Prevalence of Depression in Survivors of Acute Myocardial Infarction

Review of the Evidence

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OBJECTIVES: To assess the prevalence and persistence of depression in patients with acute myocardial infarction (AMI) and the relationship between assessment modality and prevalence.

DATA SOURCES: MEDLINE®, Cochrane, CINAHL®, PsycINFO®, and EMBASE®.

REVIEW METHODS: A comprehensive search was conducted in March 2004 to identify original research studies published since 1980 that used a standardized interview or validated questionnaire to assess depression. The search was augmented by hand searching of selected journals from October 2003 through April 2004 and references of identified articles and reviews. Studies were excluded if only an abstract was provided, if not in English, or if depression was not measured by a validated method.

RESULTS: Major depression was identified in 19.8% (95% confidence interval [CI] 19.1% to 20.6%) of patients using structured interviews (N=10,785, 8 studies). The prevalence of significant depressive symptoms based on a Beck Depression Inventory score $\geq$10 was 31.1% (CI 29.2% to 33.0%; N=2,273, 6 studies), using a Hospital Anxiety and Depression Scale (HADS) score $\geq$8%, 15.5% (CI 13.2% to 18.0%; N=863, 4 studies), and with a HADS score $\geq$11%, 7.3% (CI 5.5% to 9.3%; N=830, 4 studies). Although a significant proportion of patients continued to be depressed in the year after discharge, the limited number of studies and variable follow-up times precluded specification of prevalence rates at given time points.

CONCLUSIONS: Depression is common and persistent in AMI survivors. Prevalence varies depending on assessment method, likely reflecting treatment of somatic symptoms.

KEY WORDS: myocardial infarction; depression; prevalence; systematic review.
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Increasing attention has been focused on mood disturbance in patients recovering from an acute myocardial infarction (AMI), especially since it was first reported that depression was associated with increased mortality after AMI.[1] More recent studies have reported a similar association,[2–6] although some authors have found that this association is not significant if other predictors of mortality are taken into account,[7,8] or if one adjusts for potentially confounding symptoms, like fatigue, that may be common to depression and heart disease.[9] A meta-analysis published in 2004 found that depression is associated with cardiac and all-cause mortality in post-AMI patients after controlling for other predictors.[10] A second 2004 meta-analysis reported similar results, but focused more broadly on patients with coronary heart disease rather than specifically on patients with AMI.[11] The authors of a 2005 systematic review, however, concluded that quality issues, such as the use of nonvalidated measurements and insufficient power, made it difficult to draw unambiguous conclusions about the association between depression and post-AMI mortality.[12]

Acute myocardial infarction practice guidelines recommend that the psychosocial status of patients be evaluated, "including inquiries regarding symptoms of depression."[13] These guidelines, however, do not recommend procedures for assessing depression or distinguishing symptoms of depression from those of heart disease. Symptoms characteristically associated with depression may occur as a normal reaction to the AMI or to the hospitalization itself, complicating diagnosis.[14–16] The most commonly used assessment methods for identifying patients with depression after AMI are structured clinical interviews[17–19] and questionnaires, particularly the Beck Depression Inventory (BDI)[20] and the Hospital Anxiety and Depression Scale (HADS).[21] Van Melle et al.[10] reported prevalence data from over 15 distinct cohorts in their systematic review of the association of depression with mortality and cardiovascular events. As the focus of their study was on this association rather than on prevalence, their sample included fewer than half of the studies from the peer-reviewed literature that report prevalence of post-AMI depression within 1 month of the index event. No studies have systematically reviewed the prevalence of depression among post-AMI patients or have investigated the effect of assessment modality on reported prevalence rates.

This systematic review of the literature addresses the following questions: (1) What is the prevalence of depression among patients hospitalized for AMI? (2) How common are clinically significant symptoms of depression among patients hospitalized for AMI? (3) How do symptoms of depression, if present at the time of hospitalization, evolve over time? and (4) What is the relationship between assessment modality and reported prevalence? The review was part of a comprehensive evidence report carried out to address these and other questions related to post-AMI depression.[22]

The authors have no conflicts of interest to report.

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METHODS

Search Strategy

The MEDLINE®, Cochrane, CINAHL®, PsycINFO®, and EMBASE® databases were searched for articles published between 1980 and March 2004. Search strategies and terms are found in Appendix A. Hand searching was carried out on 16 selected journals (see Appendix B) through April 2004, and on references of reviews and eligible articles. No searching was carried out for data from unpublished articles. We used ProCite® reference management software to create a database of reference material identified through an electronic search for relevant guidelines and reviews, through discussions with experts, and through the article review process.

