Research Article

Is health status related to healthcare access in diabetic females age 45-79?

Michelle T Huang

Department of Physician Assistant Studies, University of North Texas Health Science Center, USA

Amy R Allen

Department of Physician Assistant Studies, University of North Texas Health Science Center, USA

Lindsey M Graff

Department of Physician Assistant Studies, University of North Texas Health Science Center, USA

Molly C Berrier

Department of Physician Assistant Studies, University of North Texas Health Science Center, USA

Jessica L Hartos*

Department of Physician Assistant Studies, University of North Texas Health Science Center, USA

ABSTRACT

Purpose: Healthcare access may impact diabetic patient health, but research in the area is limited. The purpose of this study was to assess the relationship between health status (general, mental, and physical health) and healthcare access (coverage and cost) in diabetic females ages 45 to 79.

Methods: This cross-sectional analysis used data from the 2016 Behavioral Risk Factor Surveillance System (BRFSS) for diabetic females ages 45 to 79 from Louisiana (N=594), Mississippi (N=541), Oklahoma (N=566), and Texas (N=1013). Multiple and ordered logistic regression analyses were conducted separately by state and outcome to determine the relationship between health status and healthcare access after controlling for health-related and demographic factors.

Results: Across states, about half of diabetic females reported fair or poor general health (43-49%), low to moderate physical health (51-61%), and low to moderate mental health (39-45%). In addition, most reported having healthcare coverage (90-95%) and few reported that cost precluded doctor visits (16-22%). Adjusted analysis indicated that health status outcomes were related to healthcare cost, but not to coverage, across states. Those for whom cost precluded doctor visits were less likely to report higher levels of general, physical, and mental health. In addition, all health status variables were inversely related to having diabetes plus two or more health conditions.

Conclusion: General, mental, and physical health status in diabetic females ages 45 to 79 were inversely related to healthcare cost and having multiple health conditions, but not related to healthcare coverage. Practitioners should screen all patients in this target population for multiple health conditions, educate patients on the health effects of multiple comorbidities, coordinate treatment across comorbidities, and refer to specialists as needed. Practitioners may also need to consider treatment costs when treating multiple health conditions in this target population.

Key words: Diabetes, Healthcare access, General health, Physical health, Mental health

Introduction

Diabetes in the United States has reached epidemic proportions. As of 2015, 23.1 million Americans (7.2% of the population) were diagnosed with diabetes and it is currently the seventh leading cause of death in the U.S. [1-3]. Diabetes has many associated health complications including hypertension, diabetic ketoacidosis, lower extremity amputation, and renal disease [2]. Furthermore, diabetes is associated with increased individual and national healthcare costs. On average, medical expenditures for diabetics are about 2.3 times greater than those without diabetes, and diabetic healthcare costs account for 2.5-15% of annual healthcare budgets and ample research shows that health status is inversely related to socioeconomic status in diabetics and in the general population [1,2,4-10].

Healthcare access can influence the health outcomes of both the general population and diabetics, and it is well established

that uninsured patients face worse health outcomes than insured patients [7,11-13]. Adverse health outcomes may be related to inconsistent access to prescription drugs, lack of continuity of care, and lower quality of care [12]. In diabetics, lack of access to care is especially dangerous as it can lead to uncontrolled blood sugar levels that put diabetics at risk for further chronic disease and disability [5,8].

A recent study examining general health status and healthcare access in diabetic females ages 30 to 50 found a relationship between poor general health and healthcare access [4]. However, the study failed to evaluate social behaviors such as alcohol and tobacco use, which may impact health status. Furthermore, the study did not address mental and physical health, key factors included in the World Health Organization's definition of "health" [14]. These facets are important as diabetes has been associated with detrimental physical, social, and psychological effects [15,16].

Because aging populations stay active much longer than in previous generations, diabetic women ages 45-79 could greatly benefit from research that indicates ways to improve and maintain their health throughout their mid to late life. Due to the long list of complications and expenses that accompanies being diabetic, examining how general, mental, and physical health status differs by healthcare access is important to discover the impact that this chronic condition may have on people's quality of life, healthcare demands, and health outcomes in the United states. The purpose of this study was to assess the relationship between health status (including general, mental, and physical health) and healthcare access (including coverage and cost) among diabetic females ages 45 to 79.

