Primary Care Providers in California and Florida Report Low Confidence in Providing Type 1 Diabetes Care

Rayhan A. Lal,[1–3] Nicolas Cuttriss,[1] Michael J. Haller,[4–6] Katarina Yabut,[1] Claudia Anez-Zabala,[6] Korey K. Hood,[1,3] Eleni Sheehan,[7] Marina Basina,[2,3] Angelina Bernier,[6] Linda G. Baer,[1] Stephanie L. Filipp,[8] C. Jason Wang,[3,9] Marissa A. Town,[1,3] Matthew J. Gurka,[8] David M. Maahs,[1,3] and Ashby F. Walker[5,10]

People with type 1 diabetes may receive a significant portion of their care from primary care providers (PCPs). To understand the involvement of PCPs in delivering type 1 diabetes care, we performed surveys in California and Florida, two of the most populous and diverse states in the United States. PCPs fill insulin prescriptions but report low confidence in providing type 1 diabetes care and difficulty accessing specialty referrals to endocrinologists.

In the United States, at least 1.25 million people live with type 1 diabetes, and more than 40,000 new diagnoses are made annually (1). Data from the T1D Exchange, a U.S. clinic registry established in 2010 and including more than 25,000 people with type 1 diabetes of all ages (2), suggest that 79% of adults and 83% of children with type 1 diabetes seen at diabetes centers in the United States do not meet A1C targets (3). Eighty-two percent of T1D Exchange participants are Caucasian, and all have access to health care at major diabetes centers. The challenges of clinical care are even greater for socioeconomically disadvantaged individuals, and limited access to resources and subspecialty care is associated with poor glycemic control (4–9). In the long term, these individuals are at disproportionately increased risk for developing microvascular and cardiovascular disease as a result of chronic hyperglycemia (10,11).

Compounding these difficulties is a shortage of clinical endocrinologists in the United States (12–14). A study of geographic access to endocrinologists in America found that the overall population-to-endocrinologist ratio within 20 miles was 75,573:1 (39,492:1 for people ≤18 years of age, 29,887:1 for those aged 18–64 years, and 6,194:1 for those ≥65 years of age), although these ratios varied widely from location to location (15). With 0.55% of the United States population effected by type 1 diabetes (16), this amounts to 416 patients with type 1 diabetes for every endocrinologist, if endocrinologists were distributed uniformly throughout the country and all saw patients with diabetes. Unfortunately, these assumptions are not reality. To see every person with type 1 diabetes four times annually would require every endocrinologist see seven patients per working day, and this volume does not include the multitude of people with type 2 diabetes or other endocrine conditions. Further, during the transition from pediatric endocrinology to adult care, many are lost to follow-up. In the Canadian universal health care system, 40% of patients with type 1 diabetes were found to have dropped out of adult medical care (17). Young adults transferring to adult endocrinology may seek care from a local primary care provider (PCP) or disconnect from the health care system entirely. We must therefore conclude that many people with type 1 diabetes do not see an endocrinologist. PCPs frequently are required to take on the responsibilities of type 1 diabetes management traditionally performed by endocrinologists.

Most studies examining type 1 diabetes health outcomes use data from endocrinology clinics. However, because of

[1]Department of Pediatrics, Division of Endocrinology, Stanford University School of Medicine, Stanford, CA; [2]Department of Medicine, Division of Endocrinology, Stanford University School of Medicine, Stanford, CA; [3]Stanford Diabetes Research Center, Stanford, CA; [4]Department of Health Services Research, Management and Policy, University of Florida, Gainesville, FL; [5]University of Florida Diabetes Institute, Gainesville, FL; [6]Division of Endocrinology, Department of Pediatrics, University of Florida, Gainesville, FL; [7]Division of Endocrinology, Department of Medicine, University of Florida, Gainesville, FL; [8]Department of Health Outcomes and Biomedical Informatics, University of Florida, Gainesville, FL; [9]Center for Policy, Outcomes and Prevention, Department of Pediatrics, Stanford University School of Medicine, Stanford, CA; [10]Department of Health Service Research, Management, and Policy, University of Florida, Gainesville, FL

