Depression Screening and Treatment Recall in Male and Female Coronary Artery Disease Inpatients: Association with Symptoms One Year Later

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Structured Abstract

Background: Guidelines and statements recommend cardiac patients to be screened for depression. This study examined whether cardiac inpatients recall depression screening, how the recollection varies by gender, and how it is related to depressive symptoms and treatment one year later.

Methods: 2635 cardiac inpatients from 11 hospitals across Ontario, Canada completed a survey and were mailed a follow-up survey one year later. The in-hospital survey queried patients about depression screening since their cardiac diagnosis, whether they had ever been diagnosed with depression, and if yes, what treatments they were recommended. Both surveys included the Beck Depression Inventory-II (BDI-II) to assess depressive symptoms.

Results: Of the 1809 (68.7%) retained participants, 513 (30.0%) participants recalled depression screening and they were significantly more likely to be male. Screening recall was not significantly related to depressive symptoms at both time points ($P > 0.05$). Participants who were recommended antidepressants had higher BDI-II scores than those who were not recommended antidepressants, both as inpatients ($P < 0.01$) and one year later ($P < 0.05$). There was no significant change in depressive symptoms over time in patients who received any type of therapy ($P > 0.05$).

Conclusion: Less than one-third of cardiac inpatients recalled being screened for depression. Recall of screening was not significantly related to depressive symptoms, and use of treatment was related to greater symptoms. Improved patient-provider communication regarding depression screening in cardiac patients is warranted, as well as better monitoring of treatment response in clinical practice.

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Cardiovascular disease is the leading cause of global mortality,[1] and depressive disorders are the second leading cause of years lived with disability.[2] Accordingly, 15-20% of cardiac patients suffer from major depression, an estimate which is three-times higher than that observed in age-matched community samples.[3,4] As many as 50% of cardiac patients report elevated depressive symptoms.[5] The prevalence of major depression in women cardiac patients is approximately two-times greater than what is observed among men,[6] rendering them a particularly vulnerable population considering depressed cardiac patients have increased morbidity and mortality compared to cardiac patients without depression.[7–12] Specifically, depressive symptomatology confers a relative risk between 1.5 and 2.5 for future cardiac morbidity and mortality; this is of similar magnitude to traditional risk factors.[13,14]

Unfortunately, comorbid depression in cardiac patients is grossly under-recognized.[15] This has led to recommendations for the screening and treatment of depression in this population. Guidelines/statements from the American Heart Association,[14] American Association for Cardiovascular Prevention and Rehabilitation,[16] American Academy of Family Physicians,[17] and Canadian Network for Mood and Anxiety Treatments,[18] among other Societies[19–23] include recommendations for depression screening. While setting is not specified, screening in hospital cardiac wards versus an outpatient setting would enable more universal capture of depressed patients.

Screening refers to a strategy applied in a population for the detection of a problem among individuals with no apparent symptoms.[24–26] The limited evidence available shows few cardiac patients are screened, and questions have been raised regarding its benefits.[27] For instance, recent work has suggested that 1,000 depression screenings would result in 304 (30%) patients needing further evaluation, of whom only 126 (13%, and only 41% of those who screen positive) would have major depressive disorder.[28] There is generally a lack of research assessing

the effects of screening on depression itself (i.e., it would not be ethical to screen, if those who screen positive do not undergo diagnostic testing and receive effective treatment where indicated, which ultimately mitigates the depression).[29,30] In addition, the extent to which patients are aware of the depression screening, whether they find it acceptable, and whether they are informed of the results are not known. This is crucial to engaging patients in the diagnostic and treatment process if they screen positive.

The low rates of screening are not due to the lack of effective treatment. Evidence-based treatments for depression include antidepressants and psychotherapy;[31,32] these therapies have also been shown to be effective in cardiac patients.[32–36] For instance, findings from the Enhancing Recovery in Coronary Heart Disease Patients (ENRICHD) trial showed that Cognitive-Behavioural Therapy significantly reduces depression.[31,32] The Coronary Psychosocial Evaluation Studies (COPES) trial demonstrated that Problem-Solving Therapy and/or pharmacotherapy using a stepped approach showed promise in not only reducing depression, but also in reducing death, recurrent myocardial infarction, and angina.[37] Despite the evidence demonstrating the efficacy of these therapies, few patients access treatment, and those who do may not receive adequate follow-up to achieve remission.[38]

Accordingly, the objectives of the current study were to: (1) describe the extent to which cardiac inpatients recalled depression screening; (2a) investigate whether screening varied by gender (among other patient characteristics), and (b) examine whether screening was related to depressive symptom severity one year later; (3) describe the use and type of depression treatment among those with a diagnosis; and (4a) investigate whether treatment varied by gender, and (b) examine whether treatment was related to depressive symptom severity one year later.

