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The Role of Nursing Home Admission and Dementia Status on Care for Diabetes Mellitus

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Abstract

Objectives—To study the role of nursing home (NH) admission and dementia status on the provision of five procedures related to diabetes mellitus.

Design—Retrospective cohort study using data from a large prospective study in which an expert panel determined the prevalence of dementia.

Setting—Fifty-nine Maryland NHs.

Participants—Three hundred ninety-nine new admission NH patients with diabetes mellitus.

Measurements—Medicare administrative claims records matched to the NH medical record data were used to measure procedures related to diabetes mellitus received in the year before NH admission and up to a year after admission (and before discharge). Procedures included glycosylated hemoglobin, fasting blood glucose, dilated eye examination, lipid profile, and serum creatinine.

Results—For all but dilated eye examinations, higher rates of procedures related to diabetes mellitus were seen in the year after NH admission than in the year before. Residents without dementia received more procedures than those with dementia, although this was somewhat attenuated after controlling for demographic, health, and healthcare utilization variables. Persons without dementia experience greater increases in procedure rates after admission than those with dementia.

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Conclusion—The structured environment of care provided by the NH may positively affect monitoring procedures provided to elderly persons with diabetes mellitus, especially those without dementia. Medical decisions related to the risks and benefits of intensive treatment for diabetes mellitus to patients of varying frailty and expected longevity may lead to lower rates of procedures for residents with dementia.

Keywords

nursing home admission; dementia; diabetes care

More than 24 million people in the United States have diabetes mellitus, and this number will grow by 1 million per year due to population aging and other factors.^{1,2} The risk of diabetes mellitus increases dramatically with age, and the devastating effect of diabetes mellitus is particularly evident in elderly and institutionalized people. Whereas 5.6% of noninstitutionalized Americans have diabetes mellitus, up to one-quarter of America's 1.5 million nursing home (NH) residents have diabetes mellitus.^{2–4} NH residents with diabetes mellitus have higher rates of cardiovascular disease, visual problems, foot conditions, kidney failure, urinary incontinence, depression, cognitive impairment, injurious falls, nutritional deficiencies, and pain than residents without diabetes mellitus.^{2,3} As the population ages, the burden of the costs of and care for diabetes mellitus will fall heavily on the U.S. long-term care system.

Following intensive regimens for the management of diabetes mellitus is essential to delaying or avoiding its many negative health consequences. Standard diagnostic and preventive procedures include periodic dilated eye examinations, lipid profiling and testing of glycosylated hemoglobin (HbA1c), fasting plasma glucose, and serum creatinine. The American Geriatrics Society (AGS) provides guidelines for older persons with diabetes mellitus,⁵ and guidelines for institutionalized elderly adults have also been offered.⁶ Unfortunately, many elderly persons with diabetes mellitus, whether in the community or residing in an NH, do not receive the level of diagnostic and preventive care prescribed by these guidelines.^{7–12}

An important question for researchers and clinicians alike pertains to the relationship between NH admission and quality of care for diabetes mellitus. Although the structured care environment of the NH might lead to better care, priority may be given to more-urgent health concerns in people newly admitted to the NH, or the goals of care for diabetes mellitus may change as the costs and expected benefits of procedures are considered.^{3,5,11,13,14} Care may also change as NH physicians, rather than endocrinologists, direct care.¹⁵ Drawing inferences about this question from existing studies of community- and NH-dwelling elderly persons with diabetes mellitus is not possible because of widely varying sample demographics, data collection time frames, geographic locations, and inclusion and exclusion of short-stay NH patients. Additionally, it is likely that community-dwelling persons with diabetes mellitus admitted to an NH differ from those remaining in the community in the severity of their diabetes mellitus and other comorbidities.¹⁴ To examine the relationship between NH admission and quality of care for diabetes mellitus, care provided to a single sample of NH residents before and after NH admission must be examined.

Because of its prevalence and relationship to care practices, evaluations of care of diabetes mellitus in the NH should also take dementia into account. Approximately half of all NH residents have dementia.¹⁶ A wide range of studies have documented a connection between cognitive impairment and the provision of less-aggressive care related to diabetes mellitus,^{12–15,17} although these studies did not consider the role of NH admission or did not examine

diabetes mellitus care practices across a wide spectrum of quality indicators. Thus, a resident's status with regard to dementia is an important factor to consider when examining how admission to an NH relates to care for diabetes mellitus. Because diabetes mellitus is a disease for which the parameters of good care are relatively well defined, comparing the provision of procedures related to the care of diabetes mellitus to those with and without dementia also yields insights into the quality of care for patients with dementia.

