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Using Nurse Practitioner Co-Management to Reduce Hospitalizations and Readmissions within a Home-Based Primary Care Program

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Abstract

Nurse practitioner (NP) co-management involves an NP and physician sharing responsibility for the care of a patient. This study evaluates the impact of NP co-management for clinically complex patients in a home-based primary care (HBPC) program on hospitalizations, 30-day hospital readmissions, and provider satisfaction. We compared pre-enrollment and post-enrollment hospitalization and 30-day readmission rates of homebound patients active in the NP co-management program within the Mount Sinai Visiting Doctors Program (MSVD) (n=87) between January 1, 2012 and July 1, 2013. Data were collected from the electronic medical record. An anonymous online survey was administered to all physicians active in MSVD in July 2013 (n=13).

After enrollment in co-management, patients have lower annual hospitalization rates (1.26 vs. 2.27, $P=0.005$) and fewer patients have 30-day readmissions (5.8% vs. 17.2%, $P=0.004$). Eight of 13 physicians feel “much” or “somewhat” less burned out by their work after implementation of co-management. The high level of provider satisfaction and reductions in annual hospitalization and readmission rates among high-risk homebound patients associated with NP co-management may yield benefits not only for patients, caregivers, and providers, but also cost savings for institutions.

Keywords

Home-based primary care; co-management; interdisciplinary care

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The authors have no relevant conflicts of interest to disclose.

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INTRODUCTION

Background

Definitions of nurse practitioner (NP) co-management differ by program, but in all cases involve an NP and physician sharing responsibility for the care of a patient. Evidence to date finds that the NP co-management model improves patients' health status in various settings (Counsell et al., 2007). Home-based care management by an NP working within a geriatrics interdisciplinary team has enhanced health outcomes for low-income older adults and reduced acute care utilization of those at high risk for hospitalization (Counsell et al., 2007). NP co-management has improved the quality of care for falls, dementia, and urinary incontinence (Ganz et al., 2010; Reuben et al., 2013) and has enhanced satisfaction with care and several clinical indicators among patients with hypertension and diabetes mellitus (Litaker et al., 2003). Frail dual-eligible older adults had improved functional status and satisfaction with access to care (Burton, Weiner, Stevens, & Kasper, 2002).

Involvement of an NP in patient care has also been associated with reductions in healthcare utilization (Naylor et al., 1999; Park, Branch, Bulat, Vyas, & Roever, 2013; Wagner et al., 1998). An NP-led, senior center-based program showed a decrease in hospitalizations and hospital days among chronically ill older adults (Wagner et al., 1998). Studies of older adults at high risk of poor post-hospital discharge outcomes (Naylor et al., 1999) and patients from a Veterans Affairs (VA) Medical Center (Park, Branch, Bulat, Vyas, & Roever, 2013) who received post-discharge care from an advanced practice nurse such as an NP showed decreased hospital readmission rates. Other studies involving case management of older adults by an interdisciplinary team that included advanced practice nurses showed no decrease in hospitalization rates or emergency department (ED) visits, but demonstrated increased contact with care providers (Kane, Homyak, Bershadsky, & Flood, 2006; Gravelle et al., 2007).

Studies suggest that NP co-management may be beneficial for a specific subset of older individuals, including those with high symptom burden and at high risk for hospitalization (Counsell et al., 2007; Stuck et al., 1995). Counsell et al., for example, found that though co-management by an advanced practice nurse was not associated with a reduction in cumulative hospital admission rates over two years, hospital admission rates in year two were lower in the intervention group for a subset of patients at high risk of hospitalization (Counsell et al., 2007). Another NP co-management intervention was associated with fewer short-term hospital stays only among a subset of patients with fair or poor self-perceived health (Stuck et al., 1995). Co-management by an interdisciplinary team that appeared to have no effect on hospital utilization was voluntary and not targeted specifically to patients at high risk of being hospitalized (Kane et al., 2006).