Methods

Design and Procedure

Secondary analysis of a larger study entitled Cardiac Rehabilitation care Continuity through Automatic Referral Evaluation (CRCARE) was undertaken. Further details regarding the methodology of the CRCARE Study are available elsewhere.[39] Ethics approval was granted from all participating institutions. This was a prospective, observational study in design.

In brief, adult inpatients on cardiology wards (i.e., coronary care unit, general cardiology ward, cardiac surgery ward or interventional cardiology ward) from 11 hospitals across Ontario were approached to participate in this study. After obtaining informed consent, clinical data were extracted from medical charts, and a self-report survey was administered to participants. This survey included the Beck Depression Inventory-II (BDI-II) and investigator-generated questions about recall of depression screening and treatment. One year later, participants were mailed a follow-up survey which again included the BDI-II.

Participants

CRCARE study inclusion criteria were: (i) confirmed acute coronary syndrome diagnosis and/or (ii) history of percutaneous coronary intervention, coronary artery bypass graft surgery, valve repair/replacement, or heart failure. Exclusion criteria were: (i) participation in cardiac rehabilitation within the past two years, (ii) significant orthopedic, neuromuscular, visual, cognitive and/or any serious mental illness (e.g., schizophrenia, but not mood or anxiety disorders) which would preclude cardiac rehabilitation participation, and (iii) lack of proficiency in the language of the survey (English, French, Punjabi, Hindi or Urdu). An additional exclusion criterion for this study was failure to respond to the survey question regarding depression screening recall (yes/no).

Measures

Sociodemographic variables assessed via self-report in the in-hospital survey included marital status, ethnocultural background (response options were based on Statistics Canada's

ethnic origin classification), highest education attainment, annual family income, and work status. The MacArthur Scale of Subjective Social Status[40] was also included in the survey administered in hospital. Participants were asked to demarcate their socioeconomic status on a 10-rung ladder compared to others in Canada. Scale scores ranged from 1 to 10, with higher scores indicating greater subjective socioeconomic status.

Sociodemographic data obtained from the medical chart were age and gender. Clinical variables obtained from the chart included risk factors (e.g., body mass index [kg/m^2], diabetes mellitus, hypertension, dyslipidemia), reason for cardiac admission, and comorbidities. Participants were also administered the Duke Activity Status Index in the in-hospital survey.[41] This brief self-administered scale assesses functional capacity through metabolic equivalents. The validity of the scale was demonstrated by strong correlations with peak oxygen uptake.[41]

The Beck Depression Inventory-II (BDI-II)[42] was administered to assess depressive symptoms, in the surveys administered in hospital and one year later. It is a reliable and well-validated 21-item scale with a forced-choice 4-alternative response format. It has been widely used in both psychiatric and medical populations, including cardiac patients.[37] Higher scores reflect greater depressive symptomatology, with scores ≥ 14 reflecting at least mild symptomatology (i.e., "elevated").

Finally, investigator-generated items assessed depression screening, diagnosis and treatment in the in-hospital survey via self-report. Participants were asked whether any healthcare provider had ever asked them if they were "feeling down or depressed" (i.e., assessment of patient-recalled depression screening, with some examples of screening tools) since their cardiac diagnosis (yes/no), and which healthcare provider asked them. They were also asked if they had ever been diagnosed with depression (yes/no). If yes, they were asked to report

what types of treatment, if any, they were prescribed (i.e., psychotherapy, antidepressants, exercise, none, other; yes/no for each); participants were asked to check all that apply.

Statistical Analyses

SPSS Version 24.0[43] was used to analyze the data. First, a descriptive examination of patient-recalled screening was performed. Percentages took into account missing data. Then *t*-tests and chi-square analyses were performed to assess differences in sociodemographic (including gender) and in-hospital clinical characteristics, between participants who reported screening for depression and those who did not, as appropriate. To test the remainder of the second objective, differences in depressive symptoms at both assessment points by screening recall were assessed using a *t*-test. Repeated measures analysis of covariance was then used to assess whether screening recall (independent variable) was related to depressive symptoms (dependent variable), after adjusting for variables that were significantly different between those who recalled and those who did not recall screening for depression identified through the bivariate analyses above.

