



## Identifying individual social needs during intake for diabetes Self-Management education and support services in the Detroit, Michigan area

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### ABSTRACT

The American Diabetes Association has recommended that diabetes self-management education and support (DSMES) teams improve diabetes outcomes by identifying and responding to patients' social needs. This study examines demographic patterns in how hemoglobin A1c (A1c) is related to individual social needs, reported urgency of those needs, and interest in obtaining assistance. A total of 1125 unique persons who had been referred for DSMES and had completed a social needs screener via our electronic medical record were included. The majority (51.9 %) had an A1c < 8 % at their most recent assessment and most respondents (52.5 %) reported having at least 1 unmet social need (n = 591). Those who reported having at least 1 social need, tended to have higher A1c levels compared with those who reported no social needs (median of 8.0 % versus 7.7 %; p < 0.05). Among Black individuals the associations were stronger (median A1c of 8.2 % among those with versus 7.2 % among those without a reported social need; p < 0.05). However, among White individuals, there was no difference in A1c between these two groups. Among those who reported a social need, those who also reported they needed assistance (35.7 %) tended to have higher A1c levels than those who did not (median 8.3 % versus 7.8 %; p < 0.10). This relationship did not vary by race. Ongoing study of the relationship between unmet social needs and glycemic control is warranted to help identify effective clinical workflows to help providers incorporate consideration of social needs into their medical decision making.

### 1. Introduction

37.3 million Americans, or 11.3 % of the population, have diabetes and only 35.8 % of these individuals have met the Healthcare Effectiveness Data and Information Set (HEDIS) criteria for achieving diabetes control – including having a hemoglobin A1c (A1c) < 8.0 % (Centers for Disease Control and Prevention, 2019). Diabetes self-management support and education services (DSMES) are integral to helping persons with Type 2 diabetes achieve their glycemic targets. Our large integrated health system in Metropolitan Detroit, Henry Ford

Health, includes an array of Certified Diabetes Care and Education Specialists and support teams who provide individualized programs through both individual sessions and group sessions focused on self-management of diabetes. Despite these resources, we estimate that 40 % of persons with Type 2 diabetes in our patient population have not reached their glycemic target and are thus at increased risk for lower quality of life, morbidity, and mortality.

Persistently high rates of non-adherence to self-management activities among people with diabetes who qualify for both Medicare and Medicaid suggest that factors beyond having insurance coverage could

*Abbreviations:* DSMES, diabetes self-management education and support.

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be driving diabetes care outcomes. Social needs may well be an important factor in quality care for patients with Type 2 diabetes. The [National Committee for Quality Assurance \(2022\)](#) has introduced a measure on Social Need Screening and Intervention to the Healthcare Effectiveness Data and Information Set that Medicare, Medicaid and commercial health plans will use to identify food, housing and transportation gaps among their populations and connect members with resources necessary to address unmet social needs. However, a clearer understanding of how social needs are associated with healthcare outcomes is needed. Prior research has shown that patients with Type 2 diabetes were more likely to report social needs including those related to food insecurity, health literacy, and housing needs ([Brady et al., 2021](#)). Similar analysis among people who receive care at federally funded safety-net health centers found housing instability to be more common among people with Type 2 diabetes than among the general population ([Berkowitz et al., 2017](#)).

The American Diabetes Association has highlighted the importance of screening for psychosocial issues known to affect self-management and health outcomes including attitudes about the illness, expectations for medical management and outcomes and available financial, social, and emotional resources ([Young-Hyman et al., 2016](#)). They recommend that DSMES teams work to identify and respond to the social needs of people with diabetes ([Young-Hyman et al., 2016](#)). Our previous analysis of demographic patterns in patient participation in diabetes management programs showed that those who did not attend their intake appointment tended to have Medicaid insurance, be aged younger than 48 years, and have hemoglobin A1c > 8.1 % ([White-Perkins et al., 2021](#)). In this current study, we aimed to quantify the frequency and reported urgency of the social needs of people referred to our DSMES programs and to assess how the information reported was associated with glycemic control. Specifically, our objectives were the following:

1. Assess the association between reporting any individual social needs and A1c, and determine whether the observed associations were the same for Black individuals and White individuals.
2. Assess the relationship between reported interest in obtaining assistance and A1c, and whether the associations are the same for Black individuals and White individuals.