Beyond improving patient outcomes, the NP co-management model has the potential to reduce physician burnout. The prevalence of burnout among physicians in the United States continues to be high (Dyrbye et al., 2014; Shanafelt et al., 2012). However, most interventions to reduce burnout have focused on personal wellness strategies or on establishing a forum to reflect on emotional and psychosocial aspects of patient care (Lown

& Manning, 2010; Swetz, Harrington, Matsuyama, Shanafelt, & Lyckholm, 2009). Various care models, including NP co-management, deserve closer inspection as they may inherently reduce provider burnout through their focus on collaboration and shared responsibility of the most clinically challenging patients. While informal feedback following a one-year pilot of a registered nurse (RN)-led Guided Care program for older adults suggests that the program is acceptable to physicians, patients, and caregivers (Boyd et al., 2007), a study of NP co-management among geriatric patients found the referral of patients to the intervention to be a challenge that required overcoming physician barriers, including unwillingness to share the responsibility of patient care or skepticism about the role of other healthcare disciplines in patient care (Reuben et al., 2013).

Home-based primary care (HBPC) programs that include teams of physicians and nurse practitioners have been shown to reduce ED visits (Beck, Arizmendi, Purnell, Fultz, & Callahan, 2009; Chang, Jackson, Bullman, & Cobbs, 2009) and hospitalizations (Chang et al., 2009; Cooper, Granadillo, & Stacey, 2007; De Jonge & Taler, 2002). However, there is a lack of research specifically evaluating the impact of NP co-management within the HBPC setting, where it has substantial potential in improving health outcomes of a medically complex and underserved population. Homebound individuals have considerable difficulty leaving the home without assistance (Centers for Medicare and Medicaid Services, 2009). Almost 6% of community-dwelling, elderly Medicare beneficiaries are either mostly or completely homebound, which translates to more than two million Americans and encompasses more people than the current U.S. nursing home population (Ornstein et al., 2015). Homebound patients tend to be frail, elderly, and medically complex (Qiu et al., 2010), often having multiple chronic conditions (Kellogg & Brickner, 2000; American Academy of Home Care Physicians, Public Policy Statement). They also have difficulty accessing primary medical care (Brickner et al., 1975; Levine, Boal, & Boling, 2003) and often receive care only in emergent situations (Brickner et al., 1975; American Academy of Home Care Physicians, Public Policy Statement). Rates of hospitalizations and ED visits are higher among homebound older adults than their age-matched peers, making the homebound a costly subset of healthcare beneficiaries (Desai, Smith, & Boal, 2008). In recent years, programs such as the Independence at Home Demonstration created by the Center for Medicare and Medicaid Innovation are being launched to meet the complex needs of the homebound (Gorman, 2012).

This study assesses the impact of NP co-management within an existing HBPC program by comparing rates of hospitalizations and 30-day hospital readmissions before and after co-management, as well as by evaluating physician satisfaction with the intervention.

The Mount Sinai Visiting Doctors Program

The Mount Sinai Visiting Doctors Program (MSVD) is the largest academic HBPC program in the United States and serves more than 1,200 homebound patients in Manhattan, 85% of whom are over 70 years of age (Ornstein, Hernandez, DeCherrie, & Soriano, 2011; Smith, Ornstein, Soriano, Muller, & Boal, 2006). The program has an interdisciplinary staff of physicians, NP's, RN's, and social workers who collaborate to provide primary care, palliative care, and social services to the urban homebound. Physicians see patients every six

to eight weeks, but make more frequent or urgent visits when there is clinical need. MSVD patients also have access to 24-hour physician telephone coverage (Ornstein, Hernandez, et al., 2011). Physicians are primary care providers and the main point of contact for their patients; RN's help with triage and referrals are made to social work as necessary.

