FEATURE ARTICLE

Increasing Social Determinants of Health Screening Rates Among Six Endocrinology Centers Across the United States: Results From the T1D Exchange Quality Improvement Collaborative

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Social determinants of health (SDOH) are strongly associated with outcomes for people with type 1 diabetes. Six centers in the T1D Exchange Quality Improvement Collaborative applied quality improvement principles to design iterative Plan-Do-Study-Act cycles to develop and expand interventions to improve SDOH screening rates. The interventions tested include staff training, a social risk index, an electronic health record patient-facing portal, partnerships with community organizations, and referrals to community resources. All centers were successful in improving SDOH screening rates, with individual site improvements ranging from 41 to 70% and overall screening across the six centers increasing from a baseline of 1% to 70% in 27 months.

Type 1 diabetes is characterized by immune-mediated destruction of pancreatic β-cells, resulting in a lifelong need for insulin (1,2). About 1.4 million people in the United States have type 1 diabetes, and the incidence is increasing (2). The management of type 1 diabetes is complex; it is best undertaken in the context of a multidisciplinary health care team with attention to insulin administration, blood glucose monitoring, meal planning, and screening for comorbid conditions, diabetes-related complications, and psychosocial needs (3).

Diabetes outcomes such as attainment of glycemic targets, number of acute complications, use of technology, and access to care are all worse in the non-Hispanic Black and Hispanic populations (4). Barriers to optimizing outcomes in these populations may be the result of differences in culture and a lack of support within the health care system for multicultural communities and social determinants of health (SDOH), including lack of financial resources (4).

SDOH are the circumstances in which people are born, grow up, live, work, and age (5). They are nonclinical and nonbiological social factors that affect health (5). These conditions are influenced by the distribution of income, power, and resources, and they in turn influence the development and progression of chronic diseases such as diabetes (6). In diabetes management, SDOH play a key role in patients' access to care and medications (7). Diabetes management presents a substantial burden to patients, their families, health care providers, and the health care system, and a greater burden is evident among individuals with lower educational attainment and socioeconomic status (SES). People with diabetes and lower SES spend more time in hyperglycemia and hypoglycemia and tend to have suboptimal disease outcomes, and these disparities have widened over time (8,9).

Screening for SDOH in clinical settings enables providers to identify unmet nonmedical needs that would otherwise go undiscovered and may affect patients' health and wellness (10). Innovations in diabetes tech-

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nology have improved quality of life and glycemic management for people with type 1 diabetes. However, despite such advances, individuals from low-income families are not accruing these benefits (4).

Identifying and addressing SDOH-related barriers to diabetes management in clinical settings is needed to improve diabetes care quality and outcomes (11). The Centers for Medicare & Medicaid Services recommends screening for SDOH (12). The American Diabetes Association likewise recommends assessing people with diabetes for food insecurity, housing insecurity/no permanent place of residence, financial barriers, and inadequate social capital/social community support and further recommends that these assessments should inform treatment decisions and prompt referrals to appropriate community resources when needed (13).

Despite growing national attention, few ambulatory care settings have developed or standardized systematic SDOH screening processes (12,14), and despite widespread acceptance of the role of SDOH in determining health outcomes, screening for individual-level social risk factors in clinical care settings remains minimal (15). Although validated SDOH screening tools are available, providers still struggle to address their patients' unmet social needs (16). Most health care systems work under resource-constrained conditions and lack the infrastructure and incentives necessary to establish adequate screening for social needs (10).

The T1D Exchange is a nonprofit organization committed to advancing therapies and enhancing care for people with type 1 diabetes. The Type 1 Diabetes Exchange Quality Improvement Collaborative (T1DX-QI) is a large-scale initiative that involves the active engagement of endocrinologists, parents/patients with type 1 diabetes, certified diabetes care and education specialists (CDCESs), clinical staff, and quality improvement (QI) experts (1). The T1DX-QI was designed to advance QI through continuous learning and ongoing assessment of best practices in the United States specifically focused on the well-being of individuals with type 1 diabetes (2). The Collaborative includes a network of 55 pediatric and adult endocrinology centers, with a combined dataset from >70,000 patients. In this project, we aimed to apply QI methodology to increase screening for SDOH among participating centers.