## 2. Materials and methods

Our team received approval from the Henry Ford Health institutional review board to analyze the data collected as part of the social needs screening intervention used during our existing DSMES intake process in which a trained member of the DSMES team calls or sends a text message to patients who have been referred by their system provider to schedule a DSMES program intake appointment. At the intake appointment, a personalized plan of DSMES sessions is developed. A 15-question survey was housed within Epic, our electronic medical record, ([Table 2.](#)) and administered either prior to the visit via the patient portal or in person during the visit by DSMES staff. This survey was adapted from the Accountable Health Communities Screening tool developed by the [Centers for Medicare and Medicaid Services Innovation Center \(2017\)](#) to standardize screening for health-related social needs in clinical settings. Our screening questions cover the following areas: current housing problems; food insecurity; transportation difficulties; problems paying utilities; interpersonal safety; social isolation; caregiver demands; employment; healthcare access; literacy; education; legal concerns; and, limitations due to health status.

Social needs screening during program intake began in November 2020. For those patients contacted between November 2, 2020 and August 30, 2021, we extracted the following information, as documented at time of DSMES referral, from their medical record: most recent A1c (within 6 months prior to referral), insurance type, race/ethnicity, age, gender, and home address.

## 2.1. Analyses

For our analyses, participants were classified as having a social need if they responded “yes” to at least one of 13 questions. For each area of need reported as a concern, the DSMES staff member also queried the person about whether they wanted assistance and the urgency of that need. Referrals were placed by the DSMES team to ambulatory case managers to address complex or urgent social needs.

Wilcoxon rank sum tests were used to compare those with A1c < 8 % (representing HEDIS definition of achieving glycemic target) versus  $\geq 8$  %. The association between reporting the presence of any social need (yes to any of questions 1–13) and this categorized A1c measure were evaluated using chi-square tests. To examine whether race has a modifying effect on the association between social needs and A1c as a continuous outcome, or on the association between social needs and having an A1c of  $\geq 8$  %, we used a linear regression model with an interaction term between reporting any social needs and race (Black or White as noted in the electronic medical record) and a logistic regression model with an interaction term with race. We considered an interaction p-value < 0.10 as suggestive of a modifying effect by race.

## 3. Results

A total of 1125 people with diabetes referred by their healthcare provider for DSMES services completed a social needs screening questionnaire. Among these, 59.7 % were female and 58 % were Black and the average age was 57.7 (standard deviation 13.7) years ([Table 1.](#)). Most (51.9 %) had an A1c < 8 % at their most recent assessment prior to referral, and most respondents (52.5 %) reported having at least 1 social need. Private (48.5 %) and Medicare (38.8 %) were the most common insurance types recorded, and 11.4 % had Medicaid listed as their insurance.

Among all participants in our sample who identified a need (N = 591, 52.5 %), 35.7 % (n = 211) reported that they needed assistance and 27.5 % (n = 58) reported this need as urgent ([Fig 1.](#)). The most common social need reported (24.5 %) was a positive answer to the question: “Does your physical or mental health keep you from doing things you need or want to do?”; 22.1 % of participants reported that “more education could be helpful”; and 17.1 % of participants reported they struggle to get together with friends or family on a regular basis. The least commonly reported concerns identified were being afraid they might be hurt in their living environment (2.0 %); needing help finding or paying for care for loved ones (2.8 %); and having any legal concerns (4.5 %). Some participants (6.4 %) reported being unable to see a provider when they needed because of cost.

### 3.1. Assessing the relationship between social needs and A1c

Those who reported having a social need tended to have higher A1c levels compared with those who reported no social needs (median of 8.0 % versus 7.7 %; p < 0.05) ([Table 3.](#)). The percent of participants considered not achieving a glycemic target (A1c  $\geq 8.0$  %) was also higher in the group with at least 1 social need (51 % versus 45 %; p < 0.05) ([Table 3.](#)). Specifically, among the Black individuals, the associations were stronger (median A1c of 8.2 % among those with versus 7.2 % among those without a reported social need; p < 0.05) ([Table 3.](#)). Among White individuals, the median A1c was 7.9 % for both those individuals who expressed at least 1 social need and those who did not.