Study Selection

Two investigators independently evaluated studies for inclusion with discrepancies resolved by consensus. Studies published since 1980 with original human data that used a standardized interview or validated questionnaire to assess depression were included. When multiple articles were published on the same study cohort, the most relevant article was included. Articles were excluded if they consisted of case series or case reports, were not in English, if only a meeting abstract was provided, if depression was not measured by a validated method, or if data was not reported on the timing of the depression assessment relative to the myocardial infarction (MI). Studies with mixed populations were included if data on MI patients were reported separately. Author and journal names were not masked as masking does not appear to significantly influence inclusion and exclusion decisions.[23]

Data Extraction and Quality Assessment

Two investigators independently extracted data, reconciling differences by face-to-face meeting and consensus. Data extraction forms were developed from consensus among the investigative team regarding the items that were most important for describing the characteristics of each study, and summarizing study results. The evidence-grading scheme followed the approach recommended by the International GRADE Working Group, and reflected the quantity, quality, and consistency of the evidence.[24] Assessment of the methodological quality of each study was performed independently by each reviewer and reflected the study's representativeness, assessment protocol, outcomes and follow-up, statistical analysis, and degree of conflict of interest.

Definition and Assessment of Depression

Depression was defined as "symptoms meeting established clinical threshold criteria for depression as measured by validated questionnaires or standardized psychiatric interviews." Questionnaires measure symptoms of depression whereas standardized interviews use Diagnostic and Statistical Manual (DSM) criteria to establish a diagnosis. This report refers to "validated questionnaires or rating scales." Although all included studies use instruments validated in at least 1 patient group, little systematic validation has been carried out specifically in AMI patients.[22] In addition, the manner in which "clinical threshold criteria" is interpreted varies considerably across studies. For example, 1 study used a score ≥ 8 on the depression subscale of the HADS to report a prevalence of "clinically significant levels of depression,"[25] whereas another used ≥ 11 to denote "clinical levels of depression."[26] Three other studies referred to a scores from 8 to 10 as "possibly clinically significant" or "borderline" depression and a score ≥ 11 as "probably clinically significant" depression.[27–29]

The second part of this inquiry addressed the percentage of patients with post-AMI depression in the hospital who continued to be depressed 1 month or longer after the index AMI. A number of studies reported overall prevalence data at hospitalization and follow-up, but did not report the prevalence of depression after discharge among the group initially depressed. Other studies just reported data 1 month or longer after AMI. Despite not addressing the persistence of depression among those depressed during hospitalization, data from these studies are reported as an indicator of the overall prevalence of depression at different points post-discharge.

Data Synthesis

Weighted in-hospital prevalence rates were calculated for all groups of studies that used an identical assessment method and cutoff criterion. Ninety-five percent confidence intervals (CI) for these estimates were calculated using the bootstrap method[30,31] with 1,000 resamples. Multiple comparisons between pairs of weighted prevalence rates across assessment methods and criteria were conducted using Hochberg's Sequential Method[32] to maintain the family-wise error rate at $p < .05$.

RESULTS

Search Results

The search process for the entire post-AMI depression review[22] identified 3,770 unique titles. During the title and abstract reviews, 2,597 and 825 citations were excluded, respectively. Of the remaining articles, 128 were reviewed for prevalence of depression during hospitalization, and 56 for prevalence 1 month or more post-AMI. After the final article review, 24 articles were included for prevalence during hospitalization (Table 1). Four reported data on the persistence of depression in those depressed during hospitalization (Table 2), and 18 on prevalence 1 month or more after AMI (Table 3).

