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Integrating Depression Care Management into Medicare Home Health Reduces Risk of 30 and 60 Day Hospitalization: The Depression CAREPATH Cluster-Randomized Trial

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Abstract

OBJECTIVES—To determine whether a depression care management intervention among Medicare home health recipients decreases risks of hospitalization.

DESIGN—Cluster-randomized trial. Nurse teams were randomized to Intervention (12 teams) or Enhanced Usual Care (EUC; 9 teams).

SETTING—Six home health agencies from distinct geographic regions. Patients were interviewed at home and by telephone.

PARTICIPANTS—Patients age >65 who screened positive for depression on nurse assessments (N=755), and a subset who consented to interviews (N=306).

INTERVENTION—The Depression CAREPATH (CARE for PATients at Home) guides nurses in managing depression during routine home visits. Clinical functions include weekly symptom assessment, medication management, care coordination, patient education, and goal setting. Researchers conducted biweekly telephone conferences with team supervisors.

MEASUREMENTS—The study examined acute-care hospitalization and days to hospitalization. H1 used data from the home health record to examine hospitalization over 30-day and 60-day periods while a home health patient. H2 used data from both home care record and research assessments to examine 30-day hospitalization from any setting.

RESULTS—The adjusted hazard ratio (HR) of being admitted to hospital directly from home health within 30 days of start of home health care was 0.65 ($p=.013$) for CAREPATH compared to EUC patients, and 0.72 ($p=.027$) within 60 days. In patients referred to home health directly from hospital, the relative hazard of being rehospitalized was approximately 55% lower ($HR = 0.45$, $p=.001$) among CAREPATH patients.

CONCLUSION—Integrating CAREPATH depression care management into routine nursing practice reduces hospitalization and rehospitalization risk among older adults receiving Medicare home health nursing services.

Keywords

hospitalization; depression; home health; care management

INTRODUCTION

The goal of reducing avoidable hospitalizations is shared by patients, families, health services providers and payers.¹ In home health (HH), Medicare has targeted hospitalizations as an indicator of poor quality of care linked to reimbursement.^{2,3} Hospitalization during HH is also important to Medicare's Hospital Readmissions Reduction Program, mandated by the

Affordable Care Act,⁴ as the majority of HH patients begin services following hospital discharge, either directly or after an interim stay at a rehabilitation or skilled nursing facility.

Depression and other mental disorders have been identified as risk factors for hospitalization in patients with various medical conditions.⁵⁻¹¹ The effect of depression on hospitalization has been reported specifically in HH patients, 97% of whom are referred for medical/surgical conditions.¹²⁻¹⁴ Our group, for example, demonstrated that, in a representative sample of new Medicare HH patients (n=529), patients with research diagnoses of major or minor depression had a significantly higher risk of hospitalization compared to other patients during the first month of care, controlling for sociodemographic and clinical factors.¹³ Using claims data in a national sample of Medicare HH patients (N=374,123), Fortinsky and colleagues similarly identified depressive symptoms as a risk factor for hospitalization.¹²

Evidence that depression contributes to the risk of hospitalization in HH patients is important because depression is both prevalent in this patient population and also potentially modifiable in the context of routine home healthcare practice. A large number of HH patients (25%) experience depressive symptoms with 14% of patients meeting criteria for major depressive disorder.¹⁵ Our randomized trial of the Depression CAREPATH intervention demonstrated clinical effectiveness of training medical HH nurses to manage depression among Medicare HH patients with moderate to severe depressive symptoms. Improvement in depression severity, compared to enhanced usual care (EUC), increased over one year.¹⁶ The trial also demonstrated the intervention's potential scalability by finding no difference between CAREPATH and EUC in duration of service, average number of visits per patient or duration of nursing visits.¹⁶

In this paper, we investigate the impact of the Depression CAREPATH intervention on hospitalization in HH patients who screen positive for depression during routine nursing assessments at the start of care. The paper tested two complementary and *a priori* hypotheses:

Hypothesis One (Home Health to Hospital)

We hypothesized that among HH patients who screened positive for depression, patients under the care of nurses trained in the Depression CAREPATH would be less likely to be hospitalized directly from HH within 30 or 60 days. As nurses were expected to follow depression care management protocol as part of standard care regardless of whether patients participated in research interviews, we tested this hypothesis among all patients who met eligibility criteria at baseline (N=755) using coded administrative data. This approach reduces any potential bias associated with whether patients were able or willing to participate in research assessments.