For five basic diagnostic and preventive procedures related to diabetes mellitus, the current study asks whether care is provided at higher rates in the 12-month period before or after NH admission and for those with or without dementia. Interactions between dementia status and place of residence were also looked for, and rates of receiving these procedures in each setting were examined. For each procedure, basic rates and rates adjusted for variables that may affect the amount or type of care received by people newly admitted to the NH, including resident demographics, health status, and the previous year's healthcare utilization, were examined.

Research Design and Methods

Parent Study

The data presented are from a cohort study of 2,285 participants newly admitted to 59 Maryland NHs, entitled "Epidemiology of Dementia in Nursing Homes." Residents were enrolled between 1992 and 1995 and were eligible if they were aged 65 and older and had not resided in an NH for 8 or more days in the previous year. Residents were followed until death, discharge from the sample NH, or for 2 years if still a resident of that facility. An expert panel of geriatric psychiatrists, neurologists, and a geriatrician determined dementia status according to *Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised*, criteria using data collected from interviews (with residents, nursing staff, and family) and medical records (Minimum Data Set (MDS) evaluations and discharge summaries).¹⁸ A detailed description of the dementia ascertainment methodology is found elsewhere.¹⁹ Of the 2,285 newly admitted residents, 1,101 (48.2%) were designated as having dementia.¹⁶

Diabetes Mellitus Sample

According to MDS data, 404 residents in the parent study had a diagnosis of diabetes mellitus at admission (17.7%). All data were adjusted for exposure (length of stay, LOS). Because five subjects were lacking LOS information, the results are presented from 399 cases. For the 1-year preadmission data, 379 (94%) had 12 months of data, whereas the remainder had 9 to 11 months of data. According to expert panel diagnosis, 182 had dementia, and 217 did not. There was no difference according to dementia status for days of preadmission data available ($P = .45$).

Demographics, Health Status, and Healthcare Utilization—Demographic information on age, sex, race, marital status, and education was obtained from the MDS, as was information on physical functioning (number of dependencies in activities of daily living, ADLs) and number of medical comorbidities. Medicare-qualifying stay (MQS) information, along with LOS, were obtained from claims data. Healthcare costs in the year preceding admission were measured using the Diagnostic Cost Group/Hierarchical Coexisting Condition (DCG/HCC) risk adjuster. The Centers for Medicare and Medicaid Services (CMS) developed the DCG/HCC, which is the basis for the "selected significant disease model" that CMS has used to set capitation rates for Medicare health maintenance organizations since January 2004.²⁰

Procedures Related to Diabetes Mellitus Diagnosis and Prevention—Using Medicare administrative claims records from 1992 to 1997, cost and source of payment information were linked to diagnoses, procedures performed, and site of care for all patients.²¹ Indicators of quality management of diabetes mellitus for 1 year before NH admission and 1 year after admission (but during the resident's NH stay) were identified according to Current Procedural Terminology (CPT) code in the Medicare claims for five primary diagnostic and prevention procedures, including HbA1c testing (CPT 83036), fasting plasma glucose (CPT 82947, 82948, 82951, 82952), dilated eye examination (CPT 92012–92014, 92002–92004, 92140, 92250), lipid profile (CPT 80061, 82465, 83721, 83715–83719), and serum creatinine (CPT 82565, 82540). Identification of the appropriate CPT codes was based on published work.²² It was not possible to include podiatric examinations in the analyses because the podiatric examination code available at the time of data collection (M0101) referred to routine foot care (cutting and removal of corns and calluses and trimming of nails) and not to procedures related to diabetes mellitus.

Statistical Analyses

Overall models examined differences between subjects with and without dementia over two time periods: 12 months before admission to the index NH and 12 months after admission to the index NH. The models were estimated using generalized estimating equations in STATA, version 9 (StataCorp., College Station, TX). This STATA procedure (xtgee) adjusts the variances for correlations of repeated measures within individuals and within NHs. It uses a theoretical bootstrap method for correcting the standard errors of the regression coefficients and can be applied to cases involving non-Gaussian distributions. The count of the procedure of interest was modeled as the dependent variable, with a Poisson distribution and an offset to account for exposure time (LOS in NH over the 12-month follow-up and months of Medicare data in the preadmission period). Main effects for dementia status, time, and the interaction between dementia and time were estimated; if the interaction was not significant, it was dropped and the significance for the main effects reported. Standard errors on the rates were corrected for cluster sampling. Adjustment was done for exposure (LOS) for all models. Models were also run that controlled for demographics (age, sex, race, and education), activities of daily living (ADLs), comorbidities, Medicaid, MQS, and the DCG/HCC.

