Diabetes Care Publish Ahead of Print, published online January 17, 2008

Glycemic Control in Elderly Veterans with Diabetes: Individualized, not age-based

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Running Title: Individualized glycemic control for the elderly

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Received for publication 24 July 2007 and accepted in revised form 7 January 2008.

ABSTRACT

Objective: To examine the role of age and endocrinology care in glycemic testing and control in elderly veterans with diabetes.

Research Design & Methods: Retrospective study of Veterans Health Administration clinic users aged 65+ years with diabetes. We compared glycemic testing and control (HbA1c>9%) in 2000 between old-old (75+ years) and young-old (65-74 years) veterans.

Results: Without adjustment, rates for glycemic testing were 70.2% in old-old and 71.1% in young-old veterans and poor control were 9.4% in old-old and 12.8% in young-old. After adjustment, old-old veterans had 1.8% lower probability of glycemic testing and 2.9% lower probability of poor control than young-old. Endocrinology care was associated with a higher probability of both glycemic testing (9.7%) and poor control (1.0%) regardless of age.

Conclusions: Glycemic testing and control and effect of endocrinology care were comparable in old-old and young-old veterans with diabetes.

Diabetes affects 20% of individuals 65+ years old (1). While glycemic testing and control using hemoglobin A1c (HbA1c) are indicated for all people with diabetes (2), glycemic management should be individually tailored, especially in the geriatric population (3). Using age to guide management decisions, rather than relevant clinical and functional considerations, may lead to a systematic bias (i.e., age disparity). Under optimal care, however, one should not detect differences in rates of glycemic testing and poor control due to age. This paper compares glycemic testing and poor glycemic control (HbA1c>9%) rates between the young-old (65-74 years) and the old-old (75+ years).

RESEARCH DESIGN & METHODS

Data. We used Veteran Healthcare Administration (VHA) and Medicare data from the Diabetes Epidemiology Cohort (DEpiC) of individuals with diabetes who used VHA for health care (4). Our inclusion criteria were: age 65+ years; one or more VHA primary care visits in 1999; continuous Medicare fee-for-service enrollment; and alive on 9/30/2000. The VA-New Jersey Health Care System approved the study.

Dependent Variables. HbA1c testing in fiscal year (FY) 2000 was identified using CPT codes in VHA or Medicare data (5). For the individuals with HbA1c values available (Medicare data do not include laboratory values), we dichotomized individuals' last FY 2000 HbA1c value to highlight poor control using HbA1c>9%. Despite controversy (6), comparisons based on poor glycemic control minimize the confounding problems of comorbidity and patient preferences. Experts agree that poor glycemic control should be addressed in all people to minimize symptoms (7,8).

Key Independent Variable. Subjects were categorized as young-old (65-74 years) or old-old (75+ years) in FY 1999, because of differences in life expectancies. Americans live an average of 18.4 years at 65 years and 11.8 years at 75 years (9).

Independent Variables (from FY 1999). These consisted of demographic (gender, race/ethnicity, and marital status), socio-economic (VHA priority group status), access to healthcare (Medicaid, Medicare Part B enrollment), endocrinologist care, medical comorbidity, and mental illness based on ICD-9-CM codes (10). Medical comorbidity was based on the individuals' DxCG Relative Risk Scores (RRS) using ICD9 codes from VHA and Medicare inpatient and outpatient records. The RRS is normalized to a mean of 1(range 0.8-146.0) (DxCG Risk Smart, Revision A. Boston, MA: DxCG, Inc.; 2002.). Endocrinologist care was determined from clinic stop codes in VHA data and physician specialty codes listed on Medicare claims.

Analytic Procedures. We used probit regressions to examine the association between age and diabetes care after controlling for other independent variables. We calculated marginal effects by transforming parameter estimates to probabilities of an outcome. The marginal effect is interpreted as the change in probability of experiencing the dependent variable in response to a one-unit change in the independent variable(e.g., from RRS (Comorbidity score) of 1.0 to 2.0, from reference group of white to comparison group of Latino).