While the majority of MSVD patients are not hospitalized, a small group of patients is admitted frequently (Ornstein, Smith, Foer, Lopez - Cantor, & Soriano, 2011) or has higher symptom changes and frequent urgent visit needs. In a recent analysis, 43% of newly enrolled MSVD patients reported severe burden on one or more symptoms, with 53% reporting poor appetite and 47% reporting pain (Wajnberg, Ornstein, Zhang, Smith, & Soriano, 2013). To address this, MSVD implemented the NP co-management program in January 2012. Goals of the NP co-management program at MSVD are to identify high-risk patients, improve quality of care for patients, reduce caregiver stress, and decrease provider burnout. We chose to study the co-management of patients by both an NP and physician rather than to implement sole management of patients by an NP because of the success of other co-management models in improving quality of care and reducing healthcare utilization and to align with the existing care plan for MSVD patients. Many patients have been enrolled in MSVD for a significant period of time and have developed strong relationships with their physicians.

The Intervention: Nurse Practitioner Co-Management

A referral to the co-management program is made by MSVD primary care physicians through a referral tool in the electronic medical record (EMR) for patients who meet the following criteria: frequent hospitalizations and ED visits, uncontrolled symptoms, congestive heart failure exacerbations, chronic obstructive pulmonary disease exacerbations, uncontrolled diabetes, severe wounds, or profound caregiver stress. Routinely, the NP reviews hospitalization lists for patients with frequent admissions and contacts relevant physicians with requests for enrollment.

The NP in MSVD's co-management program visits patients at home as needed; the patient's physician continues to make home visits, though less frequently. The rest of the NP's time is used for urgent and post-discharge visits as well as for addressing patient and caregiver calls. During the study period, the NP's co-management patient panel was limited to 50 patients at one given point in time. Patients enrolled in the NP co-management program are seen at least monthly by their NP or physician. The NP focuses on symptom management, medication management, quality of life improvement, and care coordination and transitions. He becomes the primary point of contact for the patient for all clinical care, though the patient is still seen by the physician as well. If a co-management patient is hospitalized, the NP communicates with inpatient staff, visits the patient if needed, and makes a home visit within seven days of the patient's discharge from the hospital.

METHODS

Study Sample

1114 patients were enrolled in MSVD for at least 30 days during the 1.5-year study period between January 1, 2012 and July 1, 2013. Of these, 87 patients were enrolled in NP co-management for at least one day during the study period. Patients were referred to the co-management program using the criteria described above. Any patient enrolled in co-management for at least one day during the study period was included in our sample. Sensitivity analyses also examined outcomes using a co-management enrollment threshold of at least two weeks.

Hospitalization and 30-day readmission rates for co-management patients were compared for the period when patients were enrolled in MSVD but not yet in co-management to the period in which they were enrolled in co-management. For this pre-post comparison, we used data beginning on January 1, 2011, providing one year of data before the implementation of co-management and 1.5 years of data after the program began.

The Icahn School of Medicine at Mount Sinai Institutional Review Board approved this study (protocol #12-00399).

Analyses

Demographic information, diagnoses, hospitalizations, and 30-day hospital readmissions were obtained from the EMR. To verify the validity of the automatically generated reports, we randomly reviewed approximately 5% of patient charts and compared them to data generated via EMR summary reports. Our review demonstrated that very few patient hospitalizations that were present in the EMR were not documented in the generated reports. We determined the reasons for the discrepancy via consultation with EMR technical support staff and made corrections as appropriate (e.g., modifying diagnostic criteria included in EMR queries). Updated reports were requested and reviewed until discrepancies were resolved.

We first compared our co-management sample with the non-co-management MSVD patient sample on the following demographic characteristics: age at admission to MSVD, gender, race/ethnicity, enrollment in MSVD for more than one year, marital status, and insurance status. We also compared the following comorbidities according to the two groups: depression, skin ulcers, diabetes mellitus, chronic pulmonary disease, congestive heart failure, dementia, cerebrovascular disease, peripheral vascular disease, anxiety disorders, renal disease, obesity, malignancy, myocardial infarction, and rheumatic disease. We used t-tests and chi-square analyses as appropriate to test for statistical significance in continuous and categorical variables. Specifically, T-tests were used to compare age at admission to MSVD among the groups. Chi square tests were used to test all other group differences in demographic characteristics and comorbidities. Prevalence rates of diagnoses that are included in the Charlson Comorbidity Index (e.g., myocardial infarction) were calculated based on the Enhanced ICD-9-CM codes described by Quan, et al. in their coding algorithm for Charlson comorbidities (Quan et al., 2005). For diagnoses not included in the Charlson criteria (e.g., obesity), we used the ICD-9 codes most commonly associated with each