To test the third objective, a descriptive examination of treatment types was performed. To test the fourth objective, chi-square and *t*-tests were performed to assess differences in treatment types by gender and depressive symptoms, respectively. To fully test the latter, again repeated measures analysis of covariance was used to assess whether treatment (independent variable) was related to depressive symptoms (dependent variable), after adjusting for variables that were significantly different between those who recalled and those who did not recall screening for depression identified through the bivariate analyses.

Results

Respondent Characteristics

As reported elsewhere,[39] 2635 (61.8% response rate) cardiac inpatients completed the in-hospital survey. Of these participants, 1809 (68.7% retention rate) completed the one-year follow-up survey. Differences in characteristics of retained participants and those lost to follow-up were also reported elsewhere.[39]

Ninety-seven participants (5.4%) did not report whether or not they recall being screened for depression. Sociodemographic and clinical characteristics of the 1712 retained participants who comprised the sample for this study are shown in Table 1. Other ethnocultural backgrounds represented in the sample (in descending frequency) included South Asian, East or Southeast Asian, and Caribbean. Overall, 255 (14.5%) participants self-reported a depression diagnosis in their lifetime.

Screening Recall

As shown in Table 1, approximately one-third of participants recalled being screened for depression during their cardiac hospitalization. Of these participants, 410 (80.1%) did not report a diagnosis of depression in their lifetime. In terms of who screened them, 160 (31.7%) participants reported being screened by a cardiac specialist (e.g., cardiologist, cardiovascular surgeon), 113 (22.4%) reported a nurse, 97 (19.2%) reported a general practitioner (family doctor), and 134 (26.6%) reported another healthcare provider.

Table 1 displays the sociodemographic characteristics of those who recalled and did not recall being screened for depression. Participants who recalled screening were significantly younger and more likely to be male and working than participants who did not recall screening. Participants reporting a previous depression diagnosis were significantly more likely to recall screening ($X^2 = 15.76$, $P < 0.001$).

Treatment

Table 2 displays rates of treatment use by type in those with a diagnosis of depression in their lifetime. Almost all participants who reported a diagnosis of depression reported some form of therapy. More than one-third of participants (n = 99, 41.3%) reported taking antidepressants and receiving psychotherapy. The antidepressants participants reported taking included Bupropion/Wellbutrin, Citalopram, Celexa, Cipralex, Effexor, Paxil, Prozac, and Zoloft. Other types of treatment prescribed by physicians included spiritual care, a support group, and taking deep breaths -- each recalled by only one participant. There were no significant differences in recommendations for antidepressants, psychotherapy or exercise based on gender.

Screening and Treatment by Depressive Symptoms

The mean BDI-II score in-hospital was 9.48 ± 8.33. The mean score one year later was 8.64 ± 8.87, and this represented a statistically significant reduction over time (paired *t*-test = 2.74, $P < 0.01$). Screening recall was not significantly related to depressive symptom scores in-hospital ($P > 0.05$; Table 1). Screening recall was also not significantly related to depressive symptom scores at one-year follow-up ($P > 0.05$).

There were significant differences in treatment use by depressive symptom severity in-hospital (Table 2). Participants who were taking antidepressants had higher BDI-II scores than those who were not taking antidepressants ($P < 0.05$). There was no significant difference in BDI-II scores between participants who were treated versus those who were not treated with psychotherapy or exercise ($P > 0.05$).

There was no significant change in depressive symptoms over time in participants who were treated with antidepressants, psychotherapy or exercise ($P > 0.05$). Table 2 displays the proportion of participants with elevated depressive symptoms at both time points by recommended treatment type. As shown and similar to the findings from the in-hospital assessment, there was a significant relationship between antidepressant use and BDI-II scores at

one-year follow-up ($P < 0.01$), with those taking antidepressants reporting significantly higher depressive symptoms than those not taking antidepressants. Psychotherapy and exercise were not significantly related to BDI-II scores at follow-up. In multivariate analysis, the association between use of antidepressants and depressive symptoms at both time points was only a trend (Table 3).

Discussion

Despite clinical practice recommendations,[14,16] less than one-third of cardiac patients recalled being screened for depression in this study. There are several possible explanations for this finding including: (1) recall failure due to emotional distress and fears about medical recovery, (2) prioritization of more pressing acute over chronic care by healthcare providers, and (3) lack of awareness or skepticism of screening guidelines/statements by providers given the state of the literature.[44] Future research is needed to better understand screening practices in the inpatient cardiology setting, how it is communicated with patients, and patients' acceptance of depression screening and findings. This could also inform more specific clinical practice recommendations regarding screening setting, most notably whether an inpatient or outpatient specialty or general care setting is most appropriate.

