results showed that control for gender, education, smoking, history of hypertension, and Killip class reduced the percentage increase in costs associated with depression to 11%, but the independent impact remained marginally significant ($p = 0.083$). The addition of control for estimated index hospitalization costs did not substantially change the result (11.5% increase associated with depression, $p = 0.10$). Thus, although some of the impact of depression on estimated costs during the first year postdischarge

Table 2
Average percent increases in estimated 1-year postdischarge costs associated with baseline characteristics in patients recovering from an acute MI

Baseline characteristic	Increase in estimated 1-year postdischarge costs[a]	p-Value[b]
Depressed (n = 260)	40.6%	0.004
Age ⩾65 years (n = 286)	49.6%	0.001
Women (n = 265)	87.5%	<0.0001
<8 years education (n = 231)	27.4%	0.049
Not married (n = 233)	16.3%	0.22
Living alone (n = 160)	18.8%	0.22
Non-smoker (n = 441)	53.8%	<0.0001
History of treatment for hypertension (n = 292)	59.2%	<0.0001
Diabetes (n = 132)	100.1%	<0.0001
Previous MI (n = 189)	51.6%	0.002
No thrombolysis at index (n = 475)	36.8%	0.004
Killip class ⩾2 (n = 247)	75.1%	<0.0001
Left ventricular ejection fraction ⩽35% (n = 147)	56.9%	0.002
Cardiac catheterization during index (n = 393)	Decrease of 17.2%	0.15
Angioplasty during index (n = 147)	16.2%	0.30
Bypass surgery during index (n = 79)	Decrease of 34.4%	0.12

[a] Percentages based on differences in smeared means [18].
[b] P-Values based on natural log-transformed data.

was attributable to baseline characteristics of the depressed, the independent impact of baseline depression remained evident after control for these factors.

Discussion

These results indicate that decreased quality of life and increased risk of mortality are not the only negative outcomes associated with post-MI depression. We found that, among patients who survive the first post-MI year, depression during admission for the MI is associated with increased health care costs both during the index admission and during the following year. During the MI admission, depressed patients had estimated costs that were about 11% greater than other patients. During the first postdischarge year this jumped to a 41% increase. Neither difference was associated with major procedures including cardiac catheterization, coronary angioplasty, or bypass surgery. Both during index and over the first post-MI year, depressed patients spent more time in hospital wards than did the nondepressed. There were no differences in terms of days in intensive care either at index or during the year. After discharge, depressed patients visited emergency rooms more often and saw physicians on an out-patient basis on average two to three times more than nondepressed patients. This difference was not attributable to psychiatric visits or visits for which the physician provided a diagnostic code indicating psychiatric problems. Similar links between depression and increased health care utilization above and beyond the use of psychiatric services have been reported in noncardiac samples [20,21]. It is noteworthy that most of the increases associated with depression were not associated with the traditional "big-ticket" items and were related to more minor sorts of health care contacts. This fits in well with the suggestion that patient help-seeking behaviors, or nonspecific somatic complaints that may be associated with depression [22] may at least partially explain increased utilization among depressed patients. In cardiac patients, increased awareness of chest symptoms may also play a role [23].

Two variables besides depression that were associated with increased costs deserve some comment: gender and not smoking. Women differed significantly from men on all utilization variables, and, on average, had postdischarge health care costs that were close to 90% higher than men. They also were older, less educated, more likely to have been treated for hypertension, less likely to have had a previous infarct, more often diabetic, and more likely to have an advanced Killip class than men. However, after control for these factors, women continued to have significantly higher overall estimated costs during the first post-MI year. Women had an adjusted mean cost of $3836 in comparison to $3134 for men, an increase of about 22% ($p < 0.0001$). Women were also more likely to be depressed than men, but the increases in costs for women persisted even after depression was taken into account ($p = 0.001$). Furthermore, gender did not account for the impact of depression on health care costs, and the impact of the two variables was largely independent.

