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The Influence of Depression on Utilization of Cardiac Rehabilitation Post-Myocardial Infarction: A Study of 158,991 Medicare Beneficiaries

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Abstract

Purpose—On the basis of several small studies, depression is often considered a barrier to CR enrollment and program completion. The purpose of this research was to examine the association between depression diagnosis and participation in CR in a large sample of Medicare beneficiaries with recent myocardial infarction (MI).

Methods—This was a retrospective study of Medicare Beneficiaries with an MI during 2008 (n=158,991). CR enrollment was determined by the Carrier and Outpatient files using the Healthcare Common Procedure Coding System #93797 or #93798. Depression diagnosis was obtained from the ICD-9 codes in the MEDPAR, Outpatient, and Carrier Files. The association between depression diagnosis and CR attendance was evaluated using multivariable logistic regression.

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Results—Overall, 14% (n=22,735) of the study population attended CR within 1 year of MI diagnosis. Twenty-eight percent (n=43,827) had a diagnosis of depression with 96% of cases documented prior to enrollment in CR. Twenty-eight percent with a diagnosis of depression compared to 9% without depression attended CR. In adjusted analysis, patients with depression were 3.9 (99% confidence interval: 3.7, 4.2) times more likely to attend CR compared to those without depression. Program completion (≥ 25 sessions) was more common in those with depression (56%) than those without (35%; $p < 0.001$).

Conclusions—Diagnosis of depression in Medicare Beneficiaries was strongly associated with attending CR and attending more sessions of CR compared to those without depression. Depression is not a barrier to CR participation after MI in Medicare Beneficiaries.

Introduction

Phase II cardiac rehabilitation (CR) is an evidenced-based outpatient program that is available for Medicare Beneficiaries within 12 months of a myocardial infarction (MI) or other cardiac event. Despite the well-established benefits of CR, it is severely underused with only 14% of Medicare Beneficiaries participating in CR following MI¹ and only 24% to 50% of participants adhering to the 36 recommended sessions.^{2,3} Multiple factors have been shown to contribute to low utilization of CR services including female gender, age, race, and comorbidities including depression.¹

Approximately 20-45% of cardiac patients have the comorbid condition of depression spectrum disorders (*e.g.*, Major Depressive Disorder, Dysthymic Disorder).⁴⁻⁶ Depression is often considered a barrier to CR enrollment and has been reported to predict poor adherence.⁷⁻¹³ However, research is inconsistent, and some small studies refute these findings.^{14,15} Recently, a larger study of n=6,874 patients across 38 sites in one state observed that patients with documented history of clinical depression were less likely to enroll in CR.¹⁶ A second study in the same cohort observed that documented history of clinical depression was not associated with adherence in 4,412 patients.¹⁷ Adherence was dichotomized as the median number of sessions (n=21) attended. This study included all adults attending CR and did not permit assessment of the number of sessions covered by insurance, although insurance coverage as well as co-payment likely influence the number of sessions that a patient attends.

These findings are unfortunate, as CR has been shown to reduce depressive symptoms and physical activity/exercise is recommended by the American Heart Association as helpful treatment for cardiac patients with depression.¹⁸⁻²² Given the prevalence of MI and depression, and the benefit of CR, it is of substantial public health importance to understand the influence of clinical depression on both CR enrollment and adherence. Research in a Medicare population that includes all older adults with MI may confirm the association between depression and CR attendance and number of sessions completed. Medicare coverage allows for 36 sessions of CR with more as necessary for Beneficiaries with MI, and although other factors may influence completion of CR (*i.e.*, co-payment), there is no insurance restriction that may limit participation.²³

Purpose

The purpose of this research was to examine the association between depression diagnosis and participation in phase II CR in a large sample of Medicare Beneficiaries with recent MI. Understanding these relationships is a step towards clarifying the role of depression in CR program attendance and adherence.