Hypothesis Two (30 Day Hospitalization)

We hypothesized that among patients who screened positive for depression, patients under the care of nurses trained in the Depression CAREPATH would be less likely to be hospitalized from any setting by 30 days. This hypothesis was tested among the 306 patients who participated in research interviews. Assessment of self-reported hospitalization at

follow-up made it possible to determine whether patients who completed HH in less than 30 days were subsequently hospitalized.

Exploratory analyses examined among patients with depressive symptoms: 1. the risk of rehospitalization among the subset of patients who were referred to HH directly from hospital, and 2. the impact of the intervention on an aggregate measure of all negative HH outcomes, including death, nursing home admission, hospice, and hospitalization.

METHODS

Design, Setting, and Patients

The Depression CAREPATH (CARE for PATients at Home) study was a cluster-randomized trial of home health (HH) nurse-teams randomized to either intervention or usual depression care protocols. Pre-existing nurse teams (i.e., nurses directed by a single supervisor) came from certified agencies serving six distinct regions: (1) Little Rock and rural Arkansas; (2) Miami-Dade County, Florida; (3) suburban Detroit, Michigan; (4) Bronx, New York; (5) greater Philadelphia, Pennsylvania; and (6) rural Vermont and New Hampshire. The team was chosen as the unit of randomization because the intervention involved training supervisors to oversee their nurses' use of the guidelines.^{17,18} Teams (mean size 8.5 (sd=3.4)) were randomized within each agency, resulting in 12 intervention teams and 9 enhanced usual care. The trial was approved by the institutional review boards of Weill Cornell Medical College, Montefiore Health System, and the University of Pennsylvania Health System.

Patients—Agencies used the Medicare Outcome and Assessment Information Set (OASIS) to identify eligible HH patients aged ≥65. H1 was tested among patients who met the following eligibility criteria on the OASIS: score ≥3 or on the two-item Patient Health Questionnaire (PHQ-2) depression screen,¹⁹ no dementia diagnosis, life expectancy >6 months, no active suicidality, English or Spanish speaking, and no significant hearing or speech impairment. H2 was tested among the subset of eligible patients who consented for research assessments.¹⁶

Intervention Groups

CAREPATH—Development and implementation of the Depression CAREPATH intervention have been described elsewhere.^{17,18} Briefly, for patients who screened positive for depression, nurses assessed depression severity using the 9-item Patient Health Questionnaire (PHQ-9).²⁰ For patients with a PHQ-9 score ≥10, nurses followed depression care management guidelines during routine visits including: (1) weekly depressive symptom assessment using the PHQ-9, (2) care coordination with physicians or specialists, (3) management of side effects and adherence to antidepressant medications, (4) patient and family education, and (5) assistance with setting short-term functional and behavioral goals. For patients with lower PHQ-9 scores, the protocol included education and encouragement, PHQ-9 monitoring weekly for two weeks, and employing the full protocol if suicide ideation emerged or symptoms worsened.

Enhanced Usual Care—EUC nurses participated in depression assessment training. They did not receive training in the CAREPATH protocol and were expected to follow agencies' standard procedures for depression.

Outcome and Covariates

Outcomes—Two outcomes were examined:

H1: *Home Health to Hospital* was defined as days to acute-care hospitalization admission while a HH patient. Hospitalization was ascertained from HH records making it possible to analyze this outcome in all patients who screened positive for depression and met other chart-based eligibility criteria (n=755). Patients were censored at end of HH or 60 days, whichever came first.