Results

Table 1 compares the basic demographic, functional, and healthcare cost variables of NH residents with diabetes mellitus with and without dementia using *t*-tests and chisquare analyses. Residents with dementia were slightly older and more likely to be nonwhite and had less education than their counterparts without dementia. The groups did not differ with respect to sex. In terms of health and functioning, residents with dementia were dependent in more ADLs, but the number of comorbidities did not differ. Considering the first year after admission, residents with dementia had longer stays in the NH than those without. In the year preceding admission, the average healthcare costs of those with dementia were less (\$15,078) than those without (\$19,696) ($P < .001$). Finally, residents with dementia were more likely to be on Medicaid and less likely to be in the NH as an MQS.

Table 2 compares rates of procedures for the 12 months before admission and the 12 months after admission for NH residents with diabetes mellitus with and without dementia. In models adjusted for exposure (LOS) only, differences are seen in rates of several procedures related to diabetes mellitus. Significant interactions for fasting glucose and serum creatinine revealed lower rates before admission overall and for those without dementia, with a greater increase after admission in rates of procedures for those without dementia. The main effect

of time for HbA1c and lipid profile showed higher rates of procedures after admission. A main dementia effect was seen for HbA1c and dilated eye examinations such that these procedures occurred significantly less frequently in subjects with dementia than for their counterparts without dementia. For all procedures, differences between those with and without dementia were larger after NH admission.

The lower half of Table 2 provides the same rates adjusted for LOS, demographics, ADLs, comorbidities, Medicaid status, MQS, and DCG/HCC. The patterns are similar to the unadjusted results. In these models, one additional interaction effect is significant—higher rates of lipid profiling in the postadmission period for those without dementia. The interaction terms for fasting glucose and serum creatinine retained significance in the adjusted analysis.

Conclusion

This study is the first to examine the role of NH admission and dementia status on the provision of care for diabetes mellitus. Using Medicare billing records, whether rates of procedures related to diabetes mellitus in the year before admission differed from those experienced in the year after admission was evaluated. Using expert panel dementia determination, whether a patient's status as having or not having dementia was related to procedure rates was evaluated. Interaction effects for time and dementia for these procedures were also examined.

Demographic, health status, and healthcare utilization differences between people with diabetes mellitus newly admitted to NHs with and without dementia (Table 1) reflect the short- and long-term care needs of these populations. Although no method of directly measuring severity of diabetes mellitus was available, greater severity of diabetic complications appears to be reflected in the younger age and higher preadmission healthcare costs of residents in the sample without dementia than of those with dementia. Research shows that having diabetes mellitus increases the risk of NH placement but only in persons who do not have dementia.²³ At the same time, individuals with dementia had more ADL dependencies and longer stays, reflecting the debilitating and chronic nature of dementia, and were more likely to be on Medicaid and not an MQS. In contrast, the health problems experienced by people with diabetes mellitus admitted to NHs without dementia may not preclude an MQS with return to the community after stabilization or rehabilitation.

These results suggest that admission to an NH may improve the care that elderly persons with diabetes mellitus receive in relation to diagnostic and preventive procedures. With or without adjustment for demographics, health, and healthcare utilization, four of the five procedures examined occurred more frequently in the year after NH admission than in the year preceding admission (except eye examinations). Previous studies that have evaluated samples of community- and NH-dwelling elderly adults with diabetes mellitus separately present a mixed picture of procedure rates. For example, HbA1c testing occurred at higher rates in NH samples^{10,11} than in community samples,^{7–9} whereas dilated eye examinations and lipid profile testing occurred more often in community-dwelling^{7,9} than in NH samples.^{11,12} By examining the treatments provided to a single group of patients as they transition from community to institutional settings, differences in care after NH placement can be better evaluated.

A possible explanation for the findings of the current study is that the structure of NH care, and in particular the monitoring and regulating functions of the MDS Resident Assessment Instrument, helps to ensure that basic diabetes mellitus care takes place. To the extent that a diabetic complication acts as a “trigger” leading to NH placement, these data may also

reflect heightened awareness of the diabetes mellitus care needs of new residents. The lack of improvement in dilated eye examinations after admission may reflect low rates overall for this procedure in NH residents,²⁴ as well as the fact that such examinations take place offsite and so are more challenging to implement.