Prevalence of Depression Among Patients Hospitalized for AMI

Twenty-four studies published between 1986 and 2004, which examined 14,326 patients, were included for in-hospital depression (Table 1). The studies ranged in size from 37 to 9,279 subjects. Mean age ranged from 51 to 68 years old and the percentage of males from 58% to 100%. Of the 24 included articles, 8 used a standardized interview for the diagnosis of depression (e.g., Structured Clinical Interview for DSM [SCID] or Diagnostic Interview Schedule [DIS]).[6,8,33–38] Seventeen studies used validated questionnaires or rating scales, including the BDI,[3,6,39–42,44,47,48] the Hamilton Rating Scale for Depression,[41,43] the HADS,[25–29] the Montgomery–Asberg Depression Rating Scale,[45] or the Holland Sgroi Anxiety Depression Scale.[46]

The prevalence of depression ranged from 16% to 45% in the 8 studies that used a structured clinical interview. The largest of these studies, the Enhancing Recovery in Coronary Heart Disease Patients (ENRICHD) study,[38] examined 9,279

Table 1. Summary of Studies on Prevalence of Depression During Hospitalization for Acute Myocardial Infarction (AMI)

Study	Study Design	Region	No. of Subjects	Mean Age (y)	% Male	Method and Time of Assessment	Prevalence* (%)
Structured Interviews							
Schleifer et al., 1989[33]	Prosp. cohort	United States	283	64	64	RDC; 8 to 10 d post-AMI	Major = 18, Minor = 27
Carney et al., 1990[34]	Cross-sectional	United States	70	53	76	DIS; in hospital 5 to 7 d post-AMI	23
Forrester et al., 1992[35]	Cross-sectional	United States	129	59	74	PSE; in hospital within 10 d of AMI	21
Lesperance et al., 1996[36†]	Prosp. cohort	Canada	222	60	78	DIS in hospital 5 to 15 d post-AMI	16
Kaufmann et al., 1999[8]	Prosp. cohort	United States	331	56% > 65 y	66	DIS; in hospital 3 to 15 d post-AMI	27
Bush et al., 2001[6]	Prosp. cohort	United States	267	65	58	SCID; in hospital within 2 to 5 d of AMI	17
Watkins et al., 2002[37]	Cross-sectional	United States	204	59	58	DIS; in hospital 3 to 9 d post-AMI	18
Berkman et al., 2003[38]	RCT	United States	9,279	63	61	DISH; 2 to 4 wk post-AMI	20
Weighted/unweighted means				61/60	62/67		19.8/20.2
BDI ≥ 10							
Bush et al., 2001[6]	Prosp. cohort	United States	267	65	58	BDI ≥ 10; in hospital within 2 to 5 d of AMI	20
Lane et al., 2002[39]	Prosp. cohort	Europe	288	63	75	BDI ≥ 10; in hospital within 15 d of AMI	30
Lesperance et al., 2002[3]	Prosp. cohort	Canada	896	59	68	BDI ≥ 10; in hospital	32
Luutonen et al., 2002[40]	Prosp. cohort	Europe	85	61	77	BDI ≥ 10; in hospital	21
Barefoot et al., 2003[41]	Prosp. cohort	United States	187	61	63	HAM-D, BDI ≥ 10; 2 wk post-AMI	28, 37
Lauzon et al., 2003[42]	Prosp. cohort	Canada	550	60	79	BDI ≥ 10; within 2 to 3 d of hospitalization	35
Weighted/unweighted means				61/61	70/70		31.1/29.2
HADS ≥ 8, ≥ 11							
O'Rourke and Hampson 1999[25]	Prosp. cohort	Europe	70	58	74	HADS ≥ 8; 3 to 5 d post-AMI	14
Mayou et al., 2000[27]	Prosp. cohort	Europe	344	63	73	HADS ≥ 8, ≥ 11; in hospital within 3 d AMI	17, 8
Brink et al., 2002[28]	Prosp. cohort	Europe	114	68	68	HADS ≥ 8, ≥ 11; in hospital within 1 wk AMI	11, 8
Martin et al., 2003[29]	Prosp. cohort	Europe	335	67	67	HADS ≥ 8, ≥ 11; in hospital within 1 wk AMI	15, 6
Bennett and Mayfield, 1988[26]	Prosp. cohort	Europe	37	62	73	HADS ≥ 11; in hospital	13
Weighted/unweighted means for HADS ≥ 8				65/64	70/71		15.5 / 14.6
Weighted/unweighted means for HADS ≥ 11				65/65	70/70		7.3/ 8.8
Other Assessment Tools and Criteria							
Taylor et al., 1986[43]	RCT	United States	173	52	100	HAM-D; within 3 wk of AMI	13
Davis and Jensen 1988[44]	Prosp. cohort	Canada	52	51	90	BDI ≥ 13; in hospital	10
Silverstone 1990[45]	Prosp. cohort	Europe	100	NR	NR	Montgomery-Asberg; in hospital	19
Gilutz et al., 1991[46]	Prosp. cohort	Europe, Israel	Europe = 98 Israel = 87	NR	NR	Holland Sgroi Anxiety Depression Scale; in hospital 10 to 15 d post-AMI	31, 35
Legault et al., 1992[47]	Prosp. cohort	Canada	52	55	78	BDI ≥ 16; in hospital	18
Steeds et al., 2004[48]	Prosp. cohort	Europe	131	NR	NR	BDI-II ≥ 12; in hospital	47

*See text.