Methods

Design

This cross-sectional analysis used data from the 2016 Behavioral Risk Factor Surveillance System (BRFSS) conducted by the Center for Disease Control and Prevention (CDC) [17]. BRFSS annually collects data regarding health behaviors, health conditions, and preventative medicine by conducting telephone surveys across the nation. The CDC compiles all BRFSS data and makes de-identified data available to researchers for secondary data analysis. This study was given exempt status by the Institutional Review Board at The University of North Texas Health Science Center.

Sample

The samples in this study included diabetic females ages 45 to 79 from Louisiana (N=594), Mississippi (N=541), Oklahoma (N=566), and Texas (N=1013). These states were chosen for their higher prevalence of adults with diabetes compared to other U.S. states [18].

Data

There were three outcomes of interest: general, physical, and mental health. General health status was measured as "good or better" vs "fair or poor." Physical health status was originally measured in BRFSS as "low" (defined as 0 days),

"moderate" (defined as 1-13 days), and "high" (defined as 14 or more days) days of "not good" physical health in the past 30 days, which includes "physical illness and injury," The categories were reversed to reflect days of good physical health as "low" (defined as 16 or less days), "moderate" (defined as 17-29 days), and "high" (defined as 30 days). Mental health status was also originally measured in BRFSS as "low," "moderate," or "high" number of "not good" mental health days in the past 30 days, which includes "stress, depression, and problems with emotions," These categories were also reversed to reflect days of good mental health as "low," (defined as 16 or less days), "moderate," (defined as 17-29 days), and "high" (defined as 30 days).

There were two factors of interest: healthcare coverage and healthcare cost. Healthcare coverage was measured as yes/no to having "private or public healthcare coverage." Healthcare cost was measured as "cost precluded seeing a doctor in the past 12 months" vs "cost did not preclude seeing a doctor in the past 12 months."

Control variables included routine checkup, number of health conditions, weight status, tobacco use, alcohol use, age category, ethnicity/race, educational level, income level, and employment status. Routine checkup was measured as yes/no to having a "routine checkup in the past year." Health conditions was measured as the number of "yes" responses to being diagnosed with the following health conditions: diabetes; myocardial infarction; angina or coronary heart disease; stroke; asthma; skin cancer; other cancers; chronic obstructive pulmonary disease, emphysema, or chronic bronchitis; arthritis, rheumatoid arthritis, gout, fibromyalgia, or lupus; depressive disorder; and kidney disease. Since all participants in the sample had at least one health condition (diabetes), the health conditions variable was categorized as "diabetes only," "diabetes plus one other health condition," and "diabetes plus two or more other health conditions." Weight status was measured as yes/no to "overweight or obese." Tobacco use was measured as yes/no to be a "current smoker." Alcohol use was measured as yes/no to having "drank alcohol in the past 30 days." Age was categorized as "45 to 64 years old" or "65 to 79 years old." Ethnicity/race was measured dichotomously as "white, non-Hispanic" or "other." Educational level was measured as yes/no to "graduated college or technical school." Income level was measured as yes/no to having an income of "$50,000 or more." Employment status was measured as yes/no to as being "employed."

Analysis

Frequency distributions by state were used to describe the sample and identify any issues with the distributions of variables. All analyses were conducted separately by state and outcome to determine patterns of relations among variables in similar samples. A similar result in three or four states out of four states was evidence of a reliable relationship. Multiple logistic regression analysis was used for general health status (dichotomous outcome) and ordered logistic regression analysis was used for physical and mental health status (both categorical outcomes) to determine the relationship between health status and healthcare access separately by state and health outcome

after controlling for health-related and demographic factors. Ordered logistic regression models are used to estimate a relationship between an ordinal dependent variable and a set of independent variables. The proportional odds produced for each IV relates "proportionally" or equally applies to comparisons of DV groups greater than k versus those who are in groups less than or equal to k, where k is any level of the response variable. Therefore, the interpretation of an associated OR is that for a one unit change in the predictor variable, the odds for a group that is greater than k versus less than or equal to k are the proportional odds times larger. Any observations with missing data for any variables were excluded from the adjusted analysis. All analyses were conducted in STATA 15.1 (Copyright 1985-2017 StataCorp LLC).