We estimated the interaction effect of age and endocrinology care on both outcomes using the "NLCOM" procedure in STATA (Version 8.2. College Station, TX:StataCorp LP) rather than base statistical inferences on the co-efficient and significance level of the interaction term produced by probit regressions(11). We considered associations statistically significant at $p<0.01$.

RESULTS

The table describes the study population (n=194,772) by old-old (n=74,772;38%) and young-old(n=120,000; 62%) age categories. These groups were significantly different in all the independent variables except Medicaid enrollment (p=0.329) and marital status (p=0.113). Overall, 85,288 young-old (71.1%) and 52,487(70.2%) of old-old had HbA1c testing (p<0.001). Among those with an available HbA1c value (n=112,168), fewer old-old (9.4%;n=3,860) compared to the young-old(12.8%;n=9,125) had HbA1c>9%(p<0.001).

Endocrinology care was associated with higher rates of glycemic testing (79.2% vs. 68.4% in old-old , 78.8% vs. 69.2% in young-old) and poor control(10.8% vs. 9.1% in old-old, 13.5% vs. 12.6% in young-old). Analysis of interaction terms showed (data not shown) endocrinology care did not modify the associations between age and glycemic testing (p=0.012) or age and poor glycemic control (p=0.021). Therefore, we present the results for regression models without these interaction terms. After controlling for other variables, the old-old had 1.8% lower probability of having HbA1c tested than the young-old and 2.9% lower probability of poor glycemic control than the young-old(p-values<0.001) (see table). Endocrinology care was associated with a higher probability of both glycemic testing (9.7%) and poor control (1.0%) (p-values<0.001).

CONCLUSIONS

In elderly VHA users with diabetes, the old-old had a lower, but clinically insignificant, probability of receiving glycemic testing than young-old, and a lower probability of poor glycemic control. Our data do not support the hypothesized age-based differential of glycemic management in the VHA, similar to the results for the general United States population (12).

Our analyses show that receipt of endocrinology care is similar regardless of age. Endocrinology care was associated with higher likelihood of HbA1c testing and poor glycemic control, likely reflecting a preferential referral of patients with poor glycemic control to endocrinologists (13).

Others have also found that older individuals have better glycemic control than younger individuals (14,15). It is possible that differences in diabetes diagnosis due to more frequent blood testing among the elderly (16), diabetes pathophysiology, and/or a survival bias in older patients (15) may obscure an age disparity in glycemic management.

The rates of glycemic testing and poor control found in this analysis are consistent with other studies (17-19), demonstrating opportunity for improvement. The strengths of our study include national scope of the population, examination of VHA and Medicare data, and well-established definitions of diabetes, comorbidities, glycemic testing, and poor glycemic control. Some data were missing for those few who relied on Medicaid services. Lack of HbA1c values in Medicare claims data limited our glycemic control analysis to a subset of this population. We were unable to examine specific comorbidities that impact glycemic control, such as vision loss and cognitive impairment. Finally, our definition of endocrinology care has face validity, and is likely to be sensitive, but not specific to diabetes care. Our findings must be generalized with care; the VHA serves a primarily older, male and white population with an emphasis on geriatric care that may not be typical of other healthcare systems.

This study documents the lack of a meaningful age disparity in glycemic testing or control among elderly veterans with diabetes.

It provides a baseline for surveillance for age disparities in this population and informs

future research about glycemic management for elderly people with diabetes.

ACKNOWLEDGEMENTS

Project support provided by VA-Health Services Research and Development grants to Drs. Helmer (RCD-02-041-2), Pogach (IIR 02-079), and Sambamoorthi (IIR-05-016). The views expressed are the authors' and do not necessarily reflect the position or policy of the Department of Veterans Affairs.