Participants and Methods

Data were obtained from the Chronic Conditions Warehouse (CCW), a national Medicare repository that includes the following files used in this research: Beneficiary Summary file, Medicare Provider Analysis and Review (MEDPAR), the Carrier file, and the Outpatient file. The 100% population of Medicare Beneficiaries with MI was obtained for this research. The cohort was derived from Beneficiaries who had an acute MI (ICD-9 codes: DX 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, and 410.91) identified by CCW as an MI in the first or second position on the claim form in the year 2008 (n=338,781). Data for this cohort were obtained for the year 2009 to examine CR use in both 2008 and 2009 for late enrollers. Medicare Beneficiaries were not included for the following reasons: End stage renal disease or disability that allowed enrollment in Medicare before age 65; did not have both Medicare Part A and B; were not continuously enrolled in services; or had a health maintenance organization at any time during the study period. Beneficiaries were then excluded if they were discharged to a psychiatric or long-term care/nursing facility, hospice, or signed out against medical advice; died during the hospitalization; had intellectual disability or had persistent mental disorders (e.g., Schizophrenia, Delusional Disorders, Dementia); were over age 90; died within 30 days of discharge; or had attended CR prior to the index MI (i.e., had a previous event, likely in 2007, that allowed CR participation in 2008). These steps resulted in a final sample size of N=158,991 Beneficiaries.

Outcome

The outcome variable, phase II CR attendance (yes vs. no), was described as a Beneficiary who enrolled in CR within 12 months of the index MI. CR was identified in the Carrier and Outpatient files using the Healthcare Common Procedure Coding System #93797 or #93798. A secondary outcome was number of CR sessions attended.

Depression

A depression spectrum diagnosis (yes vs. no) at any time during the study period was obtained from the ICD-9 codes (DX: 296.2, 296.3, 296.5, 300.4, 309, 309, 311) in the MEDPAR, Outpatient, and Carrier Files. This included major depressive disorder and other diagnoses (e.g., dysthymic disorder). Date of depression diagnosis was examined as a charge for depression at any time before CR start date or after CR start date.

Demographics

Predictors of CR attendance explored in analyses included the demographic variables: Age, gender, and race. Insurance type included dual-eligible (i.e., eligible for both Medicare and

Medicaid) or Medicare only. Comorbidity was defined by the 31 comorbid conditions (excluding depression) identified by Elixhauser²⁴ and was categorized as none (reference), one, two, or three or more. Treatment was defined as the invasive (coronary artery bypass grafting, valve surgery, percutaneous coronary intervention) or medical treatment of the MI. Documented relative contraindications to CR were identified from the last claim record at discharge from the index hospital stay and are defined as the presence of disorders that may restrict CR referral.²⁵ Rehospitalization within one year (yes vs. no) was defined as any hospitalization within one year of discharge from the index MI. Number of sessions of CR attended was described as a categorical (1-12; 13-24; or 25-36 sessions) and continuous variable.

Statistical Analysis

Variables were explored for the entire sample and separately by depression diagnosis using chi-square for categorical or Student's t-test for continuous data. Univariate logistic regression was used to examine the relationships between baseline demographic variables and CR enrollment. Significance was evaluated at confidence level of 99.99% due to the large sample size. Variables significant in the univariate analyses were retained for multivariable modeling. Multivariable logistic regression examined the association between depression diagnosis and CR attendance in a model controlling for all potential confounders.