Research Design and Methods

This QI study was conducted among six pediatric diabetes centers and one adult diabetes center in the T1DX-QI. All participating centers received local institutional review board approval to share aggregate data and participate in this project. Aggregate baseline data were collected and stratified by site (Table 1). No protected health information was transmitted outside of each clinic. This project was deemed nonhuman subject research by the Western Institutional Review Board.

The six participating T1DX-QI centers were Cincinnati Children's Hospital Medical Center, in Cincinnati OH; Baylor College of Medicine, in Houston, TX; Hassenfeld Children's Hospital at NYU Langone, in New York, NY; Children's Mercy Research Institute Hospital, in Kansas

TABLE 1 Baseline Characteristics of Patients by Site

	Pediatric Site 1	Pediatric Site 2	Pediatric Site 3	Pediatric Site 4	Pediatric Site 5	Adult Site 1
Total patients	3,903	4,672	616	4,060	1,636	3,030
Insurance						
Public	936	2,560	200	1,433	616	583
Private	2,732	1,848	392	2,479	690	1,269
Other/unknown	235	264	24	148	330	1,178
Race/ethnicity						
Non-Hispanic White	3,280	3,345	275	2,982	357	981
Non-Hispanic Black	358	510	48	743	134	226
Hispanic	76	514	103	—	12	32
Other/unknown	189	303	190	335	1,133	1,791
Age, years	16.9 ± 4.7	15 ± 4.6	14.1 ± 5.3	15.1 ± 4.3	14.9 ± 4.6	44.4 ± 16.6
Female sex	1,905	2,300	289	2,008	744	1,421

Data are *n* or mean ± SD.

City, MO; and the adult and children's diabetes centers at SUNY Upstate Medical University, in Syracuse, NY. Participating centers each have physician champions, advanced practice nurses, CDCESs, psychologists, social workers, and patients as part of their team (Table 2). The six participating centers in this project serve a total of 17,917 patients with a mean age of 15.1 ± 5.6 years.

The centers used Plan-Do-Study-Act (PDSA) cycles to implement and scale up interventions to increase SDOH screening. PDSA cycles were implemented and communicated to the T1DX-QI coordinating office through regular QI coaching calls (Figure 1).

Table 3 summarizes the interventions that were tested and scaled. Among these were provider training on SDOH screening, use of an SDOH tab in the electronic health record (EHR) system, development of procedures suitable for both telemedicine and in-person visits, integration of repeated SDOH screening at every visit, use of paper forms and digital tablets for screening, revised language in the screener to emphasize confidentiality and communicate the availability of free resources, translation of the screener into multiple languages, implementation of an EHR best practice alert to prompt referrals for patients with positive screening results, and a streamlined process for making referrals for social work support when needed. Standardized SDOH assessment was also introduced for patients admitted to the hospital with diabetes ketoacidosis (DKA). This assessment examines factors contributing to the occurrence of the DKA episode that extend beyond medical and insulin-related matters. (Supplementary Figure S1).

The primary QI outcome was the SDOH screening rate, measured as the total number of all patients with type 1 diabetes seen in the reporting month as the denominator and the total number of those patients who were screened in the reporting month as the numerator.

Participating clinics shared monthly aggregate data with the T1D-QI Collaborative coordinating office using a secure collaborative spreadsheet (www.smartsheet.com). Data were reported from July 2020 through October 2022.

Data were analyzed using control chart rules; a control chart is a type of process-behavior data chart that assesses shifts and evaluates QI project effectiveness (17). Shifts were identified if any point was beyond the specified three-σ control limits, if two of three consecutive points fell beyond the two-σ control limits, if four of five consecutive points fell beyond the one-σ control limits, or if the run of eight consecutive points fell on either side of center line (18). Control charts were created using SPC for Excel software (www.spcforexcel.com). We applied SQUIRE 2 (Revised Standards for Quality Improvement Reporting Excellence) guidelines when writing this article (19).