Results

Descriptive statistics

Table 1 lists participant characteristics for diabetic females ages 45-79 in Texas, Mississippi, Louisiana, and Oklahoma. Across states, about half of diabetic females reported fair or poor general health (43-49%), low to moderate physical health (51-61%), and low to moderate mental health (39-45%). In addition, nearly all the participants had either private or public coverage (90-95%) and healthcare cost prevented few participants from visiting a doctor in the past 12 months (16-22%). For health-related factors, most reported having a checkup within the past year (88-91%), about half reported diabetes plus two or more health conditions (47-57%), most were overweight or obese (85-87%), and most were not current smokers (84-89%). For demographic factors, about half or more of the participants reported their race as white, non-Hispanic (42-74%), most reported they were not employed (72-76%), and a wide range reported graduating from college or technical school (20-79%) and an income of less than $50,000 (24-81%).

Adjusted statistics

The results for adjusted analyses are shown in Table 2. For general health status, the results of the multiple logistic regression analysis for diabetic females ages 45-79 in Texas, Mississippi, Louisiana, and Oklahoma indicated that after controlling for all other variables in the model, general health was not significantly related to health coverage but was significantly related to health cost. Across states, compared to participants who reported that cost did not preclude seeing a doctor in the past 12 months, participants in three out of four states who reported that cost precluded seeing a doctor in the past 12 months were about 3 to 6 times less likely to report good or better general health. In addition, compared to participants who reported having only diabetes, participants in all four states who reported having diabetes plus two or more other health conditions were about 4 to 7 times less likely to report good or better general health.

For physical health status, the results of ordered logistic regression analysis for diabetic females ages 45-79 in Louisiana, Mississippi, Oklahoma, and Texas indicated that after controlling for all other variables in the model, physical health was not significantly related to health coverage, but was significantly related to health cost. Across states, compared to participants who reported that cost did not preclude seeing a doctor in the past 12 months, participants in three out of four states who reported that cost precluded seeing a doctor in the past 12 months were about 3 to 4 times less likely to report each successive level of physical health. In addition, compared to participants who reported having diabetes only, participants all four states who reported having diabetes plus two or more other health conditions were about 5 to 7 times less likely to report each successive level of physical health.

For mental health status, the results of the ordered logistic regression analysis for diabetic females ages 45-79 in Louisiana, Mississippi, Oklahoma, and Texas indicated that after controlling for all other variables in the model, mental health was not significantly related to health coverage but was significantly related to health cost. Across states, compared to participants who reported that cost did not preclude seeing a doctor in the past 12 months, participants in four out of four states who reported that cost precluded seeing a doctor in the past 12 months were about 2 to 3 times less likely to report each successive level of mental health. In addition, compared to those who reported having diabetes only, participants in all four states who reported having diabetes plus two or more other health conditions were about 2.5 to 4.5 times less likely to report each successive level of mental health.

Discussion

The purpose of this study was to assess the relationship between health status (including general, mental, and physical health) and healthcare access (including coverage and cost) among diabetic females ages 45 to 79. Across states, about half of diabetic females reported fair or poor general health, low to moderate physical health, and low to moderate mental health in the past month. In addition, nearly all reported having private or public health coverage, and few reported that cost did not preclude them from seeing a doctor in the past 12 months. The results of the adjusted analysis across states indicated that general, physical, and mental health were consistently related to healthcare cost, but not to healthcare coverage. These findings are like a previous study that evaluated the relationship between general health, healthcare coverage, and cost Alarcon, et al. [4], but differs from other research that shows relationships between coverage and health outcomes [5,7,11-13] These discrepancies may be related to the way other studies measured healthcare coverage as private, public, or other types of coverage [11,16,19,20]. In addition, this study used self-reported measures of health status, while previous studies used a variety of health indicators such as blood glucose levels, diabetic ketoacidosis, and hospital admissions [6,7,9,21]. The results of this study also indicated that general, physical, and mental health were significantly related to having three or more health conditions, which is also supported by past research [4,18].