### 3.2. Assessing the relationship between interest in obtaining assistance and A1c ([Table 4.](#))

Among those who reported a social need, those who also reported they needed assistance tended to have higher A1c levels than those who did not report needing assistance (median 8.3 % versus 7.8 %; p = 0.09). Similarly, fewer individuals who reported they needed assistance had

**Table 1**

Descriptive statistics for Henry Ford Health Patients referred to the DSMES program who completed a Social Needs questionnaire and the frequency of question responses.

Variable	Level	N (%) (N = 1125)
At least 1 Social Needs question answered positively	No	534 (47.5)
	Yes	591 (52.5)
A1c test result within 6 months prior to screening	Mean	8.4
	Median	7.8
	Minimum	4.8
	Lower quartile	6.5
	Upper quartile	10.0
	Maximum	17.6
	SD	2.4
A1c test result < 8.0 %	Missing	22
	No	531 (48.1)
	Yes	572 (51.9)
Sex	Missing	22
	Female	672 (59.7)
	Male	453 (40.3)
Age at intake	Mean	57.7
	Median	59.3
	Minimum	13.0
	Lower quartile	49.1
	Upper quartile	67.5
	Maximum	96.4
	SD	13.7
	Missing	22
Race	Black	652 (58.0)
	White	359 (31.9)
	Other/declined	114 (10.1)
Insurance	Medicaid	128 (11.4)
	Medicare	437 (38.8)
	Private	546 (48.5)
	Self-pay	14 (1.2)
Number of Social Needs questions answered positively	0	534 (47.5)
	1	262 (23.3)
	2	135 (12.0)
	3	86 (7.6)
	4	45 (4.0)
	5	28 (2.5)
	6	12 (1.1)
	7	13 (1.2)
	8	8 (0.7)
	9	1 (0.1)
	11	1 (0.1)
	Median	1.00

achieved the glycemic target of < 8 % compared with those who reported they did not need assistance (44.3 % versus 51.6 %). These relationships did not vary by race (linear regression interaction term p = 0.962; logistic regression interaction term p = 0.793).

**4. Discussion**

This analysis of associations between social needs and glycemic control among patients with diabetes who were referred to DSMES reveals several important findings. Over half of the individuals in our cohort reported at least one social need, the most common being physical or mental health limiting their activities. More than one-third of those with a reported social need also wanted assistance with that need. Those with at least one social need tended to have worse glycemic control compared to those who did not have a social need. Among people who reported a social need, the association with poor glycemic control was driven by the association among Black individuals as there was not an association observed among White individuals.

**Table 2**

Social Needs Questionnaire Responses for all Participants and separately for Black Participants and White Participants.

Questions	All Participants <sup>1</sup>		Black Participants		White Participants	
	N (%)		N (%)		N (%)	
	Yes	No	Yes	No	Yes	No
Does your physical or mental health keep you from doing things you need or want to do?	276 (24.5)	849 (75.5)	140 (13.9)	512 (60.6)	104 (10.3)	255 (25.2)
Have you needed to see a provider but could not because of cost?	72 (6.4)	1053 (93.6)	42 (4.2)	610 (60.3)	24 (2.4)	335 (33.1)
Do you struggle to get the food you need?	82 (7.3)	1043 (92.7)	60 (5.9)	592 (58.6)	15 (1.5)	344 (34.0)
Do you need help with housing?	56 (5.0)	1069 (95.0)	47 (4.7)	605 (59.8)	7 (0.7)	352 (34.8)
Do you have a hard time paying your utility bills?	99 (8.8)	1026 (91.2)	68 (7.7)	584 (57.8)	21 (2.1)	338 (33.4)
Do you need help finding or paying for care for loved ones?	31 (2.8)	1094 (97.2)	21 (2.1)	631 (62.4)	9 (0.9)	350 (34.6)
Do you have trouble with transportation?	63 (5.6)	1062 (94.4)	42 (4.2)	610 (60.3)	17 (1.7)	342 (33.8)
Do you ever need help reading important papers?	103 (9.2)	1022 (90.8)	55 (5.4)	597 (59.1)	33 (3.3)	326 (32.3)
Do you have any legal concerns, at this time?	51 (4.5)	1074 (95.5)	30 (3.0)	622 (61.5)	15 (1.5)	344 (34.0)
Do you need help finding a job, better job or steady source of income?	61 (5.4)	1064 (94.6)	39 (3.9)	613 (60.6)	16 (1.6)	343 (33.9)
Do you think more education could be helpful for you?	249 (22.1)	876 (77.9)	151 (22.6)	501 (49.6)	73 (7.2)	286 (28.3)
Do you struggle to get together with friends or family on a regular basis?	192 (17.1)	933 (82.9)	90 (8.9)	562 (55.6)	81 (8.0)	278 (27.5)
Are you afraid you might be hurt in your living environment?	22 (2.0)	1103 (98.0)	12 (1.2)	640 (63.3)	8 (0.8)	351 (34.7)
Do you need assistance with your needs?	214 (19.0)	911 (81.0)	164 (16.2)	488 (48.3)	33 (3.3)	326 (32.3)
Are any of your needs urgent?	62 (5.5)	1063 (94.5)	39 (3.9)	613 (60.6)	17 (1.7)	342 (33.8)