H2: *30 Day Hospitalization* was defined as days to acute-care hospitalization within 30 days of starting HH care. This outcome was analyzed in the subset of eligible patients who were willing and able to sign consent for research interviews (n=306). Hospitalization was ascertained from HH records and self-report, making it possible to assess hospitalization over the full 30 day period for all patients even for those who ended HH in less than 30 days without being hospitalized.

Covariate

Several covariates reported in previous research were considered potential confounders, including age, race, sex, marital status, education, referral source to HH care (e.g. community, skilled nursing facility, or hospital), functional impairment (i.e., limitations in activities of daily living [ADLs] and instrumental activities of daily living [IADLs]),²¹ and overall medical burden measured by the Chronic Disease Scale.²² For H1 (*Home Health to Hospital*), covariate data came from the HH record, with a sensitivity analysis conducted among the subsample of interviewed respondents. For H2 (*30 Day Hospitalization*), the analysis was first conducted using the same covariates as H1 and then reanalyzed substituting variables from the research interview as well as depression severity using the clinically-informed Hamilton Depression Rating Scale (HAM-D) that was the effectiveness trial's primary outcome.²³

Analytic Strategy

Summary descriptive statistics were generated for demographic and baseline health-related variables and compared across intervention groups using t-tests for dichotomous variables and χ^2 tests for categorical variables. To evaluate potential confounding, we first fit bivariate log-binomial generalized linear models with intervention group as the independent variable and hospitalization as the dichotomous outcome. Potential confounding variables were added to the model in a forward selection process and those producing 10% change in the estimated association between hospitalization and intervention group were included as covariates in subsequent analyses.

To estimate relative hazard of hospitalization, we first compared unadjusted risk by plotting Kaplan-Meier curves for CAREPATH and EUC patients and calculating log-rank tests of

equal survival functions. We used log-binomial generalized linear models and Cox proportional hazard models to estimate relative risk and relative hazard of hospitalization respectively, controlling statistically for selected covariates. The proportional hazards assumption was tested using Schoenfeld residuals and evaluated visually using log-log survival plots. For H1 (*Home Health to Hospital*), patients who ended HH for reasons other than hospitalization (e.g., death, discharged to home) were censored in the survival analyses at date HH ended or 30/60 days. For H2 (*30 Day Hospitalization*), patients who were not hospitalized were censored at 30 days.

We conducted two exploratory analyses. First, we compared risk of *re-hospitalization* among patients who were referred to HH from an acute care hospital (N=224). Second, we evaluated the association of intervention group and a broader set of adverse outcomes including: hospitalization, entry into a skilled-nursing facility, hospice, or death. Reliable information on emergency department use was not available.

All statistical analyses were performed using STATA software, version 14.0 (StataCorp, College Station, TX), and 2-tailed P-values of less than .05 were considered statistically significant.

RESULTS

Hypothesis One (Home Health to Hospital)

A total of 755 patients screened positive for depression (PHQ-2 ≥ 3) and met other eligibility criteria according to OASIS data (Figure 1).²⁴ As detailed in Table 1, patients had substantial medical burden and functional limitations with 89.2% and 59.5% reporting difficulty with IADLs and ADLs respectively.

Of 755 patients who screened positive for depression, 137 were hospitalized directly from HH within 30 days of starting HH, including 68 (15.5%) CAREPATH patients and 69 (22.0%) usual care patients. At 60 days following start of care, 103 (23.5%) CAREPATH patients and 92 (29.4%) EUC patients had been hospitalized (Figure 2).

The 30-day risk of being hospitalized directly from HH among CAREPATH patients was approximately 30% lower compared to EUC (Relative Risk (RR) = 0.70, $p=.020$) using log-binomial generalized linear models that adjusted for age, race, gender, IADL and ADL difficulty and baseline Chronic Disease Score (Figure 3). At 60 days from start of care, the risk of being hospitalized remained approximately 20% lower among CAREPATH patients (RR=0.79, $p=.055$). Using cox proportional hazards models to account for individual differences in time at-risk, the hazard of being hospitalized was approximately 35% lower (Hazard Ratio (HR) = 0.65, $p=.013$) among CAREPATH patients for 30 days, and approximately 28% lower (HR = 0.72, $p=.027$) for 60 days.