The relationship between smoking and reduced estimated costs during both the index admission and the first postdischarge year was unexpected. However, smokers were younger, better educated, less likely to have had a previous MI, less likely to have diabetes or a history

of treatment of hypertension, less likely to have had an advanced Killip class, and more likely to have been treated with thrombolysis at index. Control for these factors reduced the strength of the apparent link between smoking and lower overall estimated health care costs to marginal significance ($p = 0.10$). However, a link between smoking and reduced out-patient physician visits remained significant after covariate control ($p = 0.023$), with smokers seeing their physicians, on average, two to three times less than nonsmokers. One possible explanation is that after an MI smokers may be more reluctant than nonsmokers to come back for follow-up because of fear that their doctors will reinforce the need to stop smoking. Doctors may also be less open to repeated contacts with smokers with heart disease. This pattern of utilization deserves additional exploration.

Limitations

Our measure of depression was based on a self-report measure of severity of symptoms. We do not know what proportion of patients with high BDI scores would have been classified as having a major depression according to current psychiatric criteria. However, there is an increasing body of literature indicating that patients with subthreshold levels of depressive symptoms experience functional impairment [24,25]. Our previous work suggests that they may also be at increased post-MI risk [5]. Furthermore, at least one community-based study has found that patients with high levels of depressive symptoms have increases in cost as great as those fulfilling criteria for major depression [20]. The current results concerning physician utilization add support to the predictive validity of measures of depressive symptoms in post-MI patients.

Our cost analyses are based on the physician reimbursement schedule in Quebec during the study period (1991 through 1995). There were no preset administrative limits on the number of physician visits or the types of specialists patients could see. Although it would be difficult to obtain as complete a set of data on physician costs in other countries, our comprehensive universal medical system with no deductible and no limits to coverage make it difficult to generalize results to settings in which access to care may be more limited by economic factors. However, the observed increase in overall costs associated with depression was similar to that reported by Unützer et al. who studied elderly HMO patients in the United States [9]. They also found that age, gender, use of mental health services and physical illness severity did not explain the increase in costs associated with depression.

Because of the way in which hospitalization costs are covered in Quebec, we do not have individual data on aspects of medical care costs other than physician charges. Therefore, we used average accounting costs from the Montreal Heart Institute to estimate the direct costs of major procedures and per-diems for intensive care, ward care, and emergency visits, including room and board, laboratory tests, supplies, and nursing and technical services. We did not have information on more minor procedures or medication usage throughout the year, and did not attempt to estimate indirect costs. However, the data provided in Table 1 should permit interested readers to calculate estimated costs using other systems of reimbursement.

Our results suggest that, in addition to the survival risks associated with post-MI depression, there are increased health care costs linked to both readmissions and out-patient contacts among depressed patients who survive the first post-MI year. The extent to which the increased use of health care may have reduced depression and enhanced survival remains unclear. However, there was little utilization of psychiatrists in our sample, and we have no idea of whether more relevant mental health care would have reduced or increased overall costs.

This study extends previous evidence linking psychological factors with post-MI prognosis to include health care costs. We found that depression contributed a significant increment to physician costs and total estimated costs during the index admission and over the first post-MI year. In addition, these increases in costs were largely independent of gender and measures of disease severity, which themselves were important predictors of cost. Although the increased physician utilization associated with depression was not surprising, the finding that those who smoked had fewer visits with physicians was unexpected. Obviously, the missing part of the puzzle has to do with long-term outcome in relation to the care received during the first post-MI year. More costs soon after MI may mean lower costs later and/or better long-term prognosis. The ultimate question for our health care systems involves balancing the two, and more longitudinal research is needed to facilitate knowledgeable choices in terms of resource distribution.

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References

[1] Ahern DK, Gorkin L, Anderson JL, Tierney C, Hallstrom A, Ewart C, Capone RJ, Schron E, Kornfeld D, Herd JA, et al. Biobehavioral variables and mortality or cardiac arrest in the Cardiac Arrhythmia Pilot Study (CAPS). Am J Cardiol 1990; 66:59–62.

[2] Follick MJ, Gorkin L, Capone RJ, Smith TW, Ahern DK, Stablein D, Niaura R, Visco J. Psychological distress as predictor of ventricular arrhythmias in a post-myocardial infarction population. Am Heart J 1988;116:32–36.

[3] Ladwig KH, Kieser M, König M, Breithardt G, Borggrefe M. Affective disorders and survival after acute myocardial infarction: results from the post-infarction late potential study. Eur Heart J 1991;12:959–964.