This study found that individuals with diabetes mellitus and dementia received lower rates of clinical tests for HbA1c, fasting plasma glucose, and serum creatinine and of dilated eye examinations in community and NH settings than those without dementia. Because of a dearth of outcome studies evaluating diabetic treatment for very frail older people, there is controversy over the level of intensity of care for diabetes mellitus that is appropriate for such persons.^{5,13,25} For some, the risks and discomfort associated with treatment may not outweigh the benefits, especially given research documenting that several years may be required before clinical improvements in areas such as microvascular complications and renal disease are seen⁵ and that tight glycemic control can increase the risks of cardiovascular disease and hypoglycemic episodes, potentially leading to greater falls risk.¹³ Others argue that, on a case-by-case basis, tighter glycemic control and higher insulin use in institutionalized elderly people should be considered because of their positive effects on hypertension, dyslipidemia, microalbuminuria, and cognitive function. Nevertheless, studies consistently find lower rates of treatment with antidiabetic medications for the oldest old and for NH residents who are more cognitively and functionally impaired.^{13,14} These controversies primarily address the provision of medications and not the monitoring procedures examined, but whether advisable or not, at the clinical level, looser adherence to recommended monitoring schedules is likely to accompany less-intensive pharmacological treatment. Acknowledgment of the need to consider the patient's overall prognosis in relation to monitoring schedules is stated clearly within the guidelines for institutionalized diabetes mellitus, which advises that tests can be excluded "if advanced dementia or poor prognosis" is present.⁶ Such decisions regarding monitoring and treatment may therefore underlie, at least in part, the lower rates of testing found for NH patients with diabetes mellitus who also have dementia.

After controlling for demographics, health status, and healthcare utilization, differences in the provision of procedures for the care of diabetes mellitus according to dementia status were no longer significant for eye examinations, but several of the interactions remained. This might indicate some attenuation of the effect with adjustment, but the overall effects showed lower rates of procedures and less increase after NH admission for people with dementia. It is likely that the variables for which it was possible to adjust the data do not sufficiently capture the extent of differences between elderly people with diabetes mellitus with and without dementia admitted to NHs. This research suggests that patients with dementia are receiving fewer tests and procedures, but further research is needed to more clearly delineate and confirm this finding.

Although NH admission is related to higher rates of procedures related to care of diabetes mellitus for people with and without dementia, for several procedures, the positive relationship between NH admission and procedure rates was stronger for those without dementia than those with. The dementia-by-time interactions found for three of the procedures (fasting plasma glucose, serum creatinine, and in the adjusted results, lipid profiling) reinforce the conclusion that NH admission, although beneficial for all in terms of care for diabetes mellitus, may be more beneficial for those who do not have dementia. Overall rates were lower for those with dementia, and these differences become most dramatic in the postadmission period. Here again it may be that the structure of the NH may lead to a review of the diabetic care needs of all people admitted with diabetes mellitus, with accompanying orders for diabetes-related testing, but that the greater medical care needs and

higher potential benefits of treatment for new admissions without dementia result in greater increases in care for this group than for those who have dementia and diabetes mellitus.

This study has important limitations. First, the data are not timely, and community-based care and monitoring for diabetes mellitus has improved somewhat.²⁶ Nevertheless, procedure rates for community- and NH-based care remain well below guidelines.^{4,26,27} Furthermore, no information or research was found suggesting that changes in management of diabetes mellitus in recent years have differentially affected those within and outside of NHs or those with and without dementia. Given this, it was felt that the advantages of this data set (including the ability to examine procedures for a significant time frame before and after NH admission within a single patient cohort and to compare those with and without dementia based on expert panel review) outweighed the negatives for examining this important and overlooked issue. Second, as with all studies that use the MDS to identify cases of diabetes mellitus, it was not possible to differentiate between type 1 and type 2 diabetes mellitus, examine care for those with undiagnosed diabetes (levels of which can be high in NHs), or measure diabetes mellitus objectively, for example with HbA1c levels or plasma glucose concentrations. Previous research guided the selection of CPT codes, but miscoding of conditions can occur.²²

The current study suggests that the structured environment of care provided in an NH may affect evidence-based care (following practice guidelines that recommend preventive monitoring procedures) for older persons with diabetes mellitus, including those with dementia. This is critically important given the changing patient demographics in NH admissions, of whom 17% are discharges from acute hospital stays, and that 86% of all Medicare days in the NH are short-term rehabilitation days.²⁸

Already one-tenth of all NH inpatient days are attributable to diabetes mellitus,² and the responsibility for caring for Americans with diabetes mellitus grows steadily along with overall U.S. rates of diabetes mellitus and increasing life expectancies. Regardless of whether these residents return to the community or remain in an NH setting, the structure of NH care is critical for providing needed ongoing monitoring for symptoms and complications of diabetes mellitus. Research examining specific treatments and procedures provided to institutionalized elderly people is needed so that care providers have the information they need to maximize benefit while minimizing risk and cost.