<sup>1</sup> Responses from Black and White participants will not sum to all participants.

In our analyses, Black but not White individuals were more likely to have negative observable health effects associated with having a social need. These observed differences in associations between race groups aligns with a growing body of evidence documenting diminished return, defined as a systematically smaller health gain from economic resources and psychological assets, for Black individuals in comparison with White individuals (Assari, 2018).

It is likely that many of the social needs we considered are associated and influence each other. Additional analysis is needed to explore these relationships and their potential synergistic effects on A1c and other health outcomes. The prevalence of reported physical or mental health limiting function among people in our study is notable given that limitations in functional activity due to poor health have been associated with increased stress (Klapperski et al., 2013; Schultchen et al., 2019) and diabetes distress (Gonzalez et al., 2016). It is likely that the negative

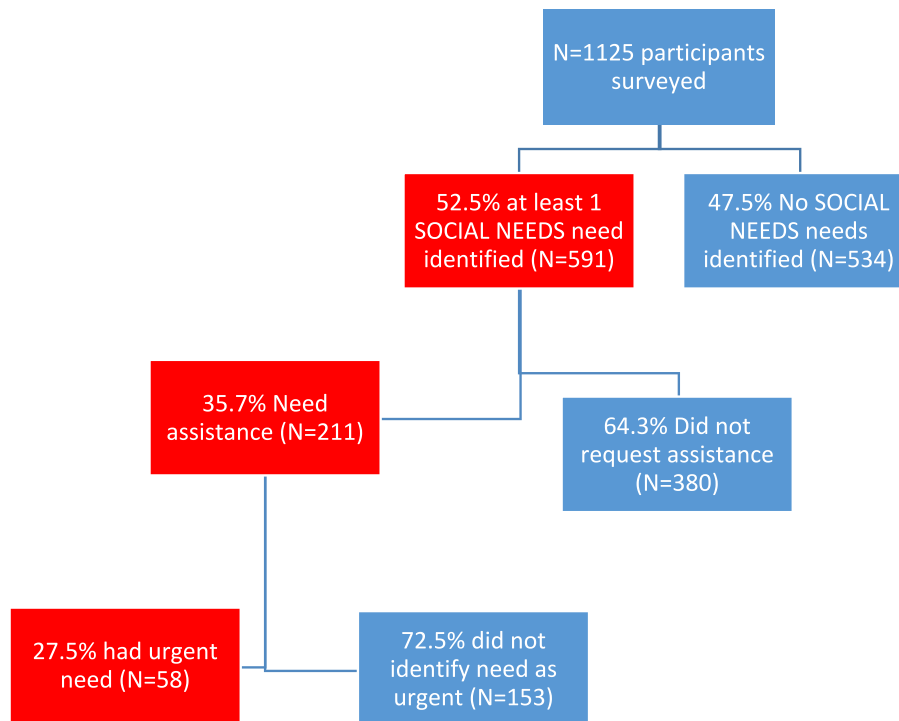


Fig. 1. Participant flow diagram: for those who completed Social Needs hierarchy (N = 1125).

Table 3

A1c levels (%) by whether the individual reported a Social Need for all participants and separately for Black participants and White participants.