[4] Frasure-Smith N, Lespérance F, Talajic M. Depression following myocardial infarction: impact on 6-month survival. JAMA 1993;270:1819–1825.

[5] Frasure-Smith N, Lespérance F, Talajic M. Depression and 18-month prognosis after myocardial infarction. Circulation 1995;91: 999–1005.

[6] Frasure-Smith N, Lespérance F, Talajic M. The impact of negative emotions on prognosis following myocardial infarction: is it more than depression? Health Psychol 1995;14:388–398.

[7] Allison TG, Williams DE, Miller TD, Patten CA, Bailey KR, Squires RW, Gau GT. Medical and economic costs of psychologic distress in patients with coronary artery disease. Mayo Clin Proc 1995;70:734–742.

[8] Shapiro S, Skinner EA, Kessler LG, Von Korff M, German PS, Tischler GL, Leaf PJ, Benham L, Cottler L, Regier DA. Utilization of health and mental health services in three epidemiologic catchment area sites. Arch Gen Psychiatry 1984;41: 971–978.

[9] Unützer J, Patrick DL, Simon G, Grembowski D, Walker E, Rutter C, Katon W. Depressive symptoms and the cost of health services in HMO patients aged 65 years and older. JAMA 1997;277:1618–1623.

[10] Frasure-Smith N, Lespérance F, Prince RH, Verrier P, Garber RA, Juneau M, Wolfson C, Bourassa MG. Randomised trial of home-based psychological nursing intervention for patients recovering from myocardial infarction. Lancet 1997;350:473–479.

[11] Mustard CA, Kaufert P, Kozyrskyj A, Mayer T. Sex differences in the use of health care services. N Engl J Med 1998;338:1678–1683.

[12] Frasure-Smith N, Lespérance F, Juneau M, Talajic M, Bourassa MG. Gender, depression and one year prognosis after myocardial infarction. Psychosom Med 1999;61:26–37.

[13] Gorkin L, Schron EB, Handshaw K, Shea S, Kinney MR, Branyon M, Campion J, Bigger T Jr, Sylvia SC, Duggan J, et al. Clinical trial enrollers vs. nonenrollers: the Cardiac Arrhythmia Suppression Trial (CAST) Recruitment and Enrollment Assessment in Clinical Trials (REACT) project. Control Clin Trials 1996;17:46–59.

[14] Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. Arch Gen Psychiatry 1961; 4:561–571.

[15] Beck AT, Steer RA. Beck Depression Inventory manual. Toronto: The Psychological Corporation/Harcourt, Brace, Jovanovich 1987.

[16] Killip T, Kimball JT. Treatment of myocardial infarction in a coronary care unit: a two year experience with 250 patients. Am J Cardiol 1967;20:457–464.

[17] SPSS, Inc. SPSS base 9.0. Chicago: SPSS 1999.

[18] Duan N. Smearing estimate: a nonparametric retransformation method. JASA 1983;78:605–610.

[19] Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. J Pers Soc Psychol 1986;51: 1173–1182.

[20] Johnson J, Weissman MM, Klerman GL. Service utilization and social morbidity associated with depressive symptoms in the community. JAMA 1992;267:1478–1483.

[21] Levenson JL, Hamer RM, Rossiter LF. Relation of psychopathology in general medical inpatients to use and cost of services. Am J Psychiatry 1990;147:1498–1503.

[22] Katon W, Berg A, Robins AJ, Risse S. Depression: medical utilization and somatization. West J Med 1986;144:564–568.

[23] Ladwig KH, Breithardt G, Borggrefe M. Extracardiac contributions to chest pain perception in patients 6 months after acute myocardial infarction. Am Heart J 1999;137:528–534.

[24] Sherbourne CD, Wells KB, Hays RD, Rogers W, Burnam A, Judd LL. Subthreshold depression and depressive disorder: clinical characteristics of general medical and mental health specialty outpatients. Am J Psychiatry 1994;151:1777–1784.

[25] Judd LL, Rapaport MH, Paulus MP, Brown JL. Subsyndromal symptomatic depression: a new mood disorder? J Clin Psychiatry 1994;55(suppl 4):18–28.