†Subset of Lesperance, 2002.

Prosp. Cohort, Prospective cohort study; RDC, Research Diagnostic Criteria; DIS, Diagnostic Interview Schedule; PSE, Present State Examination; BDI, Beck Depression Inventory; RCT, Randomized Controlled Trial; DISH, Depression Interview and Structured Hamilton; SCID, Structured Clinical Interview for DSM; NR, Not Reported; HAM-D, Hamilton Rating Scale for Depression; HADS, Hospital Anxiety and Depression Scale.

Table 2. Summary of Studies on Prevalence of Depression 1 month or More PostAcute Myocardial Infarction (AMI) for Patients Identified in Hospital

Study	Study Design	Region	Mean Age	% Male	Method	In Hospital			Follow-up		
						No. of Subjects	Time of Assessment	Prevalence (%)	No. of Subjects	Time of Assessment	% of Patients with Depression in Hospital and at Follow-up
Schleifer et al., 1989[33]	Prospective Cohort	United States	63	64	RDC	283	8 to 10 d post-AMI	Major = 18 Minor = 27	190	3 mo	Major in hospital: Major = 37 Minor = 37 Minor in hospital: Major = 16 Minor = 22
Lesperance et al., 1996[36]	Prospective Cohort	Canada	60	78	DIS	222	5 to 15 d post-AMI	16	204 182	6 mo 12 mo	48 43
Lauzon et al., 2003[42]	Prospective Cohort	Canada	60	80	BDI $\geq$ 10	550	Within 2 to 3 d of hospitalization	35	466	30 d	70
Davis and Jensen, 1988[44]	Prospective Cohort	Canada	51	90	BDI $\geq$ 13	52	In hospital	10	52	6 to 8 wk	60

RDC, Research Diagnostic Criteria; DIS, Diagnostic Interview Schedule for DSM-III; BDI, Beck Depression Inventory.

patients and reported a prevalence of 20%. ENRICHD included patients with low social support and/or major depression, but only those with major depression were included in this analysis. The weighted prevalence for all 8 studies was 20.5% (N=10,785; CI 19.8% to 21.3%). These studies differed in terms of which diagnoses were identified and reported, the duration of symptoms required to establish the diagnosis, and the timing of the assessment relative to the AMI. Four studies only reported the diagnosis of major depression,[8,34,36,37] 2 studies reported major depression and dysthymia,[6,35] 1 study included major and minor depression,[33] and 1 study included major depression, minor depression and dysthymia.[38] Three studies did not have a symptom duration criterion,[8,35,36] 2 studies used a 7-day criterion,[33,37] and 1 study required 7 days for repeat episodes, but 14 days for new diagnoses.[38] Two studies required the presence of symptoms for 2 weeks prior to the AMI.[6,34] Timing of assessment ranged from 2–5 days[6] to 14–15 days post-AMI.[8,36,38] The study that reported the highest prevalence of depression[33] reported a prevalence of 18% for major depression and 27% for minor depression, for a total of 45%. If only major depression were included for this study, which appears to be a reasonable approach, the range of prevalence rates for studies that used structured clinical interviews would be 16% to 27%, and the weighted prevalence rate would be 19.8% (CI 19.1% to 20.6%).

Symptoms of Depression Among Patients Hospitalized for AMI

In the 17 studies that used a validated questionnaire or rating scale, 10% to 47% of patients had clinically significant symptoms of depression. Instruments and threshold criteria, however, varied substantially. Of the 9 studies that used the BDI, 6 used a score of $\geq$10 to indicate "at least mild-to-moderate symptoms of depression,"[3,6,39,42] and reported a prevalence range of 20% to 37%. The weighted prevalence was 31.1% (N=2,273; CI 29.2% to 33.0%).

