

An Examination of BRFSS Data to Explore Disparities in Diabetic Foot Examinations



COLLEGE OF
OSTEOPATHIC MEDICINE
at the Cherokee Nation

Kristyn Robling, B.S., Kristen McPherson, M.P.H., Douglas Nolan, D.O., Benjamin Greiner, D.O., Micah Hartwell, Ph.D.

INTRODUCTION

Diabetes Mellitus (DM) is on the rise in the United States.¹ It frequently leads to a variety of serious health complications, including cardiovascular disease, peripheral neuropathy, foot ulcers, and even amputations.^{2,3} To prevent some of these complications, it is strongly recommended that individuals with DM obtain an annual foot examination performed by a medical professional;⁴ however, many individuals do not get their feet checked.⁵

In many patients, DM frequently leads to poor mental health⁶ and poor physical health. Poor mental health is associated with a two-fold increase in foot ulcer incidence.⁷ Due to this statistic and the physical complications that are associated with DM, we hypothesized that poor mental and physical health would correlate with a decrease in motivation to utilize preventive services. Thus, we sought to investigate how frequent poor mental health days, a depressive disorder diagnosis, frequent poor physical health days, and physical inactivity affect the likelihood of individuals with DM obtaining an annual foot examination by a healthcare professional.

METHODS

Using data about individuals diagnosed with DM from the 2021 Behavioral Risk Factor Surveillance System (BRFSS), we performed a cross-sectional analysis to determine the relationship between having frequent poor mental health days, a depressive disorder diagnosis, frequent poor physical health days, or physical inactivity and obtaining an annual foot examination by a healthcare professional. We used a bivariate regression model and determined associations using odds ratios (OR). Additionally, this model was controlled for age, sex, race/ethnicity, health insurance, level of education, current smoking status, and patient BMI.

RESULTS

Table 1. Annual foot examinations among various demographics (n = 21372; N = 12757834).

	Foot check by HCP			X ² , P
	Total n (%)	Yes n (%)	No n (%)	
Overall	21372 (100)	16121 (75.54)	5251 (24.46)	
age group				14.97, < .0001
18-24	83 (0.51)	43 (42.81)	40 (57.19)	
25-34	373 (2.12)	232 (59.5)	141 (40.5)	
35-44	1059 (6.15)	705 (66.07)	354 (33.93)	
45-54	2670 (15.10)	1935 (72.96)	735 (27.04)	
55-64	5121 (25.12)	3855 (75.49)	1266 (24.51)	
65+	12066 (51.00)	9351 (78.46)	2715 (21.54)	
sex				6.22, .013
Male	10543 (50.29)	8126 (76.82)	2417 (23.18)	
Female	10829 (49.71)	7995 (74.24)	2834 (25.76)	
race				7.91, < .0001
White	15461 (68.28)	11794 (76.34)	3667 (23.66)	
Black	2511 (14.92)	1967 (79.51)	544 (20.49)	
Asian	260 (1.52)	169 (70.04)	91 (29.96)	
AI/AN	694 (1.45)	497 (73.1)	197 (26.9)	
Hispanic	1737 (11.17)	1196 (67.56)	541 (32.44)	
Other	709 (2.67)	498 (70.55)	211 (29.45)	
insurance				51.24, < .0001
Yes	20016 (95.32)	15257 (76.79)	4759 (23.21)	
No	641 (4.68)	350 (53.75)	291 (46.25)	
educag				12.24, < .001
< HS	1835 (9.91)	1266 (69.29)	569 (30.71)	
HS	6340 (29.01)	4770 (74.83)	1570 (25.17)	
Some College	6545 (29.86)	4997 (76.85)	1548 (23.15)	
College Graduate	6573 (31.23)	5033 (76.87)	1540 (23.13)	
smoke				12.24, < .001
No	17934 (87.39)	13666 (76.2)	4268 (23.8)	
Yes	2530 (12.61)	1776 (70.82)	754 (29.18)	
Ovrwt or obese				8.90, .003
No	2711 (13.76)	1990 (71.08)	721 (28.92)	
Yes	16762 (86.24)	12749 (76.33)	4013 (23.67)	

CLINICAL IMPLICATIONS

Due to our results showing a decrease in foot examinations in those with frequent poor mental health and a sedentary lifestyle and the clinical risks that are associated with foot ulceration, we recommend healthcare organizations implement further preventive health services for individuals with DM. These methods may include increased mental health screenings, the option for receiving counseling or attending support groups, or integrating mental and/or behavioral health services in diabetes care. Additionally, the education of patients on exercise methods or implementation of exercise groups/classes that are specifically designed for individuals with DM may decrease rates of sedentary lifestyles and reduce foot ulcer development.