Hypothesis Two (30 Day Hospitalization)

Of the 755 eligible patients eligible based on OASIS data, 306 were interviewed, while 283 patients were no longer eligible when contacted due to hospitalization ($n=128$), medical

severity (n=49), cognitive impairment (n=24), hearing/speech impairment (n=63), or death (n=19). The remainder refused (n=132) or could not be contacted (n=34).

Complete data on 30-day hospitalization were available for 298 (97.4%) of interviewed patients: 30 were hospitalized within 30 days; 216 were still in HH at 30 days; and 52 completed HH within 30 days without being hospitalized. The remaining 8 patients completed HH <30 days without reliable information on subsequent hospitalization. The analyses censored these patients on their last day of HH, on average 23.6 days (range 18-28; sd=4.1).

The risk of hospitalization within 30 days of starting HH was approximately 46% lower among CAREPATH patients compared to EUC (Relative Risk (RR) = 0.54, p=.086). The hazard of hospitalization within 30 days of starting HH was 48% lower (HR = 0.52, p=.078) among CAREPATH patients, controlling for potential confounders derived from administrative data (Figure 3).

To investigate differences in the intervention effects observed for H1 vs. H2, we conducted several sensitivity analyses. First, we reanalyzed H1 (*Home Health to Hospital*) using only the subsample of interviewed participants (n=306). The results were similar to H2, with hazard of being hospitalized approximately 49% lower (HR = 0.51, p=.071) among CAREPATH patients after 30 days. These findings suggest that the impact of the intervention may be larger in the interviewed sample, although neither H1 nor H2 point estimates were significant at the .05 level. We also reanalyzed H1 (*Home Health to Hospital*) with the subset of patients who did not participate in research interviews (n=449), yielding a 31% lower hazard (HR=0.69, P=.055), similar to the 35% lower risk in the full sample, reported above.

Second, a sensitivity analysis reanalyzed H2 (*30 Day Hospitalization*) using research assessments of depression severity and socioeconomic, clinical, and functional status rather than chart data. The results did not change; the adjusted hazard of hospitalization within 30 days of starting HH was again 48% lower (HR = 0.52, p=.082) among CAREPATH patients.

Exploratory Analyses

Rehospitalization—H1 was reanalyzed with only patients who had been referred to HH directly from hospital (326/755). The adjusted hazard of being hospitalized while a HH patient was approximately 55% lower (HR = 0.45, p=.001) among CAREPATH patients after 30 days, and 44% lower after 60 days (HR = 0.56, p=.005).

All Negative Outcomes: We repeated the H1 analyses (N=755) expanding the outcome to a broader set of adverse outcomes including hospitalization, entry into a skilled-nursing facility, hospice enrollment, or death. The hazard of experiencing any of these outcomes was significantly lower among CAREPATH patients compared to EUC at both 30-days (HR=0.77, p=.052) and 60 days (HR=0.77, p=.055) following start of care.

DISCUSSION

The Depression CAREPATH intervention integrates depression care management into routine home health (HH) nursing care. This study shows that among patients who screened positive for depression upon starting Medicare HH, the Depression CAREPATH was associated with a 35% lower hazard of being hospitalized directly from HH within 30 days, and 28% lower hazard within 60 days. Exploratory analyses found even greater benefit for patients who had entered HH directly from hospital, with the adjusted hazard of being rehospitalized approximately 55% lower among CAREPATH patients after 30 days, and 44% lower after 60 days. The study also found evidence suggesting a reduction in risk of 30 day hospitalization from any setting, taking into account subsequent hospitalization among those patients who had completed home health without hospitalization.

Before discussing these findings, we note several study limitations. First, although agencies were diverse in size and location, they were not strictly representative of certified HH agencies. Second, HH nurses typically spend almost all their time making home visits alone, reducing the likelihood that intervention nurses influenced the use of the CAREPATH procedures among EUC nurses. Were such “contamination” to happen, however, it would likely dilute intervention effects making our results underestimates. Third, because patients with a dementia diagnosis were excluded, we do not know whether the intervention would reduce hospitalization risk for such patients. However, to achieve such an effect, we expect nurses would need further training in assessing depression in the context of severe cognitive impairment. Finally, analyses of H2 relied upon self-report data on post-HH hospitalizations for patients who completed HH in 30 days.