In the 4 studies that used a HADS score of $\geq$8,[25,27–29] prevalence ranged from 11% to 17%. The weighted prevalence was 15.5% (N=863; CI 13.2% to 18.0%). In the 4 studies that used a HADS $\geq$11,[26–29] the prevalence range was from 6% to 13%. If 1 study with only 37 subjects[26] is removed, the range is from 6% to 8%. The weighted prevalence was 7.3% (N=830; CI 5.5% to 9.3%).

Thus, prevalence rates were similar among studies that used the same assessment method and cutoff criterion (Fig. 1). There were significant differences, however, between all pairs of weighted prevalence rates. Overall evidence quality for the studies was rated as medium. Detailed quality ratings are available in the full evidence report.[22]

Persistence of Depression After AMI

Only 4 studies addressed the persistence of depression in patients diagnosed during hospitalization for AMI (Table 2).[33,36,42,44] These studies reported follow-up data at 30 days,[42] 6 to 8 weeks,[44] 3 to 4 months,[33] and 6 and 12 months after AMI.[36] Only 1 of these studies reported data on the number of patients who were referred for or received treatment for depression.[36]

Davis and Jensen[44] found that of the 5 of 52 patients initially having a BDI score of 13 or higher, 3 of the 5 (60%) were still depressed 6 to 8 weeks later. Schleifer et al.[33] reported in-hospital and follow-up data on 190 patients, 30 of whom had major depression and 51 of whom had minor depression during the initial hospitalization based on a SCID.[17] Of the 30 patients with major depression during the initial hospitalization, more than 70% had either major depression or minor depression at follow-up. Of the 30, 11 (36.7%) had major depression 3 to 4 months later and 11 (36.7%) had minor depression for a total of 22 out of 30 (73.3%). Lauzon et al.[42] reported prevalence data on 550 patients during the AMI hospitalization and 466 at 30-day follow-up. Of the patients with a BDI score $\geq$10 during hospitalization, 70% continued to be depressed at 30 days. Lesperance et al.[36] studied 222 patients during the AMI hospitalization and at 6 and 12 months post-AMI. Of the patients with major depression at baseline using the DIS,[19] 48% and 43% continued to have major depression at 6 and 12 months, respectively. Thus, in these 4 studies, a majority of patients with depression during

Table 3. Summary of Studies on the Prevalence of Depression 1 Month or More PostAcute Myocardial Infarction

Study	Study Design	Region	No. of Subjects	Mean Age	% Male	Method	Prevalence (%) 1 to 6 mo	Prevalence (%) >6 to 12 mo	Prevalence (%) >12 mo
Structured Interviews									
Davis and Jensen, 1988[44*]	Prosp. cohort	Canada	52	51	90	SCID	6 to 8 wk = 6	–	–
Schleifer et al., 1989[33]	Prosp. cohort	Unites States	283	64	64	RDC	Major, 3 mo = 15, Minor 3 mo = 18	–	–
Garcia et al., 1994[49]	Cross-sectional	Europe	97	50	100	RDC	Major 1 mo = 11, Minor 1 mo = 27	–	–
Travella et al., 1994[50†]	Prosp. cohort	Unites States	26 to 33[‡]	58	74	PSE	3 m = 15, 6 mo = 21	9 mo = 31 12 mo = 29	–
Lesperance et al., 1996[36]	Prosp. cohort	Canada	204,161[‡]	60	78	DIS	6 mo = 21	12 mo = 11	–
Strik et al., 2001[51]	Prosp. cohort	Europe	206	60	76	SCID	Major 1 mo = 11, Minor 1 mo = 8	–	–
Lesperance et al., 2004[52]	Prosp. cohort	Canada	481	60	81	SCID	2 mo = 8	–	–
BDI ≥ 10									
Lane et al., 2002[39]	Prosp. cohort	Europe	288	63	75	BDI ≥ 10	4 mo = 38	12 mo = 37	–
Luutonen et al., 2002[40]	Prosp. cohort	Europe	85	61	77	BDI ≥ 10	6 mo = 30	–	18 mo = 34
Lauzon et al., 2003[42]	Prosp. cohort	Canada	466 to 486	60	79	BDI ≥ 10	1 mo = 39, 6 mo = 39	12 mo = 30	–
HADS ≥ 8 ≥ 11									
Martin et al., 2003[28]	Prosp. cohort	Europe	335	67	67	HADS ≥ 8,11	6 wk ≥ 8 = 13, 6 wk ≥ 11 = 5 6 mo ≥ 8 = 10, 6 mo ≥ 11 = 5	–	–
Bennett and Mayfield, 1988[26]	Prosp. cohort	Europe	37	62	73	HADS ≥ 11	3 mo = 3	–	–
Other Assessment Tools and Criteria									
Trelawny-Ross and Russell, 1987[53]	Prosp. cohort	Europe	31	NR	100	GCIS	2 mo = 26, 6 mo = 26	–	–
Follick et al., 1988[54]	RCT	Unites States	238	55	72	SCL-90 Dep	–	9 mo = 10	–
Legault et al., 1992[47]	Prosp. cohort	Canada	52	55	78	BDI ≥ 16	3 mo = 7	12 mo = 9	–
Clarke et al., 1996[55]	Prosp. cohort	Canada	52	NR	100	ZD ≥ 50	3 mo = 24	–	–
Lehto et al., 2000[56]	Prosp. cohort	Europe	101	62	69	DEPS	–	–	Median 21 mo post-hospital = 16
Shiotani et al., 2002[57]	Prosp. cohort	Asia	1,042	63	80	ZD ≥ 40	3 mo = 42	–	–