Results

SDOH screening rates increased across all participating clinics, with improvements ranging from 41 to 70%. The mean SDOH screening rate across all six centers increased by 69% between July 2020 and October 2022 through targeted interventions specific to each center.

Two shifts were identified using control chart rules (17). The pre-intervention mean from July 2020 to January 2021 was 0.2%; the mean from February to December 2021 was 61%, and the mean from and January to October 2022 was 70% (Figure 2). Statistical significance was calculated for each shift using a *t* test, and the *P* value was <0.001 (Table 4).

Discussion

To our knowledge, this is the first multicenter QI initiative aimed at increasing screening for SDOH across

TABLE 2 Number of Full-Time Equivalent Provider Positions by Discipline at Each Participating Site

	Pediatric Site 1	Pediatric Site 2	Pediatric Site 3	Pediatric Site 4	Pediatric Site 5	Adult Site 1
Medical doctors or doctors of osteopathic medicine	8	20	4	20	3	3
Nurse practitioners or physician associates	5	2	1	6	4.1	2.2
Social workers	4	2	1	6	1	0.4
Psychologists	2	2	0.7	1.3	0	0
CDCESs	10	14	4	16.3	0.7	2.4

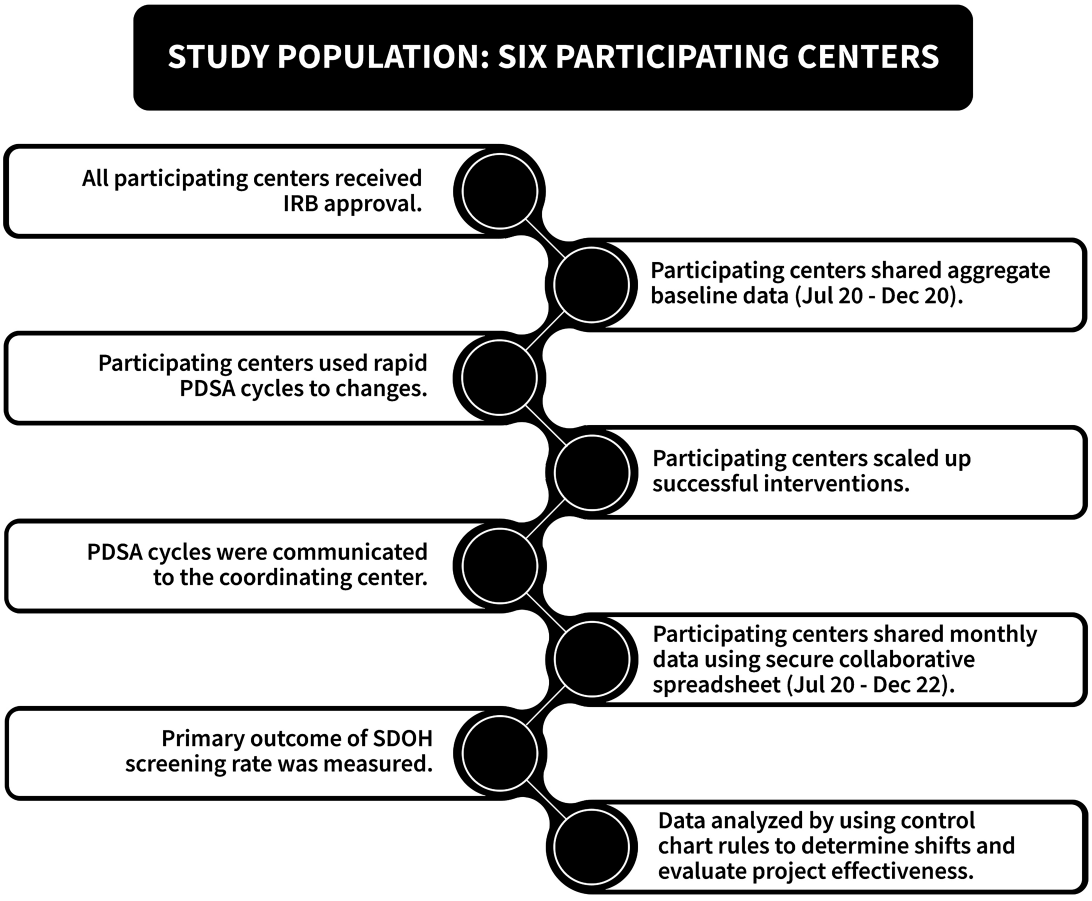

FIGURE 1 SDOH screening project methodology. IRB, institutional review board.

multiple diabetes centers in the United States. Notably, all collaborating centers achieved an increase in their SDOH screening rate throughout the study.

SDOH screening has enabled clinical settings to identify the social and environmental conditions affecting patients and to address patient needs that extend beyond standard clinical care (10). In the absence of regular SDOH screening, health care practitioners frequently remain uninformed about challenges faced by many people with type 1 diabetes and their families. In our cohort, all participating centers addressed the social needs of patients with positive screening results by referring them to appropriate local community resources.

Our project revealed that language barriers are an obstacle for non–English-speaking patients in our clinics. The screening rate increased at two participating centers that translated the SDOH screening tool into other languages such as Spanish, Arabic, and Nepali. SDOH screening rates increased among Hispanic people with type 1 diabetes when two of the participating centers revised the screening questions and added a sentence to emphasize confidentiality, highlight the voluntary nature of participation, and impart that available referral resources are free of charge. Further research is needed to establish a connection between racial/ethnic minority status and diminished frequency of SDOH screenings.