Although females are twice as likely to experience depression, they were less likely to recall screening than their male counterparts, and were no more likely than males to receive treatment. Whether females receive equitable depression care warrants further investigation.

It was surprising that screening recall was not significantly related to depressive symptoms. It would be assumed that patients with high symptom severity would more often screen positive, and hence have a discussion with a healthcare provider regarding the results and subsequently a diagnostic interview. One would expect patients would be more likely to recall this discussion. Screening was not significantly related to depressive symptoms not only at the time of

hospitalization, but also one year later, calling into question the impact of screening (as has been raised in the literature)[44], and consistent with a recent study in cardiac surgery patients.[45] Indeed, some more recent guidelines recommend providers only be "alert" to possible depression and case-find where suspected through administration of a screening tool.[25,46] There is currently a trial underway to test the American Heart Association's screening recommendations.[47]

Consistent with the literature,[48,49] participants were most commonly taking antidepressants as treatment, over and above psychotherapy. Further, contrary to expectation, participants who were recommended antidepressants had greater depressive symptom severity than those who were not recommended antidepressants over the year post-hospitalization. This could be due to appropriate provision of antidepressants to patients who are experiencing more severe depression.

Clinical Implications

Given that screening was self-reported in the current study, implications for screening recommendations and the associated controversy cannot be drawn. However, screening should be undertaken using a validated instrument (such as the Patient Health Questionnaire which is recommended by the American Heart Association; http://www.phqscreeners.com/), and all positive screens should trigger a full diagnostic interview by a qualified healthcare professional using established diagnostic criteria (e.g., http://dsm5.org/psychiatrists/practice/dsm).

Nevertheless, these results can inform the practice of depression care in cardiac patients from the patients' perspective. First, it should be established that females, non-working and elderly patients are as likely to be screened as males, working and younger patients. Systematic screening processes could mitigate these inequities. Second, communication with patients regarding depression screening and the findings should be promoted. Such communication should espouse to increase awareness of the prognostic importance of comorbid depression, the

high burden, de-stigmatize mental illness, as well as the importance, safety, availability and efficacy of treatment. Patients should be provided with treatment options, so they can make informed choices that meet their preferences. This would truly represent more patient-centered care.

The continuity and inter-professional care provided in cardiac rehabilitation programs could represent an ideal setting to screen, and subsequently understand patient depression treatment preferences, treatment tolerance, and monitor treatment response to achieve symptom remission. Indeed, the major cardiac rehabilitation societies consider depression management as a "core component" of their programs,[19–21] and both the American Association for Cardiovascular and Pulmonary Rehabilitation and Canadian Association of Cardiovascular Prevention and Rehabilitation have published performance indicators regarding depression.[22,23]

Limitations

There are several limitations to this study, such that caution is warranted in interpreting these findings. First, screening may have been under-recalled or not recalled by patients for several reasons including: (a) cognitive issues and (b) screening occurring after survey completion but before hospital discharge (screening practice would have varied across institutions). Second, patients may be screened for depression post-discharge, and therefore rates of screening recall are likely under-reported herein, but do represent rates in-hospital. Third, we did not assess whether patients were screened with validated instruments. Future research should confirm depression screening via documentation in patients' medical records of administration of a validated screening instrument, as well as the outcome of the screening.

Fourth, patients may have elevated depressive symptoms temporarily as a response to hospitalization and the cardiac event itself. This may remit spontaneously, in which case treatment initiation would not be warranted. There was no assessment in the early months post-

discharge, and therefore spontaneous remission could not be taken into consideration. Fifth, depression was not ascertained through a structured clinical interview, and self-report symptom scales have greater potential for error.

Sixth, treatment was also assessed via self-report and was not verified through charts, increasing the potential for error. Seventh, lack of change in depressive symptoms among those reporting treatment could be because the treatment was initiated at a time earlier than the study. In addition, treatment persistence was not measured at the one-year assessment, and patients may have terminated antidepressants due to side effects or choice.

Finally, the design of the study precludes causal interpretations, as this was not a randomized controlled trial. However, the data herein provide an estimate of "real-world" screening and treatment recall.