*Also reported 10% at 6 to 8 wk with BDI ≥ 13.
‡Number of subjects varies per follow-up point.
†Same study as Forrester et al.[35] in Table 1.
Prosp. cohort, Prospective cohort study; SCID, Structured Clinical Interview for DSM; RDC, Research Diagnostic Criteria; PSE, Present State Examination for DSM-III; DIS, Diagnostic Interview Schedule; BDI, Beck Depression Inventory; HADC, Hospital Anxiety and Depression Scale; NR, Not Reported; GCIS, Goldberg's Clinical Interview Schedule; RCT, Randomized Controlled Trial; SCL-90, Depression subscale of Symptom Checklist-90; ZD, Zung Depression Scale; DEPS, The Depression Scale.

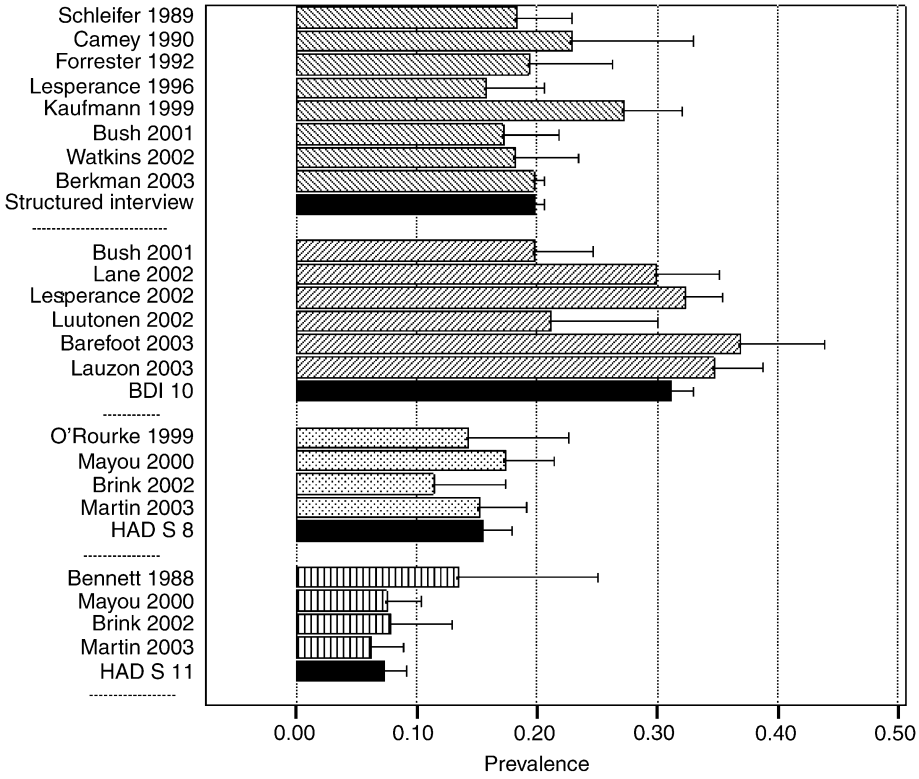

FIGURE 1. Prevalence of depression during hospitalization for acute myocardial infarction. The reported prevalence of depression in included studies is depicted, along with the error bars indicating 95% confidence intervals. Shown in forward crosshatched bars are the prevalence rates in studies that used structured interviews (top group). Shown in backward crosshatched bars are the prevalence rates using a Beck Depression Inventory score of 10 or greater (second group from top). Shown in black dots on a white background are the prevalence rates using a Hospital Anxiety and Depression Scale (HADS) score of 8 or greater (second group from bottom). Shown in vertical bars are prevalence rates using a HADS score of 11 or greater (bottom group). Weighted group prevalence rates are shown in solid black bars beneath each group.

the initial hospitalization remained depressed when assessed 1 to 12 months later.