One of the centers in our study found that Black and Hispanic patients were disproportionately affected by SDOH-related barriers (20). Years of research have demonstrated that diabetes affects racial/ethnic minorities and low-income populations disproportionately, with higher risks of diabetes complications and mortality in these populations (4,20).

QI methodology is feasible in improving outcomes for people with type 1 diabetes. Five T1DX-QI centers applied QI tools and developed interventions to target barriers to insulin pump therapy among 12- to 26-year-old patients. After a series of rapid tests of change over 22 months, insulin pump uptake increased by 13% from baseline across the centers (21). Prahalad et al. (22) described QI interventions in 10 clinics in the T1DX-QI to

TABLE 3 Interventions to Increase SDOH Screening Rates at Participating Sites

	Pediatric Site 1	Pediatric Site 2	Pediatric Site 3	Pediatric Site 4	Pediatric Site 5	Adult Site 1
In-clinic paper forms to make screening more accessible	X	X	X		X	X
SDOH tab in HER system to make screening and documentation more accessible for patients and providers and use of a best practice alert to flag patients in need of referral	X	X	X		X	X
Streamlined process to refer patients for social work services	X	X	X	X	X	X
Revised the language to emphasize confidentiality and state that free resources are available	X	X	X		X	X
Repeat SDOH screening at every visit	X	X	X	X	X	X
Translation of screening tool into other languages					X	X
SDOH screening process map that is applicable to both telemedicine and in-person visits				X		
Use of digital tablets for SDOH screening in clinic waiting area			X			
Standardized SDOH assessment for patients admitted to the hospital with DKA				X		
Provider training to ensure that staff are competent and comfortable with the SDOH screening process	X	X	X	X		X

increase the use of continuous glucose monitoring (CGM). Through targeted interventions specific to each center, CGM use increased by 21% over 20 months. QI methods also have been successfully used to improve SDOH screening in other areas of medicine (23–25).

In a recent T1DX-QI study aimed at increasing CGM use by non-Hispanic Black and Hispanic people with type 1 diabetes, the proactive identification and resolution of barriers identified through SDOH screening proved to be instrumental in increasing CGM uptake. Median CGM use increased by 12% among Non-Hispanic Black and 15% among Hispanic people with type 1 diabetes (26).