At Least 1 Social Needs Question Answered Positively											
	Statistic	Level	All Participants <sup>1</sup>			Black Participants			White Participants		
			No (N = 534)	Yes (N = 591)	P-value	No (N = 318)	Yes (N = 324)	P-value	No (N = 155)	Yes (N = 194)	P-value
A1c test result <8.0 %	N (%)	No	236 (45 %)	295 (51 %)	<b>0.043<sup>2</sup></b>	133 (41.8 %)	174 (53.7 %)	<b>0.003<sup>2</sup></b>	76 (49 %)	95 (49 %)	0.991 <sup>2</sup>
	N (%)	Yes	289 (55 %)	283 (49 %)		185 (58.2 %)	150 (46.3 %)		79 (51 %)	99 (51 %)	
A1c test result (%)	N		525	578	<b>0.030<sup>3</sup></b>	318	324	<b>0.001<sup>3</sup></b>	155	194	0.458 <sup>3</sup>
	Mean		8.3	8.6		8.1	8.8		8.5	8.4	
	Median		7.7	8		7.2	8.2		7.9	7.9	
	Minimum		4.8	5		5	5.2		5	5.3	
	Maximum		16.3	17.6		16.2	17.6		16.2	17.6	
	SD		2.3	2.5		2.4	2.6		2.4	2.6	

SD, standard deviation.

<sup>1</sup> Responses from Black and White individuals will not sum to all participants.

<sup>2</sup> The p-value is calculated by the Wilcoxon rank sum test.

<sup>3</sup> The p-value is calculated by the chi-square test.

impact of social needs on diabetes management increases when patients must also navigate the challenges of these functional limitations. Previous studies have shown older women who have diabetes have a higher risk of functional limitation (Kalyani et al., 2012) and that limitations in leisure and social activities are more common in Black men with diabetes (Kalyani et al., 2015). Further study of demographic variations in the impact of functional limitations on glycemic control, and their potential interaction with other social needs, among persons with diabetes is warranted to illuminate these relationships more clearly.

People who reported wanting assistance with a social need tended to have higher A1c levels and were less likely to have A1c < 8 %. This finding highlights the importance of healthcare teams screening for, assessing and addressing social barriers as a core function of diabetes education management and support services. The extent to which incorporating social needs screening and referral into the healthcare delivery process affects diabetes control over time remains unclear.

Research has shown that patients with uncontrolled diabetes have more unmet social needs than those with controlled diabetes, potentially indicating a dose-response relationship in the impact of unmet social needs on diabetes control (Chambers et al., 2021). Future study on a similar dose response relationship between unmet social needs and utilization of diabetes support services is warranted. More research to determine which domains of individual social needs are most strongly associated with lack of participation in DSMES and with achieving glycemic targets would also be useful.

The current literature acknowledges that there are numerous ways to conduct screenings for social needs with variations in screening tools, workforce (lay versus professional), settings (clinic versus community-based), and frequency (longitudinal empanelment versus episodic engagement) (Berkowitz et al., 2017). More study is needed to identify the most effective and efficient workflows to support empathic screening of these needs as well as shared decision making between providers and

**Table 4**

Among those with a Social Needs need identified, A1c levels by whether assistance was requested.

Covariate	Statistics	Level	Do You Need Assistance With Your Needs?		P-value
			No (N = 380)	Yes (N = 211)	
A1c test result < 8.0 %	N (%)	No	178 (48.4 %)	117 (55.7 %)	0.089 <sup>1</sup>
	N (%)	Yes	190 (51.6 %)	93 (44.3 %)	
A1c test result	N		368	210	0.062 <sup>2</sup>
	Mean		8.4	8.9	
	Median		7.8	8.3	
	Minimum		5	5	
	Maximum		16.7	17.6	
	SD		2.3	2.7	

SD, standard deviation.

<sup>1</sup> The p-value is calculated by the chi-square test.

<sup>2</sup> The p-value is calculated by the Wilcoxon rank sum test.

patients on the appropriate response to these needs.

The American Diabetes Association Clinical Practice Guidelines recommend screening patients for socioeconomic risk factors, referring to sources of community support, and providing self-management support through community health workers (ElSayed et al., 2023). Additional study of factors associated with acceptance of referrals for social needs could also provide valuable perspective. Future study may focus on understanding how community health workers, and their perspective of the patient's social context, may best be incorporated into the referral process to optimize patient engagement, mitigate barriers, and ultimately improve diabetes management. Moving beyond a focus on social needs at the individual level, future study might also examine associations between participation in diabetes management programs, diabetes control, and community level social indicators of need such as the Neighborhood Deprivation Index. This understanding would better position healthcare teams to anticipate the needs of their patients and to proactively leverage community and health system resources to address those barriers more effectively.

