Relationship between a comprehensive social determinants of health screening and type 2 diabetes mellitus

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\section*{1. Introduction}

Social determinants of health (SDOH) are conditions that influence an individual’s health. Investigators explored associations between social needs and type 2 diabetes (T2DM) diagnoses through retrospective chart review (October 2017-September 2018) and statistical analyses of an 11-domain social needs questionnaire routinely administered in a large health system in Kansas City, Kansas (n = 26,093, temporal relationship between diagnoses and screening undetermined). Except for childcare needs, all social needs were more commonly reported in patients with a T2DM diagnosis. Domains with the strongest associations were prescription cost, transportation, and health literacy. These findings may inform health system and social service provider partnerships to offer assistance in specific domains.

\section*{ARTICLE INFO}

\textbf{Keywords:}
Type 2 diabetes mellitus
Social determinants of health
Social needs

\section*{ABSTRACT}

Social determinants of health are conditions that influence an individual’s health. Investigators explored associations between social needs and type 2 diabetes (T2DM) diagnoses through retrospective chart review (October 2017-September 2018) and statistical analyses of an 11-domain social needs questionnaire routinely administered in a large health system in Kansas City, Kansas (n = 26,093, temporal relationship between diagnoses and screening undetermined). Except for childcare needs, all social needs were more commonly reported in patients with a T2DM diagnosis. Domains with the strongest associations were prescription cost, transportation, and health literacy. These findings may inform health system and social service provider partnerships to offer assistance in specific domains.

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https://doi.org/10.1016/j.pmedr.2021.101465
Received 13 January 2021; Received in revised form 1 June 2021; Accepted 17 June 2021
Available online 22 June 2021
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Most studies of SDOH and T2DM in the literature lacked a comprehensive screening of multiple social needs. It can be difficult to isolate social needs as they often interplay with each other and other variables. Therefore, a comprehensive screener is vital, as it potentially captures a more holistic view of the factors impacting an individual’s health. Furthermore, analyses on the impacts of SDOH needs on the health outcomes of specific populations are necessary before multi-disciplinary interventions can be developed and tested. This study sought to investigate the association between patient-reported SDOH screening data and a diagnosis of T2DM using a comprehensive evidence-based tool in a primary care setting. We hypothesized there would be an association between having social needs and a T2DM diagnosis.

2. Methods

This study was a retrospective chart review of patients at the University of Kansas Health System. Patients were included if they completed a primary care appointment with a SDH screening questionnaire between October 1, 2017 through September 30, 2018. A patient was considered to have a specific diagnosis if an encounter diagnosis had been submitted as part of a previous office visit. Patients were excluded if they were under the age of 18, pregnant at the time of questionnaire completion, or had a diagnosis of type 1 diabetes mellitus. Partially completed questionnaires were included in the analysis. Patients are routinely screened at primary care appointments using a modified version of the validated Health Leads tool (Toolkit, 2021), covering the following SDOH domains: childcare needs, lack of companionship, food insecurity, health care cost, health literacy, home safety, housing stability, neighborhood safety, transportation, utilities, and prescription affordability. The tool also asked if the need was urgent and if the patient wanted help addressing needs, for a total of 13 questions and 11 domains. Modifications to the tool include the separation of personal violence from community violence as those resources may differ and changing the health literacy question to specify difficulty in understanding information regarding “medical conditions” instead of “hospital materials” as the questions are asked in an ambulatory setting. Data were retrieved from the i2b2 based clinical data repository HERON, consisting of demographic data, SDOH questionnaire responses, and diabetes diagnosis. SAS 9.4 was used for descriptive and main analyses.

In the descriptive analysis, mean values and standard deviations were provided for the continuous variables. Frequency counts and percentages were calculated for categorical variables. Asymptotic Pearson’s chi-squared tests were used to test whether yes/no responses to SDOH domain questions were independent of T2DM diagnoses. Odds ratios of having T2DM for subjects concerning individual domains were estimated. Logistic regression was used to estimate the odds ratio for age and race.