Results

Overall, 14% (n=22,735) of the study population attended CR and 28% (n=43,827) had a depression spectrum diagnosis (Table 1). Beneficiaries were 51% female with a mean age of 78 (standard deviation=6.8; range 65 to 90 years). The majority of the study population (90%) was white, 52% had two or more comorbid conditions, 20% were dual eligible, and the greatest proportion (38%) had a length of stay of 3 to 5 days. Any CR contraindication was reported in 29% of Beneficiaries, 40% had invasive treatment of the MI and 56% were rehospitalized within one year. Cardiac rehabilitation was attended by 28% of those with depression and 9% of those without depression ($p<0.001$). Ninety-six percent of those with a depression diagnosis who attended CR had a charge for depression prior to entering CR (not shown). Beneficiaries with depression made up 54% of CR participants. Beneficiaries with depression compared to those without completed more sessions of CR (56% vs 38% completed 25-36 sessions; 27% vs. 27% completed 12-24; and 17% vs. 38% completed 1-12; $p<0.001$, data not shown). The mean and median number of CR sessions completed by those with depression were 26 (SD=11.6) and 29 compared to 19 (SD=12.6) and 18 ($p<0.001$) in those without depression, respectively (not shown).

In unadjusted analyses, Beneficiaries with depression were 3.8 (99.99% confidence interval: 3.6, 4.0) times more likely to attend CR compared to those without depression (Table 2). Beneficiaries were also more likely to attend CR if they had: Comorbidity; a diagnosis of smoking; obesity; or invasive treatment of the MI. Beneficiaries less likely to attend CR: Were female (OR=0.55; CI: 0.52, 0.58); were non-white (black OR=0.38; CI: 0.32, 0.45; Hispanic OR=0.24; CI: 0.16, 0.37; other/unknown race OR=0.55; CI: 0.44, 0.68); had increasing age (OR=0.92; CI: 0.92, 0.93); were dual eligible (OR=0.21; CI: 0.19, 0.24); had

lengths of stay greater than 2 days; had any contraindication to CR (OR=0.54; CI: 0.50, 0.57) or had a rehospitalization within one year of the index MI (OR=0.68; CI: 0.64, 0.72). All predictors were significant ($p<0.001$) in univariate analyses and were retained for the multivariable model.

Depression diagnosis remained a strong predictor of attending CR after adjusting for potential confounders. Beneficiaries with depression diagnosis were 3.9 (CI: 3.7, 4.2) times more likely to attend CR compared to those without depression when controlling for sex, age at MI, race, comorbidity count, smoking, obesity, dual eligible, length of stay in acute care, any CR contraindication, invasive treatment of the MI, and rehospitalization within one year of the MI. All predictors remained significant with the exception of comorbidity count as defined by Elixhauser.

Discussion

In this large study of Medicare Beneficiaries, depression was not a barrier to CR participation. Depression diagnosis was strongly associated with attending CR and attending more sessions of CR compared to those without depression. These findings are in line with the guidelines for depression management in patients with MI but are contradictory to several previous studies.^{7-13,18, 25} This research was conducted using the ICD-9 diagnosis codes of all Medicare Beneficiaries with MI in 2008 identified as candidates for CR. Provided this large sample, the findings may provide a more accurate overview of the current status of attendance and usage of CR by older adults with a diagnosis of depression than what has been previously reported in small clinical studies.

An important caveat is that all depression spectrum diagnoses were included, such as Major Depressive Disorder, Dysthymic Disorder, etc. The method of depression diagnosis was not known and depression medication usage could not be ascertained. A chart diagnosis of depression, using ICD-9 codes, has some limitations. For example, there may not be agreement between the chart and the claims data.²⁶ A chart diagnosis of depression would not differentiate between low versus high levels of depressive symptoms, and it could reflect short-lived episode of depression or a more chronic depression. Many research studies use self-report measures of depressed mood and analyze current levels of depressed mood. On the other hand, a chart diagnosis of depression indicates that treating clinicians were aware of the depression and considered it to be severe enough to warrant documentation and treatment. It is likely that some cases of depression were in remission or controlled with treatment.