The prevalence of depressive disorders is especially high in HH patients, a population characterized by major risk factors for depression in later life including medical burden, disability, social isolation, and personal losses.²⁵ The Depression CAREPATH intervention was based on effective depression care management interventions designed for primary care, tailored for HH. Its clinical effectiveness trial reported a small but significant intervention effect on depression severity at 3 months that grew larger and more clinically meaningful over the course of one year. As the average length of HH service was approximately two months, those results suggest that the nurses’ activities in the short term, in effect, changed the longer term trajectory of patients’ care.

A large literature documents that in addition to personal suffering, depression contributes to older adults’ risk of excess services use, hospitalization, falls,²⁶ and mortality.²⁷⁻²⁹ Recent evidence suggests that interventions designed to reduce depressive symptoms also affect other adverse outcomes. For example, the PROSPECT intervention in primary care is associated with reduction in eight year mortality.^{24,30,31} In HH, Gellis reports that a multicomponent telehealth-intervention that included psychotherapy for patients with congestive heart failure or chronic obstructive pulmonary disease was associated with reduced likelihood of emergency room use and suggestion of fewer hospitalization days at one year.³² In our interviews, HH clinicians believed that depression seriously interfered with the goals of HH because depressed patients have low motivation for recovery and poor compliance with medical regimens: “it [depression] presents a big challenge in trying to help

them garner the strength and the willpower to do what they need to do to stay out of the hospital...”^{33,34}

In contrast to its effect on depression, the intervention effect on hospitalization was evident within 30 days. Given the time needed to initiate and respond to antidepressant treatment, it is unlikely that the Depression CAREPATH’s impact on 30-day hospitalization was solely a function of decline in depressive symptoms per se. We expect that depression care management served a more generalized, protective role. The protocol guided nurses in fuller assessment and monitoring of patients who screened positive for depression and in discussing depression with patients’ physicians, other clinicians, families, and patients themselves. Depression was acknowledged as real but neither inevitable nor intractable, and nurses encouraged patients to participate in self-care and other elements of their care plan despite their depressive symptoms. Thus the basic clinical activities of assessment, care coordination, medication management, education, and goal setting bring the overall well-being of patients to the forefront and may, in some cases, prompt clinical and psychosocial responses that ultimately reduce the risk of hospitalization.^{1,35} These clinical functions coupled with nurses’ personal care and attention are consistent with many programs of transitional care management including new coverage of such services by Medicare.³⁵⁻³⁷

Although neither group of patients with milder depressive symptoms improved clinically over the study year, the intervention was associated with lower rates of hospitalization among all patients who screened positive for depression regardless of severity. One interpretation is that these milder symptoms may not always be indicative of a psychiatric illness but, for some patients, evidence of a more generalized risk associated with progressive frailty.³⁸⁻⁴⁰ These persistent mild symptoms may for some recently hospitalized patients be a component of what Krumholz labels “post-hospital syndrome”, an acquired, transient condition of general risk for rehospitalization and other negative outcomes.”⁴¹ Our findings suggest that the CAREPATH’s key elements for patients with milder symptoms – including patient education, monitoring symptoms over time, and encouraging patients to participate in self-care – may help reduce this generalized risk.

A strength of this study is the Depression CAREPATH intervention’s potential scalability. The intervention is designed to be implemented within the existing infrastructure of Medicare Certified HH agencies. Thus its potential to reach a subset of patients at risk of hospitalization is large. In 2013, over 11,000 Medicare Certified HH agencies served >3.5 million fee-for-service Medicare patients, most (86%) age 65.⁴² The intervention was designed in collaboration with HH personnel with the aim to fit within routine practice and administrative constraints. Depression management was integrated into already scheduled visits and the protocol itself was simple enough to integrate into five commercial clinical software systems. As reported previously, the intervention did not affect patient length of stay, the number of nurse home visits, or the duration of these visits.¹⁶ In this context, the decrease in hospitalizations suggests that the intervention may be associated with net cost savings, although future research is needed to assess total costs to agencies (e.g., training and supervision) and to Medicare (e.g., increased outpatient visits).