Table 2. Reception of annual foot examination among individuals with diabetes based on mental and physical health variables with the likelihood of not having feet checked.

	Foot Check in the past 12 months			Logistic Regression	
	Total n (%)	Yes n (%)	No n (%)	OR (95%CI)	AOR (95%CI)
Depressive disorder					
No	16093 (74.85)	12239 (76.42)	3854 (23.58)	1 (Ref)	1 (Ref)
Yes	5177 (25.15)	3803 (72.93)	1374 (27.07)	1.2 (1.07-1.35)	1.13 (0.98-1.30)
Frequent poor mental health days					
No	17822 (84.25)	13599 (76.38)	4223 (23.62)	1 (Ref)	1 (Ref)
Yes	3147 (15.75)	2238 (72.06)	909 (27.94)	1.25 (1.09-1.44)	1.21 (1.03-1.43)
Sedentary					
No	12938 (61.29)	9952 (77.07)	2986 (22.93)	1 (Ref)	1 (Ref)
Yes	8370 (38.71)	6122 (73.15)	2248 (26.85)	1.23 (1.1-1.38)	1.31 (1.14-1.49)
Frequent poor physical health days					
No	15691 (75.08)	11899 (76.04)	3792 (23.96)	1 (Ref)	1 (Ref)
Yes	5042 (24.92)	3767 (74.85)	1275 (25.15)	1.07 (0.94-1.21)	1.08 (0.94-1.25)

As shown in Table 1, individuals who were less than 35 years of age were significantly less likely to obtain a foot examination, and less than half of those who were less than 25 got their feet checked. Additionally, females were less likely than males to get an annual exam. Individuals who were Hispanic, lacked insurance, were currently smoking cigarettes, did not complete high school, or had a BMI < 25 were also less likely to obtain an annual foot examination by a healthcare professional.

Individuals with diabetes who reported frequent poor mental health days got less annual foot examinations (72.06%) compared to those without frequent poor mental health days (76.38%) – a statistically significant association. Of those who reported a sedentary lifestyle with no physical activity, 73.15% had their feet checked. This is compared with those who led an active lifestyle where 77.07% had a foot exam. This was also statistically significant.

Although our results show fewer foot checks for individuals with a depressive disorder diagnosis and those reporting frequent poor physical health days, these results were not statistically significant.

CONCLUSION

Our results showed that individuals who reported frequent poor mental health days or a sedentary lifestyle underwent fewer annual foot examinations by a healthcare professional. This is likely due to decreased motivation for self-care in individuals with poor mental health or a sedentary lifestyle. It is important to highlight groups of individuals with diabetes who are at a greater risk for development of foot ulceration to prevent serious complications such as amputations. Interventions such as counseling, support groups, increased mental health screenings, exercise classes, and educational materials may improve utilization of preventive services among individuals with diabetes. Thus, annual foot examinations may be increased, and foot ulcer development and subsequent amputations may be prevented.

REFERENCES AND ACKNOWLEDGEMENTS

- Saeedi P, Petersohn I, Salpea P, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Res Clin Pract.* 2019;157:107843.
- Harding JL, Pavkov ME, Magliano DJ, Shaw JE, Gregg EW. Global trends in diabetes complications: a review of current evidence. *Diabetologia.* 2019;62(1):3-16.
- Bonner T, Foster M, Spears-Lanoix E. Type 2 diabetes-related foot care knowledge and foot self-care practice interventions in the United States: a systematic review of the literature. *Diabet Foot Ankle.* 2016;7:29758.
- How to promote foot health for people with diabetes. Published June 27, 2022. Accessed December 9, 2022. <https://www.cdc.gov/diabetes/professional-info/health-care-pro/diabetes-podiatrist-health.html>
- Van Netten JJ, Woodburn J, Bus SA. The future for diabetic foot ulcer prevention: A paradigm shift from stratified healthcare towards personalized medicine. *Diabetes Metab Res Rev.* 2020;36 Suppl 1:e3234.
- Lustman PJ, Clouse RE. Depression in diabetic patients: the relationship between mood and glycemic control. *J Diabetes Complications.* 2005;19(2):113-122.
- Williams LH, Rutter CM, Katon WJ, et al. Depression and incident diabetic foot ulcers: a prospective cohort study. *Am J Med.* 2010;123(8):748-754.e3.

Special thanks to Dr. Micah Hartwell for his mentorship and guidance on this research.