3. Results

A total of 26,093 subjects were included in this analysis, 4,649 with T2DM and 21,444 without T2DM. The majority of patients were female (63.2%) and white (70.2%). The mean age of the population was 54. Fifteen percent of subjects had at least one social need. Descriptive statistics are described in Table 1. Table 2 describes odds of having T2DM among selected demographic variables and by reported domain need. The odds of having T2DM for subjects who have at least one social need is 1.7 times higher than those who do not have any social needs. As expected with our large sample size, p-values were generally small, ranging from < 0.0001 to 0.0419, significance level α= 0.05. All tests were significant. Odds ratios ranged from 0.5 for childcare to 2.0 for prescription cost.

4. Discussion

This study investigated associations between SDOH and T2DM through secondary analysis of screening data from a comprehensive 11 domain primary care SDOH screening tool routinely used in a large academic medical center patient population. Our results are consistent with literature showing several social needs are individually associated with T2DM.

With the exception of a need for childcare, all social needs were more commonly reported in patients with T2DM. Social needs with the highest odds ratios were prescription cost (OR = 2.0, p = <0.0001), transportation (OR = 1.9, p = <0.0001), and health literacy (OR = 1.8, p = <0.0001). Childcare had decreased odds of a T2DM diagnosis (OR = 0.5, p = 0.0071) likely due to confounding. Younger individuals have a decreased burden of diabetes overall and an increased need for help caring for young children compared to older individuals. Patients with diabetes have been found to have significantly more total medications and a higher total out-of-pocket expense for prescriptions (Rodbard et al., 2010), so it is unsurprising that many patients with T2DM diagnosis.

Table 1
Descriptive statistics.

| Type II Diabetes | No Diabetes | Total |
|-----------------|-------------|-------|
| Age: mean (sd)  | 63 (12.9)   | 52 (18.2) | 54 (17.9) |
| # of yes, mean (sd) | 0.4 (1.02) | 0.3 (0.83) | 0.3 (0.87) |
| Sex: n (%)      | Female 2663 (57.3) | 13,836 | 16,499 |
|                 | Male 1986 (42.7) | 7608 (35.5) | 9594 (36.8) |
| Race: n (%)     | Black 1281 (27.6) | 3508 (16.4) | 4789 (18.4) |
|                 | Other 510 (11.0) | 2471 (11.5) | 2981 (11.4) |
|                 | White 2858 (61.5) | 15,465 | 18,323 |
| Any need: n (%) | No 3666 (78.9) | 18,462 | 22,128 |
|                 | Yes 983 (21.1) | 2945 (13.7) | 3928 (15.1) |
| Child Care: n (%)| No 4620 (99.4) | 21,202 | 25,822 |
|                 | Yes 21 (0.5) | 178 (0.8) | 199 (0.8) |
| Food Insecurity: n (%) | No 4390 (94.4) | 20,645 | 25,035 |
|                 | Yes 251 (5.4) | 752 (3.5) | 1003 (3.8) |
| Health Care Cost: n (%) | No 4375 (94.1) | 20,308 | 24683 |
|                 | Yes 270 (5.8) | 1087 (5.1) | 1357 (5.2) |
| Health Literacy: n (%) | No 4411 (94.9) | 20,782 | 25193 |
|                 | Yes 29 (0.6) | 86 (0.4) | 1150 (4.4) |
| Housing: n (%)   | No 4507 (96.9) | 20,994 | 25501 |
|                 | Yes 139 (3.0) | 403 (1.9) | 542 (2.1) |
| Neighborhood Safety: n (%) | No 4579 (98.5) | 21,174 | 25753 |
|                 | Yes 67 (1.4) | 218 (1.0) | 285 (1.1) |
| Prescription Cost: n (%) | No 4284 (92.1) | 20,544 | 24828 |
|                 | Yes 361 (7.8) | 847 (3.9) | 1208 (4.6) |
| Transportation: n (%) | No 4465 (96.0) | 20,941 | 25406 |
|                 | Yes 181 (3.9) | 453 (2.1) | 634 (2.4) |
| Utilities: n (%)  | No 4522 (97.3) | 20,987 | 25509 |
|                 | Yes 126 (2.7) | 413 (1.9) | 5392 (2.1) |
| Companion: n (%)  | No 3915 (84.2) | 17,393 | 21308 |
|                 | Yes 282 (6.1) | 719 (3.4) | 1001 (3.8) |

The denominator of each percentage is the number of subjects in the corresponding group.
beneficial for primary care providers to partner with community-based organizations that can provide those services. This study shows that our patient population with T2DM may benefit meaningfully from additional supports related to healthy food access, transportation, prescription costs, and health literacy. It may be that a self-reported transportation need is representative of overall socioeconomic status and highly correlated with other social needs. Diabetes is a complex disease process and the recommended treatments, such as glucose monitoring and insulin dosing, as well as lifestyle recommendations, such as carbohydrate counting are often confusing. These features likely contribute to the health literacy needs reported by patients with T2DM.