diagnosis among the MSVD patient population. Similarly, we included in our calculations of dementia prevalence additional ICD-9 codes that were not used in the coding algorithm delineated by Quan, et al.

To account for patients' differing lengths of follow-up before and after implementation of co-management, we based hospitalization and readmission rates on the days that each patient was active in either MSVD alone or in NP co-management within MSVD. The pre co-management hospitalization rate was calculated by dividing the total number of hospitalizations during the patient's time in MSVD prior to enrollment in co-management by the patient's total days in MSVD alone. The post co-management hospitalization rate was calculated by dividing the number of hospitalizations during the patient's time in MSVD after enrollment in co-management by the patient's total days in MSVD with co-management. Annualized rates were calculated based on days of observation. We estimated the percentage of patients pre and post intervention with any 30-day readmissions and calculated annual 30-day readmission rates for patients.

We conducted bivariate analyses to compare differences in hospitalization and readmission rates among MSVD patients during their time pre and post co-management. Since our comparison groups are paired, McNemar's test was performed for matched binary outcomes. McNemar's test was used to compare the percent of patients with at least one hospitalization or at least one readmission pre versus post co-management. The mean number of hospitalizations and the annual hospitalization rate pre versus post co-management were compared using the sign test. Due to the non-parametric distributions of our rates, a Wilcoxon sign rank test was performed to assess differences in the mean number of readmissions and the annual readmission rate pre versus post co-management. All analyses were conducted using the SAS 9.3 software.

To measure provider satisfaction with the program, an anonymous online survey was administered to all 13 physicians active in MSVD at the time of the survey. The survey was created by author MJ and reviewed by an expert on questionnaire construction who had no connection with the study. It was then pilot tested by three individuals involved with the NP co-management program, including one MSVD physician, and feedback was integrated into the final version of the survey that was disseminated to MSVD physicians. The survey consisted of 24 questions designed specifically for this project (20 multiple choice and four short response). Questions addressed referral to co-management, care of co-management patients, the process of NP-physician collaboration, and overall experience with the program.

RESULTS

The subset of patients who were enrolled in the co-management program (n=87) are younger (72.83 vs. 80.80 years old; $P=0.044$) than non-co-management MSVD patients and have lower rates of dementia (34.5% vs. 51.9%; $P=0.002$) (Table 1). They have higher rates of several disorders, including depression (58.6% vs. 34.3%; $P<0.001$), skin ulcers (52.9% vs. 30.0%; $P<0.001$), diabetes mellitus (47.1% vs. 29.7%; $P<0.001$), chronic pulmonary disease (39.1% vs. 19.8%; $P<0.001$), and congestive heart failure (34.5% vs. 21.3%; $P=0.005$).

During their time in MSVD before co-management enrollment, 56.3% of patients had at least one hospitalization, compared to 37.9% after enrolling in co-management ($P=0.01$) (Table 2). Twenty-five percent of patients (22 patients) were hospitalized both before and after co-management, and were thus included in both groups, while 31.0% (27 patients) were never hospitalized during the observation period. The mean number of hospitalizations in the study population decreased from 1.38 before co-management to 0.74 after enrollment ($P<0.001$). Annual hospitalization rates were significantly reduced from 2.27 annual hospitalizations in the pre co-management period to 1.26 annual hospitalizations post co-management ($P=0.005$).