A total of 18 studies, including the 4 above, reported prevalence data 1 month or longer after AMI without necessarily distinguishing persistent depression from new incidence and remission patterns. Of the 18 studies, 7 employed commonly used standardized clinical interviews for the diagnosis of depression,[33,36,44,49–52] 11 used validated questionnaires or rating scales such as the BDI,[39,40,42,44,47] the Zung Depression Rating Scale (ZDS),[55,57] the HADS,[26,28] the SCL-90 Depression Subscale,[54] or the Depression Scale,[56] and one used Goldberg's Clinical Interview Schedule[53] (Table 3). The studies varied widely in terms of method and timing of assessment and reported prevalence rates. Nevertheless, the reported prevalence of major depression or potentially significant symptoms of depression in these studies is much higher than the generally accepted 5% prevalence in the general population.[58]

DISCUSSION

This is the first systematic review of the literature examining the prevalence of depression after AMI with data on more than 14,000 patients. Based on 10,785 patients assessed using a structured clinical interview, major depression was present in approximately 1 of 5 patients hospitalized for AMI. Based on 2,273 patients assessed using a BDI[20] score ≥ 10, approximately 1 of 3 patients hospitalized for AMI had "at least mild-to-moderate symptoms of depression." A lower prevalence of depressive symptoms meeting threshold criteria suggesting clinical significance was reported in studies using the HADS,[21] for both thresholds designating "*possibly* clinically significant depression" (≥ 8; approximately 1 in 6 patients) or "*probably* clinically significant depression" (≥ 11; approximately 1 in 13 patients). Only 4 studies reported the proportion of patients with major depression or clinically significant symptoms of depression during the AMI hospitalization that remained depressed after hospital discharge. In these studies, which included 1,107 patients during the AMI hospitalization and 912 patients at follow-up, depression during the AMI hospitalization persisted in about half to two-thirds of initially depressed individuals in the first 1 to 12 months after discharge. The 19.8% prevalence of depression in patients hospitalized for AMI is higher than the possibly conservative rate of major depression in the general population as reported by the National Comorbidity Study (5%),[58] in primary care (5% to 10%),[59] or in other inpatient medical settings (6% to 14%).[59] It is closer to the prevalence rates reported among patients with a stroke (20% to 30%).[60–63]

The reported prevalence of depression using a structured clinical interview (19.8%) was higher than the prevalence of possible (15.5%) or probable (7.3%) clinical depression using the HADS and lower than the prevalence of "at least mild-to-moderate symptoms of depression" using the BDI (31.1%). These differences do not appear related to population charac-

teristics, which were similar across all assessment method groups (Table 1), or to sample size, regional differences, or evidence quality. These discrepancies appear to reflect some of the challenges in evaluating symptoms of depression among patients hospitalized with acute medical illness. Somatic symptoms used to diagnose depression can be difficult to distinguish from symptoms secondary to medical illness or its treatment.[15,64–66] Koenig et al.[66] documented similar variability in the reported prevalence of depression among medically ill patients based on characteristics of the method of assessment.

The DSM-IV[67] states that symptoms "accounted for by a general medical condition" should not be counted toward a diagnosis of major depression. There are no explicitly defined paradigms, however, for determining the origin of somatic symptoms. Thus, whether to attribute them to depression or not is typically left to interviewer judgment. The HADS does not include any questions about somatic symptoms.[68] By contrast, 7 of the 21 items on the BDI assess somatic symptoms of depression with no reference to origin.[20] It is therefore not surprising that the prevalence of possible or probable clinical depression using the HADS was lower than either the prevalence of major depression with a structured clinical interview or the prevalence of potentially significant depressive symptoms as assessed by the BDI.