Conclusions

Less than one-third of cardiac inpatients recalled being screened for depression. There was no association between screening recall and depressive symptoms one year later. Females, who suffer twice the rates of depression, less often recalled screening and were no more likely to be receiving treatment than males. Patients taking antidepressants had higher depressive symptom severity than those not taking antidepressants. This study raises questions about screening communication with patients, and highlights the need to improve depression treatment response monitoring, so remission rates achieved in trials are realized in the "real-world".

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Table 1. In-hospital sociodemographic and clinical characteristics of patients by screening recall

Mean ± SD / n (%)	Recalled Screening (n = 513; 30.0%)	Did Not Recall Screening (n = 1199; 70.0%)	Total (N = 1712; 100.0%)
Sociodemographic Characteristics			
Age	63.83 ± 10.12	65.78 ± 10.37	65.39 ± 10.40***
Gender (male)	406 (79.1)	884 (73.7)	1290 (75.4)*
Ethnocultural background (white)	428 (84.9)	971 (82.9)	1399 (83.5)
Marital status (married)	394 (77.7)	926 (78.1)	1320 (78.0)
Education (≥ High school)	384 (77.7)	869 (74.7)	1253 (75.6)
Work status (Retired)	236 (46.7)	635 (53.9)	871 (51.8)**
Annual family income (≥$50,000CAD)	219 (50.8)	494 (50.5)	713 (50.6)
Subjective socioeconomic status	6.40 ± 1.75	6.35 ± 1.78	1.55 ± 0.50
Rurality	62 (12.1)	143 (11.9)	205 (12.0)
Clinical Characteristics			
Primary Reason for Admission			
Coronary artery bypass graft surgery	232 (45.6)	473 (39.7)	705 (41.4)*
Myocardial infarction	146 (28.7)	326 (27.4)	472 (27.8)
Percutaneous coronary intervention	149 (29.3)	428 (35.9)	577 (33.9)**
Heart failure	71 (13.9)	115 (9.6)	186 (10.9)*
Valve (Repair)	10 (25.6)	28 (29.2)	38 (28.1)
Risk Factors			
Body mass index	29.15 ± 5.52	29.06 ± 5.33	29.04 ± 5.45
Diabetes mellitus	152 (32.7)	337 (30.8)	489 (31.4)
Family history of cardiovascular disease	248 (63.9)	566 (65.7)	814 (65.2)
Hypertension	353 (74.3)	815 (73.6)	1168 (73.8)
Hypercholesterolemia	368 (83.3)	853 (81.3)	1221 (81.9)
Current smoking	30 (6.0)	78 (6.6)	108 (6.4)
Depressive symptoms (BDI-II)	9.45 ± 8.30	8.98 ± 7.65	9.14 ± 7.82
Functional status (DASI)	27.90 ± 16.62	27.95 ± 17.36	27.91 ± 17.18
Comorbidities (% yes)	312 (67.4)	744 (68.1)	1056 (67.9)

SD, standard deviation; CAD, Canadian dollar; BDI-II, Beck Depression Inventory-II; DASI, Duke Activity Status Index

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$

Table 2. Correlates of use of depression treatment by type among patients with a self-reported diagnosis of depression

n (%)	Antidepressant 204 (71.8%)	Psychotherapy 133 (47.5%)	Exercise 68 (24.6%)	None 22 (8.8%)	Total
Recalled screening	81 (40.3)	53 (39.8)	28 (41.8)	6 (27.3)	513 (30.0)
Gender (male)	134 (65.7)	88 (66.2)	50 (73.5)	14 (63.6)	1357 (75.0)
Elevated depressive symptoms (in-hospital)	92 (46.2); $P < 0.01$	53 (40.2)	23 (33.8)	7 (31.8)	366 (21.0)
Elevated depressive symptoms (one-year follow-up)	80 (40.8); $P < 0.05$	49 (38.0)	22 (32.8)	11 (52.4)	322 (18.4)

Note. Participants were asked to report all treatment types that apply (i.e., they were not mutually exclusive).

Table 3. Repeated measures analysis of covariance assessing association with Beck Depression Inventory-II scores

Variable	F	*P*	Partial Eta Squared
Age	1.98	0.16	.008
Gender	1.17	0.28	.005
Work status	1.43	0.23	.006
Indication			
Percutaneous coronary intervention	1.38	0.24	.006
Coronary artery bypass graft surgery	2.30	0.13	.009
Heart failure	1.56	0.21	.006
Recall depression screening	1.82	0.18	.007
Antidepressant therapy	3.01	0.08	.012