The percent of patients with any 30-day hospital readmissions decreased from 17.2% to 5.8% ($P=0.004$). As the vast majority of the study sample was not hospitalized during the study period, the median number of readmissions was 0 both pre and post co-management. Among the entire sample of co-management patients, there was a mean of 0.37 30-day hospital readmissions before enrollment, which decreased to 0.15 after co-management ($P=0.004$) (Table 3). The annual readmission rate decreased, though not statistically significant, from 0.38 before co-management to 0.22 after co-management ($P=0.06$).

While our analyses included anyone enrolled in co-management for at least one day, we also examined changes in hospitalizations and readmissions in a reduced sample of patients enrolled in co-management for at least two weeks ($n=80$) and our findings were unchanged (data not shown).

All physicians surveyed reported that the care their co-management patients received after enrollment in co-management was better than the care they received before enrollment. Twelve of 13 physicians felt that they could devote more time to non-co-management patients after they referred certain high-risk patients to co-management. In addition, eight of 13 physicians reported feeling “much” or “somewhat” less burned out by their work as a direct result of co-management, while five experienced the same level of burn-out. All MSVD physicians surveyed found co-management to be a useful program that MSVD should maintain.

DISCUSSION

Our study found that enrollment in NP co-management is associated with reduced rates of hospitalization and 30-day hospital readmission and that provider satisfaction with the program is high. The hospitalization rates of patients who receive NP co-management at MSVD are significantly lower after enrollment in co-management than during their time in MSVD alone. There was also a statistically significant decline in the average number of hospitalizations and in the percent of patients with at least one hospitalization among this group after co-management enrollment. Our analysis of readmission data suggests that 30-day readmissions declined after program enrollment.

One limitation of our study is that referral to co-management was not mandatory for MSVD patients with specific symptom burden or hospitalization rates. Providers may not have used uniform criteria in referring patients to co-management. It is possible that patients were not

referred to co-management because providers did not think that the program would help them to reduce high healthcare utilization. This would limit generalizability of our study by including only patients who were likely to benefit from the intervention and reduce utilization. It is, however, unlikely that this is the case because the majority of providers cite frequent hospitalizations or ED visits as the most common reason for referring a patient to co-management. Provider-specific variations in referral patterns may relate to personal stress levels, variations in case mix, provider obligations outside of the program, and provider variability in trust of co-management; closer examination of these potential influences is currently under way. As we were specifically studying those MSVD patients enrolled in NP co-management, our study sample consists of high-risk, homebound patients with high baseline hospitalization and readmission rates. It is possible that a variety of interventions would also have decreased the hospitalization and readmission rates of this medically complex cohort. By comparing patients pre and post intervention, we eliminate threats to internal validity that come from comparing the co-management group to the non-co-management group in our main findings on utilization.

Additionally, we only used information on patients' hospitalizations and 30-day readmissions at the Mount Sinai Hospital. Though the overwhelming majority (83%) of hospitalizations and ED visits for MSVD patients are at the Mount Sinai Hospital, a substantial number of readmissions occur outside of the institution. Although we did not control for time-varying confounders such as new diagnoses in our pre-post analysis of co-management patients, the patients would tend to become sicker over time and thus would only bias our findings toward the null. In addition, it is difficult to know which elements of the NP co-management program most directly helped to reduce healthcare utilization, and further research should address this question. Lastly, our survey for MSVD providers was a new tool designed specifically for this study and not validated by formal testing. However, survey questions and format were reviewed by an expert on questionnaire construction and the survey was pilot tested by three individuals familiar with the co-management program to achieve maximal clarity and avoid bias in survey wording and format. A formal definition of burnout was not specified in the survey for MSVD physicians, but rather left to each physician's interpretation.

Our study evaluates the impact of NP co-management among patients with many comorbidities who were referred to the intervention by their primary care physicians due to their frequent hospitalizations, need for additional home visits, or high symptom burden. Reducing unnecessary hospitalizations by providing higher intensity primary care is a key objective of MSVD's NP co-management program and our results demonstrate that the program is generating the desired effects in our study population. This should yield benefits for patients, caregivers, and providers, and may also contain healthcare costs by preventing hospitalizations. Further research is needed to evaluate potential cost savings associated with NP co-management for the high-risk homebound.