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TABLE 1. Study Population Characteristics by Age and Age Disparities in Glycemic Testing and Poor Glycemic Control Among Elderly Veteran Clinic Users with Diabetes

		ALL	Young-Old	Old-Old	Marginal Effects from Separate Probit Regressions on Glycemic Testing and Poor Glycemic Control			
					Glycemic Testing		Poor Glycemic Control†	
		N=194,772	N=74,772	N =120,000	Marginal Effect	Standard Error	Marginal Effect	Standard Error
		%	%	%				
Age								
	Old-Old	61.6	NA	100	-0.018***	0.002	-0.029***	0.002
	Young-Old	38.4	100	NA				
Gender								
	Women	0.9	2.2	1.4	-0.004	0.009	-0.007	0.008
	Men	99.1	97.8	98.6				
Race/Ethnicity								
	White	78.6	82.4	80.1				
	African American	14.0	11.9	13.1	-0.056***	0.003	0.045***	0.003
	Latino	6.4	4.8	5.8	-0.330***	0.005	0.053***	0.007
	Other/Missing	1.0	1.0	1.0	-0.079***	0.011	0.050***	0.012
Marital Status								
	Married	68.9	69.2	69.0	0.015***	0.002	-0.016***	0.002
	Not Married	31.1	30.8	31.0				
VHA Priority Status								
	SC disability >30%	18.2	23.7	20.3	0.007**	0.003	-0.017***	0.002
	SC disability < 20%	14.7	20.1	16.8	0.003	0.003	-0.01***	0.003
	Non-SC, Low income	55.8	47.0	52.4				
	Non-SC, high income	11.3	9.3	10.5	0.022***	0.004	-0.015***	0.003
Medicaid Enrollment								
	Yes	18.9	19.1	19.0	-0.002	0.003	0.002	0.002
	No	81.1	80.9	81.0				
Dual System Use								
	Both VHA & Medicare	53.1	63.5	57.1	0.050***	0.002	-0.021***	0.002

	Only VHA	46.9	36.5	42.9				
Any Mental Illness								
	Yes	20.6	24.9	22.3	-0.014***	0.003	0.001	0.002
	No	79.4	75.1	77.7				
Endocrinologist Visit								
	Yes	19.3	16.8	18.3	0.097***	0.002	0.010***	0.002
	No	80.7	83.2	81.7				
Medicare Part-B (Months)					0.002***	0.000	-0.001**	0.000
	Mean	10.55	10.33	10.89				
	SD	3.87	4.09	3.45				
DxCG Relative Risk Score					-0.004***	0.001	0.002	0.001
	Mean	1.69	1.58	1.86				
	SD	2.11	2.07	2.16				
Dependent Variables								
HbA1c Testing								
	Yes	70.7	71.1	70.2	not applicable	not applicable	not applicable	not applicable
	No	29.3	28.9	29.8	not applicable	not applicable	not applicable	not applicable
HbA1c > 9%†								
	Yes	11.6	12.8	9.4	not applicable	not applicable	not applicable	not applicable
	No	88.4	87.2	90.6	not applicable	not applicable	not applicable	not applicable

Note: Based on 194,772 veteran clinic users with diabetes aged 65 years and older in fiscal year 1999, enrolled in Medicare fee-for-service and alive as of the end of fiscal year 2000. Both glycemic testing and poor glycemic control (HbA1c > 9%) were derived from the last test and values available in fiscal year 2000.
† Study population based on those who had HbA1c testing done and HbA1c values available (n=112,168).

In bivariate analysis, all variables were significantly different ($p<0.001$) by age category except Medicaid enrollment and marital status.
Asterisks denote significant group differences compared to the reference group based on probit regressions.
*** $p < .001$; ** $.001 \leq p < .01$; NA= Not Applicable; HbA1c= hemoglobin A1c; SC= service-connected; VHA=Veterans Health Administration; SD= Standard Deviation