The use of administrative data allowed us to examine the effect of the Depression CAREPATH on all patients who screen positive for depression and met other eligibility criteria regardless of whether or not they ultimately consented to research interviews. Thus the analysis is essentially free from unmeasured sampling bias. The major reasons that eligible patients did not participate in research interviews were being hospitalized shortly after starting home healthcare, subsequently identified cognitive impairment or severe medical illness, or refusal. Patients who were able and willing to participate in research assessments allowed us to examine the impact of the intervention on risk of 30 day hospitalization from any setting and to control for more clinically meaningful measures. The results were stronger in the interviewed sample, albeit not reaching statistical significance. To the extent that this stronger effect is “real” in the smaller sample, the intervention may be more meaningful for patients who are not immediately hospitalized (suggesting that the intervention effect takes a little time) or without cognitive impairment (suggesting that the intervention effect is contingent upon some level of cognitive function).

Conclusion

Hospitalizations are a significant source of rising healthcare costs and are designated by Medicare as a key indicator of poor quality of care in home health. These findings demonstrate that the Depression CAREPATH intervention is associated with lower risk of hospitalizations among home health patients without dementia who screen positive for depression. Evidence that the intervention does not increase nurses’ in-home time or patient’s overall use of nursing services suggests that the Depression CAREPATH may be a feasible approach to improving patient outcomes while containing cost growth.

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Figure 1.
Nurse Team Randomization and Patient Recruitment

^{H1} Eligible patients considered for Hypothesis 1 (H1). Eligible patients received care from nurses randomized to CAREPATH or Enhanced Usual Care but may or may not have participated in detailed research assessments.

^{H2} Subset of eligible patients who participated in research interviews and included in analysis of Hypothesis 2 (H2).

Figure 2.
Hospitalization among Eligible Medicare Home Health Patients with PHQ2 Score 3.

Figure 3.

Estimated Relative Hazard of Hospitalization for CAREPATH Patients Compared to Enhanced Usual Care Patients

Note. aRR: adjusted relative risk from log-binomial generalized linear models; aHR: adjusted hazard ratio from Cox proportional hazards models.

Table 1

Eligible Sample Characteristics (N=755)

	All	CAREPATH	Usual Care	p-value
	N=755 (100%)	N=439 (100%)	N=316 (100%)	
Age, mean (sd)	77.8 (7.9)	77.2 (7.7)	78.6 (8.1)	0.02
Female	513 (68.0)	292 (66.5)	221 (69.9)	0.32
Race				0.86
Black	120 (15.9)	71 (16.2)	49 (15.5)	
White	570 (75.5)	323 (73.6)	247 (78.2)	
Other	12 (1.6)	7 (1.6)	5 (1.6)	
CDS, ¹ mean (sd)	6.52 (3.1)	6.77 (3.1)	6.17 (3.1)	0.01
IADL Difficulty	647 (89.2)	383 (90.8)	264 (87.1)	0.12
ADL Dependent	439 (59.5)	255 (59.3)	184 (59.7)	0.90
PHQ2, ² mean (sd)	3.5 (1.6)	3.5 (1.6)	3.6 (1.6)	0.13
Referral Source				0.09
Hospital	326 (43.2)	190 (43.3)	136 (43.0)	
SNF/Rehab	237 (31.4)	148 (33.7)	89 (28.2)	
Community	186 (24.6)	98 (22.3)	88 (27.9)	
Other/unknown	6 (0.8)	3 (0.7)	3 (1.0)	
Hospitalized				
30-day	137 (18.2)	68 (15.5)	69 (22.0)	0.02
60-day	195 (26.0)	103 (23.5)	92 (29.4)	0.07

¹CDS: Chronic Disease Scale, range 0-18²PHQ2: Patient Health Questionnaire (2-item), range 0-6