Corresponding author: Rayhan A. Lal, inforay@stanford.edu

TABLE 1 Provider/Practice Demographics (*N* = 123)

	Replies Received, *n*	Results
Location	123	
California		68 (55.3)
Florida		55 (44.7)
Years in practice	116	18.6 ± 11.3 (1.0, 45.0)
Type of practice	119	
Solo		24 (20.2)
Multispecialty group		42 (35.3)
Single-specialty group		27 (22.7)
Hospital (or hospital system–owned)		13 (10.9)
Other		13 (10.9)
Multiple site locations	121	53 (43.8)
Number of providers at primary site	117	
1–3		17 (14.5)
4–10		41 (35.0)
11–20		19 (16.2)
≥21		40 (34.2)
Mean number of patients seen per week	117	391 ± 604 (8.0, 5,000.00)†
Median number of patients with diabetes seen		
Patients 0–21 years of age with type 1 diabetes	102	2.0 (0.0, 10.0)†
Patients 0–21 years of age with type 2 diabetes	100	2.0 (0.0, 10.0)†
Patients >21 years of age with type 1 diabetes	97	15.0 (2.0, 50.0)†
Patients >21 years of age with type 2 diabetes	99	200.0 (85.0, 600.0)†
Percentage of practice pediatric patients (<21 years of age)	118	26.2 ± 29.8 (0.0, 100.0)
Average percentage distribution of insurance payer type*	119	
Private		30.7 ± 25.6 (0.0, 90.0)
Public (Medicaid or Children's Health Insurance Program)		33.1 ± 27.4 (0.0, 100.0)
Public, >65 years of age		25.0 ± 19.8 (0.0, 80.0)
Self-pay		6.3 ± 7.2 (0.0, 60.0)
No insurance		7.3 ± 13.8 (0.0, 95.0)
Other		5.1 ± 18.0 (0.0, 100.0)
Practices currently participating in a telemedicine program	121	33 (27.3)
Distance from practice location to pediatric endocrinologist, miles	85	42.8 ± 57.4 (0.0, 350.0)
Distance from practice location to adult endocrinologist, miles	85	23.8 ± 30.8 (0.0, 200.0)

Data are mean ± SD (minimum, maximum), *n* (%), or median (interquartile range). *Participants left blank insurance types that were not used in their clinic; thus, each individual insurance type has a different *n*. Of the 123 participants, only 8 had total distributions that did not sum across the six insurance types to 100% (total percentages for those eight respondents were 95, 95, 96, 102, 105, 110, 110, and 115%). Four respondents did not answer at all, so a total of 119 practices reported the insurance distribution of their clinic. †One respondent reported on six clinics with a total of 800 providers who saw a total of 71,000 patients/week. This outlier observation was excluded from subsequent results marked with † because of its extreme impact.

the aforementioned barriers to access and utilization of specialty services, primary care clinics play a central role in the management of patients, particularly among those affected by health disparities (18). To improve health care delivery, we must understand the unique challenges PCPs face in providing care to patients with type 1 diabetes.

Research Design and Methods

Sampling

To better understand barriers for individuals with type 1 diabetes in primary care settings, we administered a cross-sectional survey to PCPs in California and Florida. Convenience sampling was used to recruit participants from a diverse range of clinical settings. Given challenges related to obtaining high response rates from PCPs, the Dillman method (19) was used for subsequent follow-up. Publicly available statewide provider directories were used to mail 400 printed surveys with postage-paid return envelopes provided, as well as a website where the survey could be completed online instead. Family medicine departments and other primary care locations were identified from online directories for each state. Department chairs were telephoned and asked to participate and to disseminate a REDCap (Research Electronic Data Capture) online survey Internet link to their faculty distribution lists. REDCap is a secure web-based application designed to support data capture for research studies. After

completing the survey online or mailing in a completed paper survey, respondents received via e-mail a link to a website where they could redeem a $25 Starbucks gift card.