There are a few limitations to this study. Social needs screening data were only available from patients who reported for their DSMES intake session or those who completed the screening themselves via the patient portal. It is possible that this subset of screened patients did not have the same degree of social needs, or were better able to navigate those needs, as compared to those who did not complete the screening. There may have also been ambiguity around some of the screening questions used in our electronic health record. Those related to struggling to get together with friends and family could have been influenced by the social isolation of the COVID-19 pandemic. Additionally, the question on whether more education would be beneficial could be interpreted by respondents as referencing either education on a health-related topic or as additional formal schooling/training. Thus, we cannot be sure that affirmative responses to this question indicate a lower level of education, especially given that some respondents might feel that additional education could always be beneficial. We acknowledge some inconsistencies in the phrasing of the social needs screening questions which could have created ambiguity for respondents. Because these questions had been pre-populated into our electronic health record they unfortunately could not be changed for this study. However we conducted specific analysis to look at associations between those who reported they wanted assistance with a specific needs as compared to simply reporting that they needed help or had a need. In future iterations of this work we will plan to use screening language that more clearly delineates this.

Social desirability bias, a tendency to respond in ways one feels are more appropriate or socially acceptable to others, could have led to people under-reporting social needs. In addition, people may not have perceived a potential benefit to disclosing social needs in a healthcare

setting where traditionally only mental and physical needs are addressed. Further study of patients' perceptions around social needs screening in medical settings would be helpful.

This study is novel in that we assessed the social needs of an insured cohort of patients with diabetes who received their care within a large integrated urban health system. Much of the social needs research to date has focused on people who are receiving services in federally qualified health centers or those who are living in communities that are known to be disadvantaged. Our work demonstrates that even among people who have health insurance and are accessing primary care, social needs are still present. Although the reported prevalence and urgency of social needs might be less among those with access to health care, it is important to assess and respond to social needs before they become urgent. This study is highly generalizable and represents a pragmatic approach that utilizes existing staff, workflow, and chronic disease management supports already embedded within our ambulatory care processes.

## 5. Conclusion

Aligned with recommendations from the American Diabetes Association and emerging guidelines from the Centers for Medicare and Medicaid Services, we screened for social needs among people who had been referred for diabetes self-management education and support services. Similar to our previous research identifying demographic patterns among those who participate in diabetes support studies (White-Perkins et al., 2021), future studies could examine the influence of social needs on glycemic control among people who are at various stages of engagement in diabetes services, ranging from referral to completion. This area of research is critical to ensuring chronic disease management and support interventions can optimally benefit disadvantaged as well as minoritized racial and ethnic groups in a more equitable manner and thereby mitigate the deleterious impact of underlying social inequities and structural barriers at the root of healthcare disparities.

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Authorship contribution statement

**Denise White Perkins:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Pam Milan:** Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – review & editing. **Kimberly Miazek:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – review & editing. **Ashely Francis:** Writing – original draft, Writing – review & editing. **Suzanne Havstad:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Andrew S. Bossick:** Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Ganesa Wegienka:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing.

## CRedit authorship contribution statement

**Denise White Perkins:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal



analysis, Conceptualization. **Pamela Milan:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Kimberly Miazek:** Writing – review & editing, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Ashley Francis:** Writing – original draft. **Suzanne Havstad:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Andrew S. Bossick:** Writing – review & editing, Writing – original draft, Formal analysis. **Ganesa Wegienka:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability

The data that has been used is confidential.