Inconsistent findings on the relationship between depression and CR completion have been reported in the literature. A study from the United Kingdom of one community-based CR program observed that individuals with depression at entry to CR were twice as likely to drop out as individuals without depression at baseline.⁹ The average age of the participants was 60 years for men and 63 years for women, younger than the average age of the current Medicare study and the UK study was from one CR program. Similar findings were observed in a retrospective study ($n=348$) from one Ohio CR program. Those with depression identified as a score 14 on the Beck Depression Inventory (BDI) were 5.7 times

more likely to drop out of CR. However, similarly to the UK study, drop-outs were younger (56 years) than those who completed (64 years) the program.¹⁰ These findings suggest that those with younger age and depression may be at greater risk for non-compliance to CR.

An Australian study found no difference in prevalence of depression between CR-attenders and non-attenders and that those with depression were 32% more likely to attend CR compared to non-depressed; however, this was not significant, likely due to small sample size.¹⁴ A study conducted in the United States administered the BDI to hospitalized cardiac patients (all were referred to CR) and followed them to determine enrollment in CR. The investigators found no difference in enrollment between depressed and non-depressed patients but a trend towards BDI to predict failure to enroll.¹⁵ A Canadian study in 2002 found no difference between depressed and non-depressed in enrollment in CR but did find that those with anxiety were 1.9 (CI: 1.0, 3.4) times more likely to enroll in CR compared to those without anxiety.²⁷ A more recent study of CR programs enrolled in the Wisconsin Cardiac Rehabilitation Outcomes Registry (WiCORE) observed that patients with depression were 44% less likely to enroll in CR compared to those without depression.¹⁶ Patients in the study were those referred to CR and may be different than those not referred. The findings of the WiCORE study are important as they present data from a large proportion of referred CR patients including those under (47%) and over (53%) age 65. The WiCORE study differs from the current Medicare study in that the study population approached to enroll only consisted of 8% with MI as the principal admitting diagnosis while all the Medicare Beneficiaries in the current study had MI. Further, the current Medicare study could not examine referral; however, it does represent all eligible Medicare patients with MI.

Other explanations for the difference between previous research and the current Medicare findings include that a chart diagnosis of depression may indicate that depression treatment facilitated a patient's adherence to healthcare recommendations, including CR referral. Recent guidelines from the American Heart Association¹⁸ support referral to CR for depressed patients and even though the current data were produced concurrently with the recommendations (e.g., the recommendations were first published online in September, 2008), physicians may have anticipated these new recommendations and increased referral to CR among their patients with a chart diagnosis of depression. This is likely due to the known benefits of CR in reducing depression symptoms.¹⁹⁻²¹ That physician referral is important in a patient's attendance at CR is not surprising as it has been reported that the strength of the primary physician's referral is a consistent predictor of CR enrollment.²⁸⁻³¹ In a previous study of outpatients with coronary artery disease,²⁸ bivariate analysis indicated that depressive symptoms predicted enrollment. However, after adjusting for other factors the relationship was attenuated and the final model predicting enrollment revealed that strength of physician referral predicted enrollment, not depressive symptoms. CR staff characteristics may have influenced continued CR attendance. Patients have reported discussing progress and encouragement from professionals to be among the most preferred features of CR.³² Programming features may have been important in adherence as research has found that patients who participated in relaxation training and group-based psychological counseling were more adherent to CR than patients not participating in these programs although no differences emerged between non-depressed and depressed

individuals and adherence.¹⁷ Other factors commonly associated with enrollment include shorter distance to CR, marital status, lack of insurance, and perceived barriers to CR; however, distance and perceived barriers could not be examined in the current research.^{28,33}

Although overall utilization of CR was low, it is encouraging that many Medicare beneficiaries with a chart diagnosis of depression attended CR. CR has been shown to reduce depression.^{11,33,34} Depression screening at the time of hospitalization as well as during follow-up remains important to maximize the benefits of comprehensive treatment to physical and psychological health. Unfortunately, depression management is complicated by comorbidity and cognitive impairment as well as underdiagnosis and lack of appropriate treatment.³⁵ Approximately 66% of depression is underdiagnosed in primary care settings while a meta-analysis stratified on age found that general practitioners were only able to correctly identify 47% of late life depression cases.^{36,37} Removing the barriers to diagnosis and management of depression in clinical practice is important to the care of older adults.