The survey (see Supplementary Materials) included inquiries regarding the provider's title, roles, responsibilities, practice type, size of practice, insurance accepted, patient demographics, number of patients with diabetes, and clinical practice patterns with regard to diabetes. The survey also assessed existing protocols for type 1 diabetes care delivery and confidence in type 1 diabetes care management and allowed providers to identify common barriers they encounter in the care of patients with type 1 diabetes.

The Stanford University and University of Florida institutional review boards approved the research protocol.

Data Capture and Statistical Methods

This cross-sectional survey was administered between April and December 2018. Data were collected directly via a REDCap online survey or on paper; paper survey responses were returned via mail and manually entered into the REDCap database by trained research coordinators. Data were monitored for errors throughout the study period. Data management and analyses were conducted using SAS, version 9.4 (SAS Institute, Cary, NC).

Descriptive statistics were computed for basic provider and practice demographic information, practice management and standards of care, challenges, and confidence in managing patients with type 1 diabetes. A paired t test was used to compare the difference in distance (miles) between adult and pediatric endocrinologists among those responding to both pediatric and adult care questions. To further evaluate confidence in managing patients with type 1 diabetes, these questions were stratified by years in practice. Cochran-Mantel-Haenszel tests of nonzero correlation were used to determine whether confidence varied across strata by years in practice.

Results

In total, 123 completed surveys were returned, including 68 (55.3%) from California and 55 (44.7%) from Florida. Demographics of respondents are presented in Table 1. Surveys were completed by PCPs in a multitude of settings, including solo practice (20.2%), multispecialty groups (35.3%), single-specialty groups (22.7%), hospital systems (10.9%), and other settings (10.9%). These practices saw private, public, self-pay, and uninsured patients. Self-pay may reflect revenue from uninsured, from those with insurance who pay a balance, or from those whose insurance is not accepted. The mean distance to the closest pediatric endocrinology practice (42.8 ± 57.4 miles) was greater than the distance to an adult endocrinologist (23.8 ± 30.8 miles); among those responding to both pediatric and adult questions, the average distance to a pediatric endocrinologist was 22.4 miles greater than to an adult endocrinologist
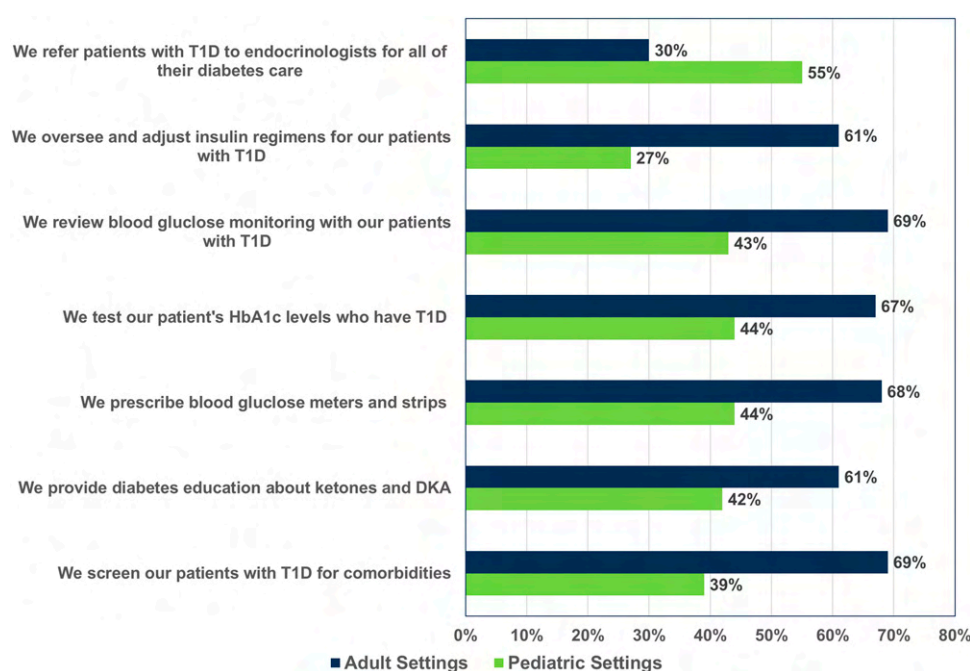