The results of this study extend previous findings to include health cost related to physical and mental health as well as to general health, and to include the impact of having multiple

Table 1. Participant Characteristics by State

Variable	Louisiana (N=594)		Mississippi (N=541)		Oklahoma (N=566)		Texas (N=1013)	
	N	%	N	%	N	%	N	%
General Health Status	590	99	539	100	564	100	1009	100
Good or better	318	54	276	51	320	57	553	55
Fair or poor	272	46	263	49	244	43	456	45
Physical Health Status	574	97	503	93	538	95	965	95
Low	164	29	120	24	181	34	277	29
Mod	182	32	134	27	140	26	276	29
High	228	40	249	50	217	40	412	43
Mental Health Status	581	98	518	96	548	97	991	98
Low	90	15	98	19	115	21	164	17
Mod	150	26	121	23	129	24	216	22
High	341	59	299	58	304	55	611	62
Healthcare Cost	592	100	541	100	565	100	1008	100
Cost precluded seeing a doctor	94	16	119	22	105	19	158	16
Cost did not preclude seeing a doctor	498	84	422	78	460	81	850	84
Healthcare Coverage	594	100	538	99	565	100	1012	100
Yes	561	95	491	91	523	93	908	90
No	33	6	47	9	42	7	104	10
Routine Checkup	588	99	534	99	555	98	1003	99
Within past year	535	91	486	91	500	90	885	88
Not within past year	53	9	48	9	55	10	118	12
Health Conditions	558	94	511	94	523	92	967	95
Diabetes only	112	20	128	25	88	17	249	26
Diabetes plus one other	139	25	142	28	135	26	249	52
Diabetes plus two or more others	307	55	241	47	300	57	469	49
Weight Status	545	92	504	93	506	89	905	89
Overweight or obese	474	87	440	87	434	86	768	85
Not overweight or obese	71	13	64	14	72	14	137	15
Tobacco Use	568	96	525	97	544	96	971	96
Current smoker	90	16	78	15	84	15	103	11
Not current smoker	478	84	447	85	460	85	868	89
Alcohol Use	568	96	520	96	537	100	961	95
Drank in past 30 days	432	76	98	19	95	18	723	75
Did not drink in past 30 days	136	24	422	81	442	82	238	25
Ethnicity/race	584	98	539	100	563	99	990	98
White, non-Hispanic	246	42	257	48	416	74	457	46
Other	338	58	282	52	147	26	533	54
Educational level	592	100	541	100	564	100	1009	100
Graduated college or technical school	470	79	109	20	125	22	741	73
Did not graduate college or technical school	122	21	432	80	439	78	268	27
Income level	491	83	431	80	463	82	840	83
$50,000 or more	375	76	84	19	124	27	609	73
Less than $50,000	116	24	347	81	339	73	231	28
Employment status	591	99	538	99	563	99	1006	99
Employed	150	25	149	28	141	25	244	24
Not employed	441	74	389	72	422	75	762	76

health conditions on multiple health outcomes in diabetic females. Our findings suggest that healthcare cost may impact multiple aspects of health status, regardless of healthcare coverage. Whereas the use of public versus private health insurance may impact quality of healthcare and health outcomes [11,16,19,20], healthcare costs such as copays, preventative screenings, in office procedures, and prescriptions may further influence the health status of diabetic females, especially for those with multiple health conditions. Future research should focus on the costs of healthcare and how those are related to health outcomes and healthcare access.