Limitations of this study include that the sample includes only patients with MI. The findings of the current study may not generalize to samples of patients eligible for CR due to other cardiovascular illness. The study population also included only those over age 65 and as indicated above, younger depressed patients may be more likely to drop out. In addition, Medicare Beneficiaries may be different from younger MI patients in their prevalence of depression and use of CR and these results may not generalize to a younger population. This could not be examined in the current research but deserves further investigation as there may be under referral - or underutilization - of these individuals. The current results may not generalize to individuals who are uninsured as prior research has revealed the importance of insurance coverage in CR enrollment.¹⁶ Finally, data on referral was not available in Medicare, and referral rates to CR are undoubtedly greater than attendance rates. This may mean for example that referrals are the same between depressed and non-depressed and depressed attend at greater rates. This negates the notion that clinicians are aware of the benefits of CR on depression and therefore are not making a point to refer depressed Beneficiaries; however, this is unlikely as clinicians are certainly aware of the importance to manage depression in cardiac patients. The strengths of this study include that it used a large population of Medicare Beneficiaries who are eligible for CR and ascertainment of the timing of depression diagnosis relative to CR attendance.

Conclusions

The current study found that depression is not a barrier to CR enrollment after MI in Medicare Beneficiaries. On the contrary, Beneficiaries with a chart diagnosis of depression were 4 times more likely to enroll in CR compared to those without depression and they were more likely to attend more sessions of CR compared to those without depression. This finding may be due to higher referral rates for older patients with a chart diagnosis of depression; however, referrals could not be examined in the database and utilization of CR overall remains low. Future research will examine CR attendance and completion in a large national sample including all eligible coronary artery disease among younger and older adults diagnosed with depression. This study evaluated a large, broadly representative population of patients with recent MI and included more patients than all prior studies on

this question combined. Contrary to some prior evidence, we found that depression was neither a barrier to CR enrollment nor program completion. This is seminal, as CR is designed to address the psychosocial as well as the physical needs of the patient, and depressed patients may receive particular benefit from this service post-MI. Future research is needed to address more specific measures of the benefit (e.g., mortality reduction, quality of life, functional status) of CR to those with depression as well as increase CR enrollment and program completion of all post-MI patients above the current low 14% rate.

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Table 1

Characteristics of Medicare Beneficiaries with Myocardial Infarction overall and by Depression Diagnosis in 2008, N=158,991

	Overall N (%)	Depression diagnosis N (%) 43,827 (27.6)	No depression diagnosis N (%) 115,164 (72.4)	P [*]
CR attendance (yes)	22,735 (14.3)	12,165 (27.8)	10,570 (9.2)	<0.001
Sex (female)	80,678 (50.7)	21,731 (49.6)	58,947 (51.2)	<0.001
Mean age at MI (SD)	78.1 (6.8)	77.0 (7.1)	78.6 (6.7)	0.01
Race				
white	143,243 (90.1)	38,480 (87.8)	104,763 (91.0)	
black	9,586 (6.0)	2,375 (5.4)	7,211 (6.3)	<0.001
Hispanic	2,212 (1.4)	1,019 (2.3)	1,193 (1.0)	
other/unknown	3,950 (2.5)	1,953 (4.5)	1,997 (1.7)	
Comorbidity count				
0	12,950 (8.2)	0(0)	12,950 (11.2)	
1	62,986 (39.6)	20,821 (47.5)	42,165 (36.6)	<0.001
2	55,122 (34.7)	15,343 (35.0)	39,779 (34.5)	
>=3	27,933 (17.6)	7,663 (17.5)	20,270 (17.6)	
Smoking (yes)	19,018 (12.0)	5,589 (12.8)	13,429 (11.7)	<0.001
Obese (yes)	6,145 (3.9)	1,896 (4.3)	4,249 (3.7)	<0.001
Dual eligible (yes)	30,955 (19.5)	9,050 (20.7)	21,905 (19.0)	<0.001
LOS in acute care				
<=2 days	36,507 (22.0)	10,246 (23.4)	26,261 (22.8)	
3 to 5 days	60,614 (38.1)	16,604 (37.9)	44,010 (38.2)	<0.001
6 to 10 days	40,665 (25.6)	11,060 (25.2)	29,605 (25.7)	
>10 days	21,205 (13.3)	5,917 (13.5)	15,288 (13.3)	
Any CR contraindication (yes)	46,460 (29.2)	12,295 (28.1)	34,165 (29.7)	<0.001
Invasive treatment of MI	63,320 (39.8)	19,393 (44.3)	43,927 (38.1)	<0.001
Rehospitalized w/in one year of MI (yes)	88,366 (55.6)	26,072 (59.5)	62,294 (54.1)	<0.001
Rehospitalized before starting CR (yes)^a	6,554 (28.8)	3,611 (29.7)	2,943 (27.8)	<0.05