FIGURE 1 Practice management responses from PCPs seeing children and adults with type 1 diabetes. DKA, diabetic ketoacidosis; HbA1c, glycated hemoglobin; T1D, type 1 diabetes.

(P <0.0001). Among 123 responders, 12 had incomplete responses regarding the number of patients with type 1 diabetes in their practice. Of the remaining 111 who answers that question, 109 (98%) reported that their practice saw patients with type 1 diabetes.

PCPs were questioned regarding practice habits and standards of care for the treatment of type 1 diabetes. Pediatric and adult practice management responses are reflected in Figure 1. For the pediatric population, 58% of PCPs reported referring children to endocrinologists for diabetes care, and only 45% reported checking A1C for children with type 1 diabetes during clinic visits. For the adult population, 30% of PCPs referred patients to endocrinologists, and 65% reported checking A1C.

Inquiries regarding insulin prescribing habits, challenges with referrals, and the need for resources are presented in Table 2. A majority of PCPs (73%) reported filling an insulin prescription for a patient with type 1 diabetes in the past year. Fewer than half of respondents (43%) reported experiencing no problems with referrals to endocrinology. The majority of respondents indicated that patients may prefer receiving care from a PCP because of its convenience. PCPs desired clinical resources including type 1 diabetes educational materials, information about diabetes technology, and behavioral health services.

A final set of survey questions was designed to assess PCP confidence with type 1 diabetes management (Table 3). Many respondents (58%) reported feeling "not at all confident" or only "somewhat confident" with management of type 1 diabetes in the primary care setting. Even fewer reported confidence with diabetes technology, including insulin pumps (17% said they were "moderately" or "extremely" confident) and continuous glucose monitoring (CGM) systems (28% said they were "moderately" or "extremely" confident). Despite this lack of confidence, >76% stated they prescribed insulin for patients with type 1 diabetes. Furthermore, there is a statistically significant difference in the distribution of confidence in management of patients with type 1 diabetes being treated with insulin pumps when stratified by years in practice. Among those with the least clinical experience, 77% were not at all confident managing these patients. Overall, few were extremely confident, regardless of years in practice.

Discussion

Many people with type 1 diabetes do not consistently receive care from an endocrinologist. PCPs are

TABLE 2 Challenges, Patient Care Preferences, and Needed Resources (N = 123)