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Table 1
Demographic, Functional, and Healthcare Costs According to Dementia Status of People Newly Admitted to the Nursing Home with Diabetes Mellitus

Variable	Overall N = 399	Dementia n = 182	No Dementia n = 217	P value
Demographic				
Age, mean $\pm$ SD	78.9 $\pm$ 7.4	79.8 $\pm$ 7.6	78.2 $\pm$ 7.2	.03
Male, %	29.1	30.2	28.1	.65
White, %	75.1	67.0	81.9	<.001
Years of education, mean $\pm$ SD	10.3 $\pm$ 3.8	9.6 $\pm$ 3.9	10.9 $\pm$ 3.7	.003
Health status				
Number of activity of daily living dependencies, mean $\pm$ SD	3.7 $\pm$ 2.0	4.1 $\pm$ 1.8	3.4 $\pm$ 2.1	.001
Number of comorbidities, mean $\pm$ SD	2.9 $\pm$ 1.5	2.9 $\pm$ 1.6	2.9 $\pm$ 1.5	.95
Healthcare utilization				
Length of stay up to 360 days, mean $\pm$ SD*	201.1 $\pm$ 144.5	252.3 $\pm$ 131.8	158.2 $\pm$ 141.0	<.001
Medicaid enrolled, %	29.1	35.2	24.0	.01
Medicare qualified stay, %	62.8	54.0	69.8	.002
Estimated healthcare costs for the 12 months before admission, \$, mean $\pm$ SD	17,706.7 $\pm$ 9,818.8	15,077.7 $\pm$ 8,026.5	19,695.9 $\pm$ 10,575.7	<.001

* Patients could stay longer but were only analyzed for 360 days.

SD = standard deviation.

Table 2
Unadjusted* and Adjusted† Rates of Procedures for Nursing Home Residents with Diabetes Mellitus with and without Dementia: Before and After Nursing Home Admission

Variable	Rate (Standard Error)				P-Value		
	12 Months Before Admission		12 Months After Admission		Interaction	Time	Dementia
	Dementia n = 187	No Dementia n = 217	Dementia n = 187	No Dementia n = 217			
Unadjusted*							
Glycosylated hemoglobin	0.19 (0.03)	0.26 (0.03)	0.19 (0.04)	0.45 (0.07)	>.05 [‡]	.02	.001
Fasting glucose	0.66 (0.04)	0.76 (0.03)	1.23 (0.06)	1.96 (0.12)	<.001		
Eye examination	0.20 (0.03)	0.33 (0.03)	0.13 (0.03)	0.33 (0.06)	>.05 [‡]	.33	<.001
Lipid profile	0.18 (0.03)	0.23 (0.03)	0.36 (0.05)	0.70 (0.09)	>.05 [‡]	<.001	.11
Serum creatinine	0.58 (0.04)	0.72 (0.03)	1.19 (0.12)	1.91 (0.12)	.009		
Adjusted [†]							
Glycosylated hemoglobin	0.20 (0.04)	0.27 (0.04)	0.19 (0.05)	0.44 (0.09)	>.05 [‡]	.12	.007
Fasting glucose	0.79 (0.04)	0.81 (0.04)	1.43 (0.08)	2.13 (0.17)	.003		
Eye examination	0.20 (0.04)	0.24 (0.04)	0.15 (0.04)	0.33 (0.08)	>.05 [‡]	.66	.10
Lipid profile	0.24 (0.04)	0.22 (0.04)	0.44 (0.08)	0.77 (0.12)	.048		
Serum creatinine	0.71 (0.05)	0.75 (0.04)	1.41 (0.08)	2.08 (0.17)	.02		

* All models adjusted for exposure (length of stay).

† Adjusted for length of stay, demographics, activities of daily living, comorbidities, healthcare costs, Medicaid status, and Medicare-Qualified Stay.

‡ When the interaction term was $P > .05$, the model was rerun without it and main-effect P -values reported.