N=number; CR=cardiac rehabilitation; MI=myocardial infarction; SD=standard deviation; LOS=length of stay; CR=cardiac rehabilitation

* Significance evaluated at 99.99% confidence level

Table 2

Unadjusted and Adjusted Odds Ratios and Confidence Intervals for Association of Depression with Cardiac Rehabilitation Attendance in Medicare Beneficiaries with Myocardial Infarction in 2008, N=158,991

	Unadjusted Models OR (99.99% CI)	Adjusted Model OR (99.99% CI)
Depressed		
No	Reference	Reference
Yes	3.8 (3.6, 4.0)	3.9 (3.7, 4.2)
Sex		
Male	Reference	Reference
Female	0.55 (0.52, 0.58)	0.79 (0.74, 0.84)
Age at MI (continuous)	0.92 (0.92, 0.93)	0.96 (0.95, 0.96)
Race		
White	Reference	Reference
Black	0.38 (0.32, 0.45)	0.53 (0.45, 0.64)
Hispanic	0.24 (0.16, 0.37)	0.38 (0.25, 0.59)
Other/unknown	0.55 (0.44, 0.68)	0.53 (0.42, 0.68)
Comorbidity count		
0	Reference	Reference
1	1.8 (1.6, 2.0)	1.1 (0.95, 1.2)
2	1.4 (1.2, 1.6)	1.1 (0.93, 1.2)
>=3	1.1 (0.96, 1.2)	1.0 (0.87, 1.2)
Smoking		
No	Reference	Reference
Yes	1.6 (1.4, 1.7)	0.87 (0.80, 0.95)
Obese		
No	Reference	Reference
Yes	1.8 (1.6, 1.9)	1.2 (1.0, 1.4)
Dual eligible		
No	Reference	Reference
Yes	0.21 (0.19, 0.24)	0.29 (0.26, 0.33)
LOS in acute care		
<=2 days	Reference	Reference
3 to 5 days	0.80 (0.75, 0.86)	0.88 (0.82, 0.95)
6 to 10 days	0.61 (0.56, 0.66)	0.78 (0.71, 0.85)
>10 days	0.61 (0.55, 0.67)	0.66 (0.59, 0.74)
Any CR contraindication		
No	Reference	Reference
Yes	0.54 (0.50, 0.57)	0.81 (0.75, 0.88)
Invasive treatment of MI		
No	Reference	Reference
Yes	5.1 (4.8, 5.4)	3.8 (3.6, 4.1)
Rehospitalized w/in one year of MI		

	Unadjusted Models OR (99.99% CI)	Adjusted Model OR (99.99% CI)
No	Reference	Reference
Yes	0.68 (0.64, 0.72)	0.91 (0.85, 0.97)

OR=odds ratio; MI=myocardial infarction; LOS=length of stay; CR=cardiac rehabilitation

* Significance evaluated at 99.99% confidence interval

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