Patients with type 1 diabetes are able to get their insulin prescriptions from providers in your office.†	96 (82.8)
How many patients with type 1 diabetes have you written insulin prescriptions for in the past year?††	29.3 ± 99.8 (0.0, 800.0)
0	22 (23.7)
1–10	49 (52.7)
11–50	13 (14.0)
>50	9 (9.7)
Have you experienced any problems or issues in getting patients with type 1 diabetes referrals to endocrinology?	
Not applicable	10 (8.1)
No, I have not experienced any problems with endocrinology referrals.	53 (43.1)
Yes, we have a lack of endocrinologists in this geographic area.	37 (30.1)
Please indicate for which type of patient there is a lack of endocrinologists in your geographic area.	
Adult	29 (78.4)
Pediatric	28 (75.7)
Yes, we have a lack of endocrinologists who are covered by our patients' insurance.	23 (18.7)
Yes, we have experienced long wait times when trying to schedule our patients with endocrinologists	34 (27.6)
Other	10 (8.1)
Can you think of a situation where patients with type 1 diabetes may prefer to receive their diabetes-related treatment at your practice rather than through a specialist like endocrinology?	
No	33 (26.8)
Yes, primary care providers can fully care for type 1 diabetes patients in our offices so there is no need for them to go see endocrinologists.	10 (8.1)
Yes, it is more convenient for patients with type 1 diabetes to receive their diabetes-related care with their primary care providers.	72 (58.5)
Yes, my patients are not interested in going to see endocrinologists for care.	14 (11.4)
Other	18 (14.6)
Please describe examples of information or resources that would be most helpful to your practice in serving patients with type 1 diabetes.	
Type 1 diabetes education materials	89 (72.4)
Information about diabetes-related technologies like insulin pumps	84 (68.3)
Information about behavioral health services for my type 1 diabetes patients	72 (58.5)
Other	13 (10.6)

Data are n (%) or mean ± SD (minimum, maximum). †n = 116 (missing = 7), ††n = 93 (missing = 30).