Limitations of this review include the wide variations in the designs of the studies from which data was synthesized. Although results were relatively homogeneous within assessment modalities and threshold criteria, there was marked heterogeneity in study size, in-hospital and follow-up assessment timing, symptom duration criteria utilized, and diagnostic inclusiveness in studies that used standardized interviews. In addition, the review did not include abstracts, nonpublished studies, or studies published in non-English language journals. Although there does not appear to be a relationship between prevalence and sample size of the studies, we cannot rule out selection biases.

There are several reasons why it seems appropriate to screen for depression during the AMI hospitalization. Depression may have a greater effect on quality of life and physical limitation in patients with coronary disease than traditionally determined measures of cardiac function.[69] This effect is likely to persist for at least several months, since depression that is present during the AMI hospitalization does not resolve in a substantial proportion of patients based on the few studies that have addressed this issue. Depression would be important to identify in AMI patients if it were shown that patients should be treated differently than those who are not depressed. For example, patients with depression after AMI have increased platelet activation[70] and poor adherence to recommended therapy,[71] raising the possibility that these patients should receive more aggressive antiplatelet therapy or focused adherence-enhancing initiatives. Although the effect of these strategies has not yet been examined, proper identification of patients with depression during the AMI hospitalization is critical if these questions are to be appropriately addressed. Some have argued that depression should be identified during the AMI hospitalization because depressed patients have a higher risk of morbidity and mortality after AMI.[1,2,4] Two recent large, randomized controlled trials assessed whether treatment of depression affects prognosis in AMI patients with depression,[33,72] and neither definitively demonstrated that treatment of depression alters cardiovascular prognosis of AMI patients. It would be unfortunate if these results were to lead health care providers to turn their attention away from depression in the AMI setting, however, as it is widely accepted that depression is common and underrecognized in many clinical settings. A patient hospitalized for AMI provides an opportunity for the diagnosis and treatment of health conditions other than the individual's cardiac condition.

This systematic review suggests that if clinicians assess for symptoms of depression as endorsed by AMI practice guidelines,[13] results will differ considerably depending on method of assessment. It appears reasonable to screen patients with a validated questionnaire, and then to assess patients who screen positive using a structured clinical interview. This assessment can be further refined by re-examining the patient several weeks after discharge. At first glance, based on reported prevalence rates alone, it would appear that the BDI is a more appropriate initial screening instrument than the HADS as it identifies more potentially depressed patients during the AMI hospitalization, a desirable quality in a screening instrument. Although a BDI score of 10 or above may overdiagnose depression, evidence suggests that patients with BDI scores at or above this threshold soon after an AMI have higher morbidity[41] and mortality[3,5,6] risks than those patients who endorse fewer symptoms of depression on this questionnaire. These findings, coupled with the "dose response" of BDI scores as predictors of risk after AMI[3,6] suggest that the BDI is the preferred mode of assessment in this setting. We believe that further research studies are warranted to compare the performance characteristics of the BDI to other depression screening instruments in patients who are hospitalized with AMI; to assess whether alternative assessment methods, such as administering only the nonsomatic items on the BDI, produce improved results; and to examine which patients so identified are likely to remain depressed after discharge from the hospital. Until these studies are performed, we suggest that clinicians consider using the BDI when following current practice guidelines that recommend assessing patients for symptoms of depression after an AMI.[13] Patients who score 10 or above on the BDI should then be evaluated by a clinical psychologist or psychiatrist.

Although this systematic review did not address the ideal timing of post-AMI depression screening, a reasonable strategy would be to use the BDI during the initial hospitalization when the patient is readily accessible. If a patient has symptoms of depression (BDI ≥ 10), the possibility that depression may impact the patient's recovery could be discussed with the patient and other appropriate individuals in collaboration with the patient. If the patient notes that negative emotions are adversely affecting self-care and ability to function or if the patient has thoughts of self-harm, a referral to a mental health provider should be facilitated. In cases where an immediate referral is not made, the patient could be reassessed by BDI screening 2 weeks after discharge. If the patient still scores ≥ 10, referral to a mental health provider for a formal assessment should be arranged; somatic symptoms present at this point should be assumed to be related to depression rather than to the patient's cardiac condition, particularly if the cardiologist indicates that the latter has stabilized.

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Supplementary Material

The following supplementary material is available for this article online:

Appendix A: Literature Search Strategies.

Appendix B: Journals Included in Hand Searching.