#### References

- Assari, S., 2018. Unequal gain of equal resources across racial groups. *Int. J. Health Policy and Manag.* 7, 1–9. <https://doi.org/10.15171/ijhpm.2017.90>.
- Berkowitz, S.A., Hulberg, A.C., Standish, S., Reznor, G., Atlas, S.J., 2017. Addressing unmet basic resource needs as part of chronic cardiometabolic disease management. *JAMA Intern. Med.* 177, 244–252. <https://doi.org/10.1001/jamainternmed.2016.7691>.
- Brady, E., Bridges, K., Murray, M., Cheng, H., Liu, B., He, J., Woodward, J., 2021. Relationship between a comprehensive social determinants of health screening and type 2 diabetes mellitus. *Prev. Med. Rep.* 23, 101465 <https://doi.org/10.1016/j.pmedr.2021.101465>.
- Centers for Disease Control and Prevention, 2019. National Diabetes Statistics Report. <https://www.cdc.gov/diabetes/data/statistics-report/index.html> (accessed 8 October 2022).
- Centers for Medicare & Medicaid Services, 2017. Accountable Health Communities Model. <https://innovation.cms.gov/initiatives/ahcm>.
- Chambers, E.C., McAuliff, K.E., Heller, C.G., Fiori, K., Hollingsworth, N., 2021. Toward understanding social needs among primary care patients with uncontrolled diabetes. *Journal of Primary Care & Community Health.* 12 <https://doi.org/10.1177/2150132720985044>.
- Nuha A. ElSayed, Grazia Aleppo, Vanita R. Aroda, Raveendhara R. Bannuru, Florence M. Brown, Dennis Bruemmer, Billy S. Collins, Marisa E. Hilliard, Diana Isaacs, Eric L. Johnson, Scott Kahan, Kamlesh Khunti, Jose Leon, Sarah K. Lyons, Mary Lou Perry, Priya Prahalad, Richard E. Pratley, Jane Jeffrie Seley, Robert C. Stanton, Robert A. Gabbay; on behalf of the American Diabetes Association, 1. Improving Care and Promoting Health in Populations: *Standards of Care in Diabetes—2023. Diabetes Care* 1 January 2023; 46 (Supplement 1): S10–S18. <https://doi.org/10.2337/dc23-S001>.
- Gonzalez, J.S., Tanenbaum, M.L., Commissariat, P.V., 2016. Psychosocial factors in medication adherence and diabetes self-management: implications for research and practice. *Am. Psychol.* 71, 539–551. <https://doi.org/10.1037/a0040388>.
- Kalyani, R.R., Tian, J., Xue, Q.L., Walston, J., Cappola, A.R., Fried, L.P., Brancati, F.L., Blaum, C.S., 2012. Hyperglycemia and incidence of frailty and lower extremity mobility limitations in older women. *J. Am. Geriatr. Soc.* 60, 1701–1707.
- Kalyani, R.R., Rodriguez, D.C., Yeh, H.C., Golden, S.H., Thorpe Jr., R.J., 2015. Diabetes, race, and functional limitations in older U.S. men and women. *Diabetes Res. Clin. Pract.* 108, 390–397. <https://doi.org/10.1016/j.diabres.2015.04.003>.
- Klaperski, S., von Dawans, B., Heinrichs, M., Fuchs, R., 2013. Does the level of physical exercise affect physiological and psychological responses to psychosocial stress in women? *Psychol. Sport Exerc.* 14, 266–274. <https://doi.org/10.1016/j.psychsport.2012.11.003>.
- National Committee for Quality Assurance, 2022. NCQA updates and releases new quality measures for HEDIS 2023 with a focus on health equity. <https://www.ncqa.org/news/ncqa-updates-releases-new-quality-measures-for-hedis-2023-with-a-focus-on-health-equity-stratifying-measures-by-race-ethnicity-and-affirming-gender-identity-helps-tackle-health-disparities/> (accessed 17 April 2023).
- Schultchen, D., Reichenberger, J., Mittl, T., Weh, T.R.M., Smyth, J.M., Blechert, J., Pollatos, O., 2019. Bidirectional relationship of stress and affect with physical activity and healthy eating. *Br. J. Health Psychol.* 24, 315–333. <https://doi.org/10.1111/bjhp.12355>.
- White Perkins, D., Milan, P., Miazek, K., Havstad, S., Wegienka, G., 2021. Identifying factors affecting diabetes education program participation within a metro Detroit integrated health system. *Prev. Med. Rep.* 24, 101646 <https://doi.org/10.1016/j.pmedr.2021.101646>.
- Young-Hyman, D., de Groot, M., Hill-Briggs, F., Gonzalez, J.S., Hood, K., Peyrot, M., 2016. Psychosocial care for people with diabetes: a position statement of the American Diabetes Association. *Diabetes Care.* 39, 2126–2140. <https://doi.org/10.2337/dc16-2053>.