delivering type 1 diabetes care and regularly filling insulin prescriptions despite a lack of confidence in providing services, especially related to diabetes technologies such as CGM systems and insulin pumps. These survey responses, from PCPs in a range of clinical settings, demonstrate gaps in the delivery of standard care and concurrently reveal the crucial role PCPs play in type 1 diabetes management.

Efforts to improve outcomes in type 1 diabetes must include targeted interventions in

TABLE 3 Confidence in Managing Patients With Type 1 Diabetes in Primary Care Settings (*N* = 123)

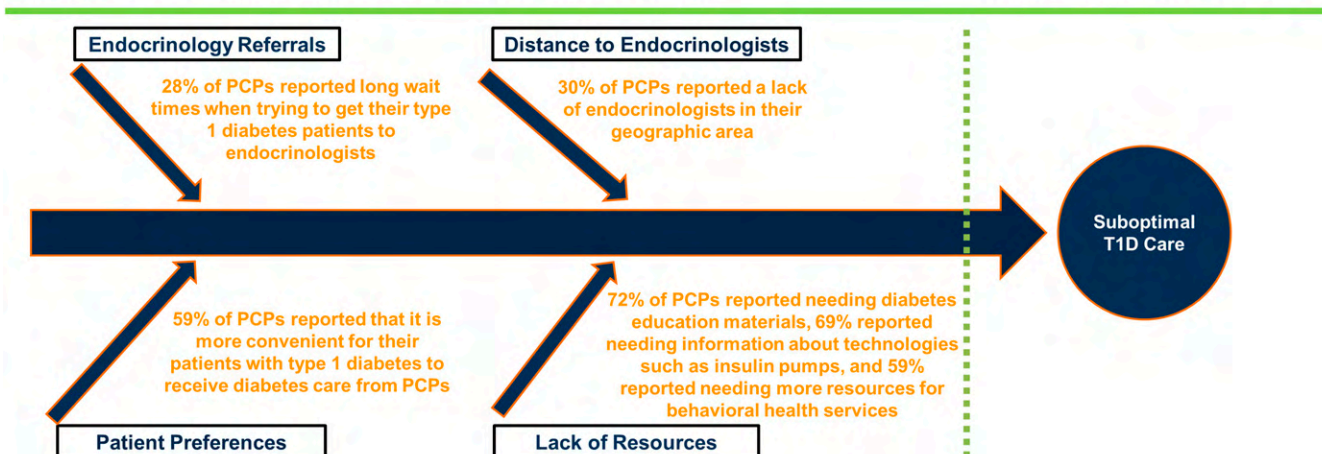| How confident are you in your ability to:	Replies Received, *n*	Not at All Confident, *n* (%)	Somewhat Confident, *n* (%)	Moderately Confident, *n* (%)	Extremely Confident, *n* (%)
Manage type 1 diabetes patients treated with insulin pumps?	117	**71 (60.7)**	**25 (21.4)**	13 (11.1)	8 (6.8)
Serve as a type 1 diabetes resource for other providers in your community?	118	**46 (39.0)**	**42 (35.6)**	21 (17.8)	9 (7.6)
Utilize and interpret continuous glucose monitoring data in type 1 diabetes?	117	**44 (37.6)**	**38 (32.5)**	22 (18.8)	13 (11.1)
Educate clinic staff about patients with type 1 diabetes?	117	14 (12.0)	**49 (41.9)**	**37 (31.6)**	17 (14.5)
Provide appropriate interventions for overcoming social barriers for patients with type 1 diabetes?	118	26 (22.0)	**44 (37.3)**	**37 (31.4)**	11 (9.3)
Manage patients with type 1 diabetes in your primary care setting?	119	23 (19.3)	**46 (38.7)**	**36 (30.3)**	14 (11.8)
Identify social barriers for your patients with type 1 diabetes?	117	13 (11.1)	38 (32.5)	**36 (30.8)**	**30 (25.6)**
Identify depression using validated scales and recommend evidence-based depression treatment for patients with type 1 diabetes?	117	11 (9.4)	31 (26.5)	**43 (36.8)**	**32 (27.4)**
Discuss complications related to type 1 diabetes and how to avoid them?	117	8 (6.8)	31 (26.5)	**47 (40.2)**	**31 (26.5)**
Collect a diabetes-focused health history for patients with type 1 diabetes?	116	8 (6.9)	30 (25.9)	**44 (37.9)**	**34 (29.3)**