All MSVD physicians have referred patients for co-management and report that they are comfortable doing so. In addition, providers appear to be quite satisfied with co-management overall and wish to see the program continue. By reducing provider burnout and the rate of physician home visits to co-management patients, NP co-management may

enable HBPC programs to not only increase their capacity, but also to improve the quality of care provided to both co-management and non-co-management patients.

As MSVD's co-management program expands, it will be important to assess the length of time needed to demonstrate a meaningful impact on hospitalization rates. Other studies of NP co-management suggest that these effects may be seen after the first year of the intervention, after relationships with the care team have been developed (Counsell et al., 2007; Sommers, Marton, Barbaccia, & Randolph, 2000).

The promising outcomes of MSVD's co-management program demonstrate the value of using the NP co-management model in an HBPC setting. Not only has the intervention decreased hospitalization rates among frequently hospitalized homebound patients with multiple comorbidities, but it is also widely accepted by home-based primary care physicians and may serve to decrease burnout for physicians working with a growing patient population with complex care needs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Patient Characteristics

	Co- Management (N=87)	Non-Co- Management (N=1027)	Total MSVD (N=1114)	P Value
Mean (SD) age at MSVD admission: years	72.83 (15.91)	80.80 (13.69)	80.18 (14.04)	0.044 ^a
% Female	70.1	76.8	76.3	0.16
% White	33.3	38.2	37.8	0.44
% in MSVD >1 year	78.2	79.3	79.2	0.81
% Single, widowed, or divorced	64.4	58.1	58.6	0.76
% with Medicaid	63.2	61.0	61.1	0.68
<i>Patients with Diagnosis (%)</i>				
Depression	58.6	34.6	36.5	<0.001
Ulcers of skin	52.9	30.0	31.8	<0.001
Diabetes mellitus	47.1	29.7	31.1	<0.001
Chronic pulmonary disease	39.1	19.8	21.3	<0.001
Congestive heart failure	34.5	21.3	22.4	0.005
Dementia	34.5	51.9	50.5	0.002
Cerebrovascular disease	29.9	27.4	27.6	0.61
Peripheral vascular disease	27.6	12.4	13.6	<0.001
Anxiety disorders	23.0	13.6	14.4	0.017
Renal disease	20.7	17.8	18.0	0.50
Obesity	18.4	10.0	10.7	0.015
Any malignancy	17.2	16.7	16.7	0.89
Myocardial infarction	10.3	4.3	4.8	0.011
Rheumatic disease	9.2	5.2	5.5	0.11

^aT-test; all other P-values in this table were obtained using the Chi-square test.

MSVD: Mount Sinai Visiting Doctors Program; SD: Standard Deviation

Table 2

Hospitalizations Pre and Post Co-Management (N=87)

	Pre Co-Management	Post Co-Management	P Value
Number with 1 hospitalization	49	33	
Percent with 1 hospitalization	56.3	37.9	0.01 ^a
Mean (SD) number of hospitalizations	1.38 (1.97)	0.74 (1.55)	<0.001 ^b
Annual hospitalization rate (SD)	2.27 (4.29)	1.26 (2.91)	0.005 ^b

^aMcNemar's Test^bSign Test

SD: Standard Deviation

Table 3

30-Day Hospital Readmissions Pre and Post Co-Management (N=87)

	Pre Co-Management	Post Co-Management	P Value
Number with 1 readmission	15	5	
Percent with 1 readmission	17.2	5.8	0.004 ^a
Mean (SD) number of readmissions	0.37 (1.11)	0.15 (0.81)	0.004 ^b
Median number of readmissions (Range)	0 (0–8)	0 (0–7)	
Annual readmission rate (SD)	0.38 (1.46)	0.22 (0.93)	0.06 ^b

^aMcNemar's Test^bWilcoxon Sign-Rank

SD: Standard Deviation