Primary care support for social service needs is an area of active research. In our health system, we currently screen all patients for social needs annually. If a need is self-reported, patients receive a list of resources on their post-visit paperwork. Patients who request help receive a follow-up phone call from a social worker to provide appropriate referrals. This study shows that our patient population with T2DM may benefit meaningfully from additional supports related to healthy food access, transportation, prescription costs, and health literacy. It may be beneficial for primary care providers to partner with community-based organizations that can provide those services.

Importantly, we found a diagnosis of T2DM was more common in those of Black race (OR = 2.0, p < 0.0001). This is consistent with previous studies (Spanakakis and Golden, 2013) and is likely intertwined with social needs and structural racism (Zhu et al., 2019; Bacon et al., 2017). Racial/ethnic minorities develop diabetes and prediabetes at lower body mass index than white patients, suggesting a role for factors other than obesity and diet in increased diabetes incidence (Zhu et al., 2019). Racism is a psychosocial stressor linked to poor health outcomes (Williams et al., 2019). Data from the large-scale Black Women’s Health Study revealed that women with the highest exposure to everyday and lifetime racism had an increased risk of type 2 diabetes (Bacon et al., 2017). Understanding the relationship between racism, downstream SDOH needs, and further downstream health outcomes for specific racial/ethnic groups is a critical next step.

Our study had limitations. First, investigators cannot definitively claim a causal relationship between social needs and T2DM. Due to the limitations of retrospective chart review, we are unable to determine if the diagnosis of diabetes or presence of food insecurity presented first in the patient. Thus, data was only evaluated for prevalence, not incidence or causality. Second, due to the large sample size, this study may have enough power to detect a small effect size that is not clinically meaningful. Third, since sicker individuals tend to present more often to health care facilities, we may show an over-prediction of adverse health outcomes in our study, resulting in a form of selection bias, Berkson’s bias. Fourth, external validity may be limited to populations with similar household income, however our healthcare system does not routinely collect this information. Fifth, the Health Leads SDOH screening tool has not been psychometrically validated, as is the case for most social risk screening tools (Henriksson et al., 2019). Last, external validity in this study is limited to populations presenting to urban health care facilities. Future investigations will explore causal interactions between SDOH domains and add associations with HbA1c, a common measurement of glycemic control.

5. Conclusion

Social needs are often interrelated, making simple analysis of single domains difficult. In this study, except for childcare, all social needs were more commonly reported by patients diagnosed with T2DM. Prescription cost, transportation, and health literacy had higher odds ratios than other domains. Investigators are unable to discern if social needs increase the risk of developing T2DM or if a diagnosis of T2DM leads to increased social needs due to financial factors involved with treatment. These results may inform future studies to understand how patients with pre-diabetes may be at higher risk for certain domains of social needs and how preventive care may include these considerations. Overall, results showed that patients diagnosed with T2DM are indeed a population with increased social needs and may benefit from a targeted approach to social services.

CRediT authorship contribution statement

Elliott Brady: Conceptualization, Methodology, Investigation, Writing - original draft. Kristina Bridges: Conceptualization, Investigation, Writing - original draft. Megan Murray: Conceptualization, Investigation, Project administration, Data curation, Writing - original draft. Huan Cheng: Methodology, Validation, Formal analysis. Bing Liu: Methodology, Validation, Formal analysis. Jianghua He: Methodology, Validation, Formal analysis, Supervision. Jennifer Woodward: Conceptualization, Investigation, Supervision, Writing - review & editing.

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.

Acknowledgments

This work was supported by a CTSA grant from NCATS awarded to the University of Kansas for Frontiers: University of Kansas Clinical and Translational Science Institute (# UL1TR002366) The contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH or NCATS.

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