Red shading indicates least confidence, yellow indicates mid-level confidence, and green indicates greatest confidence.

primary care settings (Figure 2) (20). Protocols for type 1 diabetes care in primary care settings need improvement, including more consistent A1C monitoring, the provision of basic type 1 diabetes education, and screening for comorbidities. Most importantly, PCPs seeing patients with type 1 diabetes desire additional resources to learn about and provide the best care.

Reported Barriers to Providing Type 1 Diabetes Care in the Primary Care Setting

Effect: Suboptimal Type 1 Diabetes Care

Endocrinology Referrals — 28% of PCPs reported long wait times when trying to get their type 1 diabetes patients to endocrinologists

Distance to Endocrinologists — 30% of PCPs reported a lack of endocrinologists in their geographic area

Patient Preferences — 59% of PCPs reported that it is more convenient for their patients with type 1 diabetes to receive diabetes care from PCPs

Lack of Resources — 72% of PCPs reported needing diabetes education materials, 69% reported needing information about technologies such as insulin pumps, and 59% reported needing more resources for behavioral health services

Suboptimal T1D Care

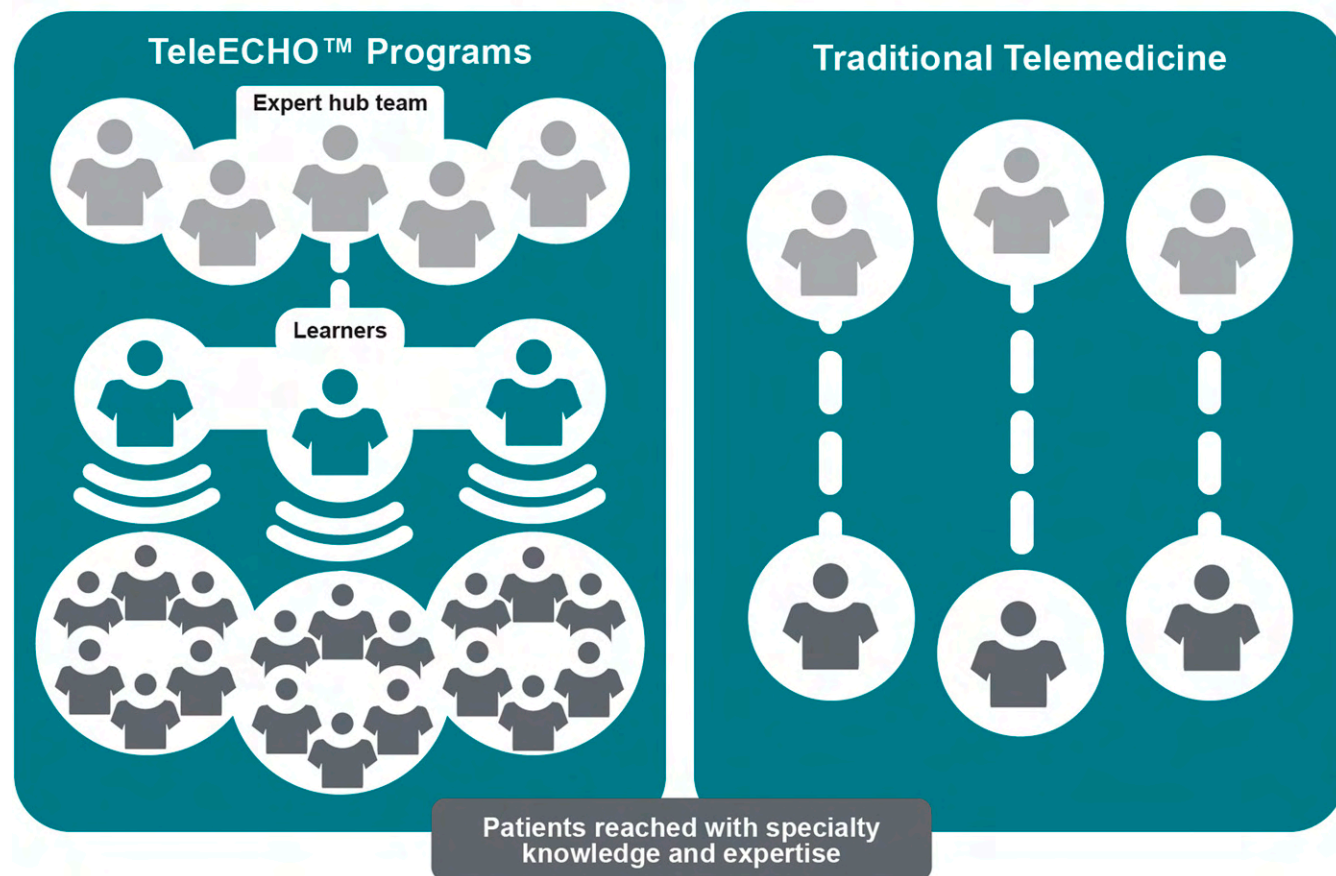**FIGURE 2** Barriers to providing type 1 diabetes care in primary care settings. T1D, type 1 diabetes.

FIGURE 3 Project ECHO is not traditional telemedicine and leverages tele-mentoring to interact with groups of providers to amplify knowledge and the effect of the specialist. Reprinted with permission from Project ECHO/ECHO Institute.

There are not enough endocrinologists to provide routine follow-up care to all patients with diabetes. Given this growing mismatch between supply and demand, the health care delivery system is in need of interventions that rapidly multiply provider efficacy. Programs such as Project ECHO (Extension for Community Healthcare Outcomes) can amplify specialty knowledge by linking primary care community practices ("spokes") to multi-disciplinary specialists ("hub") via tele-education, using the hub-and-spoke model (21–23). Whereas traditional telemedicine connects patients with a specialist for a one-to-one visit, Project ECHO amplifies specialty knowledge by building and leveraging local capacity (Figure 3).

The data presented here summarize PCP-identified education needs and will help target future programs. It is our hope that providing training and resources to PCPs will lead to improved diabetes care and reduce rampant inequities in health care delivery.

DUALITY OF INTEREST

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