Limitations

This study used data from the 2016 BRFSS, which provided large and multiple samples within the target population. This study also included mental and physical health to expand the

Table 2. Adjusted Results by State

Models Predicting Health*	Louisiana			Mississippi			Oklahoma			Texas		
	AOR	95% CI		AOR	95% CI		AOR	95% CI		AOR	95% CI	
		Low	High		Low	High		Low	High		Low	High
Predicting General Health Status (good or better vs. fair or poor)												
Healthcare Cost												
Cost precluded seeing a doctor	0.70	0.36	1.35	0.17	0.07	0.41	0.37	0.17	0.78	0.37	0.20	0.68
Healthcare Coverage												
Yes	1.11	0.35	3.54	0.22	0.07	0.70	0.65	0.18	2.40	0.73	0.33	1.58
Health Conditions												
Diabetes only	ref	-	-	ref	-	-	ref	-	-	ref	-	-
Diabetes plus one other	0.58	0.27	1.24	0.75	0.34	1.66	0.58	0.20	1.71	0.38	0.22	0.67
Diabetes plus two or more others	0.24	0.12	0.48	0.24	0.11	0.50	0.14	0.05	0.37	0.19	0.11	0.31
Predicting Physical Health Status (Low vs. moderate vs. high)												
Healthcare Cost												
Cost precluded seeing a doctor	0.29	0.16	0.54	0.25	0.13	0.47	0.36	0.19	0.69	0.66	0.39	1.12
Healthcare Coverage												
Yes	1.05	0.38	2.93	0.97	0.39	2.42	0.68	0.23	2.05	1.17	0.60	2.29
Health Conditions												
Diabetes only	ref	-	-	ref	-	-	ref	-	-	ref	-	-
Diabetes plus one other	0.63	0.33	1.21	0.66	0.31	1.40	0.60	0.27	1.31	0.43	0.26	0.69
Diabetes plus two or more others	0.20	0.11	0.36	0.18	0.09	0.36	0.17	0.08	0.35	0.15	0.10	0.24
Predicting Mental Health Status (Low vs. moderate vs. high)												
Healthcare Cost												
Cost precluded seeing a doctor	0.32	0.18	0.60	0.43	0.23	0.81	0.48	0.25	0.92	0.50	0.30	0.83
Healthcare Coverage												
Yes	1.37	0.44	4.26	1.43	0.56	3.60	1.00	0.35	2.85	1.51	0.76	3.01
Health Conditions												
Diabetes only	ref	-	-	ref	-	-	ref	-	-	ref	-	-
Diabetes plus one other	0.91	0.42	1.96	1.12	0.54	2.34	0.53	0.22	1.22	0.57	0.33	1.01
Diabetes plus two or more others	0.26	0.13	0.50	0.40	0.21	0.77	0.31	0.14	0.67	0.23	0.14	0.37

*Models controlled for routine checkup, weight status, tobacco use, alcohol use, age category, ethnicity/race, education level, income level, and employment status. AOR: Adjusted Odds Ratio; 95% CI: 95% Confidence Intervals; ref: Referent Group; boldface indicates significance (AORs with 95% CI that do not include 1.00 are significant).

scope of the diabetic health beyond just general health [15,16]. However, diabetes was measured as ever having a diagnosis, which does not indicate type 1 or type 2, the duration and severity of the disease, and how well it is being managed. Furthermore, while data was gathered on number of comorbidities, it did not provide information on the severity of specific conditions or management, including medication use, all of which could impact health status. Future research should include these as may would help providers to determine effective management strategies, especially for multiple health conditions.

Conclusions

Because this was a population-based study, the results of this study may generalize to diabetic females ages 45-79 in a primary care. Providers may expect about half of their patients in this target population to report low to moderate general, physical, and mental health, as well as having two or more health conditions plus diabetes. Because these are highly related, providers should screen all patients in the target population in all these areas, determine the severity and management of diabetes and each comorbidity, and advise and educate patients of the additional importance of managing of multiple comorbid

conditions. Practitioners should also assess and coordinate treatment plans for comorbid conditions and refer to specialists as needed. Furthermore, because healthcare cost was inversely related to all three health outcomes, practitioners may also need to consider treatment costs when treating multiple health conditions in this target population.

Disclaimers

No author has any conflict of interest.

Source(s) of support

There was no financial support for the conduct or findings of this study.