Screening for and addressing SDOH barriers should be tailored to each center's ability to change and adapt its

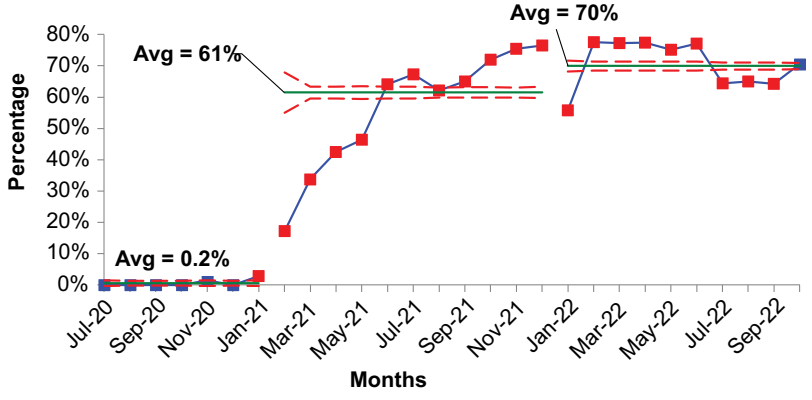

FIGURE 2 Control chart showing a trend line reflecting an increase in SDOH screening among participating centers over time. The center line represents the mean. The upper and lower dashed lines represent the upper and lower control limits. Avg, average.

TABLE 4 SDOH Screening Rate Before the Intervention Versus During the Intervention Period

	Pre-Intervention Period (July to January 2021)	Intervention Period (February to December 2021)	Intervention Period (January to October 2022)	*P*
Mean screening rate, %	0.2	61	70.4	<0.001

workflows and should be cost-effective and culturally appropriate to promote health equity (5). As health care systems continue to address this need, it is important to establish best practices for implementing SDOH screening and making necessary referrals. Future studies should explore follow-up processes for individuals who have positive SDOH screening results.

Strengths and Limitations

A strength of this project was that participating clinics had the flexibility to create their own PDSA cycles based on their specific priorities, procedures, and policies and their patient population's needs. This multicenter project also provided an opportunity for centers to learn from each other during monthly coaching calls.

A limitation of this project was that participating centers were all academic settings with varying levels of QI infrastructure and capacity; thus, some centers conducted more PDSAs than others. Some of the centers relied on paper documentation, which may have led to underreporting of SDOH screening. All participating centers screened for SDOH, but there was no agreement on which specific domains to include in the screening. Finally, this was an observational study, and most participating centers implemented multiple interventions. Therefore, we were unable to assess the success of a single intervention in increasing SDOH screening.

Conclusion

We applied QI methodology and principles to execute this project. Participating centers tested changes through rapid PDSA cycles. Once successful interventions were identified, they were expanded and sustained over time. This project demonstrated that increasing SDOH screening and facilitating connections between people with positive screening results and potentially helpful resources is feasible.

We learned the following key lessons through this project: *1*) clinic processes and policies differ among participating centers, allowing interventions to be customized according to existing guidelines and procedures and facilitating favorable outcomes; *2*) regular team meetings with multidisciplinary team members are a valuable tool for sharing improvement ideas and fostering learning; *3*) involving patients/parents in brainstorming change ideas is important and aids in recognizing potential obstacles and contributing factors; and *4*) the timely provision of data reports and the enthusiasm of the QI team accelerate the achievements of QI initiatives.

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DUALITY OF INTEREST

O.E. is a compensated Health Equity Advisory Board member for Medtronic Diabetes and serves as principal investigator for investigator-led projects sponsored by Abbott, Eli Lilly, Insulet, and Medtronic. He is compensated through his organization, the T1D Exchange. No other potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS

O.O. wrote the first draft of the manuscript. O.E. conceptualized the study, served as its principal investigator, and substantially reviewed and edited the manuscript. All authors critically edited the manuscript and approved the final version for submission. O.O. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

PRIOR PRESENTATION

A portion of the data included in this article was presented in abstract form at the American Diabetes Association's 83rd Scientific Sessions, 23–26 June 2023, in San Diego, CA

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