References

1. American Diabetes Association (ADA). Statistics about Diabetes: Overall Numbers, Diabetes and Prediabetes. 2018.

2. Centers for Disease Control and Prevention (CDC). National Diabetes Statistics Report, 2017: Estimates of Diabetes and Its Burden in the United States. 2017.

3. National Institute of Diabetes and Digestive and Kidney Diseases

(NIH). *Diabetes Statistics*. 2017.

4. Alarcon A, Swartzentruber V, Vaswani R, Chua J, Holmes V, et al. Does general health differ by healthcare access in diabetic females ages 30-50? *J Prev Med*. 2017, 2: 7.

5. Stark Casagrande SS, Cowie CC. Health insurance among people with and without diabetes in the U.S. adult population. *Diabetics Care*. 2012, 35: 2243-2249.

6. Grintsova O, Maier W, Mielck A. Inequalities in health care among patients with type 2 diabetes by individual socio-economic status (SES) and regional deprivation: A systematic literature review. *Int J Equity Health*. 2014, 13: 43.

7. Lindner LME, Rathmann W, Rosenbauer J. Inequalities in glycaemic control, hypoglycaemia and diabetic ketoacidosis according to socio-economic status and area-level deprivation in type 1 diabetes mellitus: A systematic review. *Diabet Med*. 2018, 35: 12-32.

8. Piette JD, Wagner TH, Potter MB, Schillinger D. Health insurance status, cost-related medication underuse, and outcomes among diabetes patients in three systems of care. *Med Care*. 2004, 42: 102-109.

9. Trump LJ, Mendenhall TJ. Community health workers in diabetes care: A systematic review of randomized controlled trials. *Fam Syst Health*. 2017, 35: 320-340.

10. Wolters RJ, Braspenning JCC, Wensing M. Impact of primary care on hospital admission rates for diabetic patients: A systematic review. *Diabetes Res Clin Pract*. 2017, 129: 182-196.

11. Institute of Medicine. Care without Coverage: Too Little, Too Late. The National Academies Press. Washington, DC. 2002.

12. Kesselheim AS, Huybrechts KF, Choudry NK, Fulchino LA, Isaman DL, et al. Prescription drug insurance coverage and patient health outcomes: a systematic review. *Am J Public Health*. 2015, 105: e17- e30.

13. Zhang X, Bullard KM, Gregg EW, Beckles GL, Williams DE, et al. Access to health care and control of ABCs of diabetes. *Diabetics Care*. 2012, 35: 1566-1571.

14. World Health Organization (WHO). Constitution of the World Health Organization. 2018.

15. Garratt AM, Schmidt L, Fitzpatrick R. Patient assessed health outcome measures for diabetes: A structured review. *Diabet Med*. 2002, 19: 1-11.

16. Sommers BD, Blendon RJ, Orav EJ, Epstein AM. Changes in utilization and health among low-income adults after Medicaid expansion or expanded private insurance. *JAMA Intern Med*. 2016, 176: 1501-1509.

17. Centers for Disease Control and Prevention (CDC). About BRFSS. 2014.

18. Centers for Disease Control and Prevention (CDC). BRFSS Prevalence & Trends Data. 2017.

19. Doucette ED, Salas J, Wang J, Scherrer JF. Insurance coverage and diabetes quality indicators among patients with diabetes in the US general population. *Prim Care Diabetes*. 2017, 11: 515-521.

20. Zhang JX, Huang ES, Drum ML, Kirchhoff AC, Schlichting JA, et al. Insurance status and quality of diabetes care in community health centers. *Am J Public Health*. 2009, 99: 742-747.

21. Fisher MA, Ma ZQ. Medicaid-insured and uninsured were more likely to have diabetes emergency/urgent admissions. *Am J Manag Care*. 2015, 21: e312-e319.

ADDRESS FOR CORRESPONDENCE:

Jessica L Hartos, Department of Physician Assistant Studies, University of North Texas Health Science Center, 3500 Camp Bowie Blvd, Fort Worth, Texas, 76107, USA, Tel: (817) 735-2454; Fax: (817) 735-2529; E-mail: jessica.hartos@unthsc.edu