



# Project ECHO Diabetes Cost Modeling to Support the Replication and Expansion of Tele-mentoring Programs in Non-research Settings

Eugene M. Lewit · Lauren E. Figg · Ananta Addala ·  
Stephanie L. Filipp · Rayhan Lal · Matthew J. Gurka · Jill Boylston Herndon ·  
Michael J. Haller · David M. Maahs · Ashby F. Walker

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## ABSTRACT

**Introduction:** Project ECHO Diabetes is a tele-education learning model for primary care providers (PCPs) seeking to improve care for patients with diabetes from marginalized communities. Project ECHO Diabetes utilized expert

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Project ECHO Diabetes Research Team members' names are listed in the "Acknowledgement" section.

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E. M. Lewit · for the Project ECHO Diabetes Research Team  
Department of Health Policy, Stanford University, Stanford, CA, USA

L. E. Figg · A. Addala · R. Lal · D. M. Maahs · for the Project ECHO Diabetes Research Team  
Department of Pediatrics, Division of Pediatric Endocrinology, Stanford University, Stanford, CA, USA

S. L. Filipp · M. J. Gurka · M. J. Haller (✉) · for the Project ECHO Diabetes Research Team  
Department of Pediatrics, Pediatric Endocrinology, University of Florida, PO Box 100296, Gainesville, FL 32610, USA  
e-mail: hallemj@peds.ufl.edu

R. Lal · for the Project ECHO Diabetes Research Team  
Department of Medicine, Division of Endocrinology, Stanford University School of Medicine, Stanford, CA, USA

"hub" teams comprising endocrinologists, dietitians, nurses, psychologists, and social workers and "spokes" consisting of PCPs and their patients with diabetes. This Project ECHO Diabetes model provided diabetes support coaches to provide additional support to patients. We sought to estimate the costs of operating a Project ECHO Diabetes hub, inclusive of diabetes support coach costs.

**Methods:** Data from Project ECHO Diabetes from June 2021 to June 2022 and wages from national databases were used to estimate hub and diabetes support coach costs to operate a 6-month, 24-session Project ECHO Diabetes

J. B. Herndon · for the Project ECHO Diabetes Research Team  
Key Analytics and Consulting, LLC, Sarasota, FL, USA

R. Lal · D. M. Maahs · for the Project ECHO Diabetes Research Team  
Stanford Diabetes Research Center, Stanford University, Stanford, CA, USA

A. F. Walker  
Department of Health Services Research, Management and Policy, University of Florida, Gainesville, FL, USA

E. M. Lewit (✉)  
2448 Emerson Street, Palo Alto, CA 94301, USA  
e-mail: eugenelewis@gmail.com

program at hubs (University of Florida and Stanford University) and spokes (PCP clinic sites in Florida and California).

**Results:** Hub costs for delivering a 6-month Project ECHO Diabetes program to five spoke clinics were \$96,873. Personnel costs were the principal driver. Mean cost was \$19,673 per spoke clinic and \$11.37 per spoke clinic patient. Diabetes support coach costs were estimated per spoke clinic and considered scalable in that they would increase proportionately with the number of spoke clinics in a Project ECHO Diabetes cohort. Mean diabetes support coach costs were \$6,506 per spoke clinic and \$3.72 per patient. Total program costs per hub were \$129,404. Mean cost per clinic was \$25,881. Mean cost per patient was \$15.03.

**Conclusion:** Herein, we document real-world costs to operate a Project ECHO Diabetes hub and diabetes support coaches. Future analysis of Project ECHO Diabetes will include estimates of spoke participation costs and changes in health care costs and savings. As state agencies, insurers, and philanthropies consider the replication of Project ECHO Diabetes, this analysis provides important initial information regarding primary operating costs.

**Keywords:** Project ECHO Diabetes; Diabetes; Cost; Tele-education; Hub; Spoke; Diabetes support coaches

### Key Summary Points

Project Extension for Community Healthcare Outcomes (ECHO) Diabetes is a hub-and-spoke tele-education learning model designed to improve outcomes for patients with diabetes treated in primary care clinics that serve high-need communities.

In addition to the traditional Project ECHO model, Project ECHO Diabetes provides diabetes support coaches to participating spoke clinics for additional patient-level engagement.

We report the cost at a hub of offering a 6-month, 24-session Project ECHO Diabetes program and the cost of diabetes support coaches for such a program.

The estimated hub cost of delivering a 6-month Project ECHO Diabetes program to five spoke clinics was \$96,873. The total cost for the program with five spoke clinics is estimated to be \$129,404, with a mean cost per clinic of \$25,881 and a mean cost per patient of \$15.03.

Hub and diabetes support coach costs combined with spoke participation costs and changes in health-care costs and patient outcomes associated with Project ECHO Diabetes will provide decision-makers with valuable information when they consider the replication of Project ECHO Diabetes.

## INTRODUCTION

Project Extension for Community Healthcare Outcomes (ECHO) Diabetes is a pragmatic multi-year clinical trial conducted by the University of Florida College of Medicine (UF) and the Stanford University School of Medicine (Stanford) to determine whether the Project ECHO Diabetes model can improve outcomes for patients with both type 1 diabetes (T1D) and type 2 diabetes (T2D) treated in primary care clinics serving medically underserved lower socioeconomic status (SES) communities [1–6]. Developed at the University of New Mexico, the Project ECHO<sup>®</sup> model employs a hub-and-spoke design in which experts at a hub provide tele-education learning opportunities and real-time consultative support on specific topics to primary care providers (PCPs) in a group of community clinics serving medically underserved communities called spokes [7].

In Project ECHO Diabetes, consistent with the traditional Project ECHO<sup>®</sup> model, participating spoke clinics receive weekly tele-education sessions including a didactic presentation and case study discussion using Zoom (Zoom Video Communications, San Jose, California,

United States), real-time access to support from multidisciplinary hub teams for complex medical decision-making, and access to an online repository of recorded tele-education sessions and other diabetes resources for PCPs [1]. In addition to the traditional Project ECHO<sup>®</sup> model, Project ECHO Diabetes provides access to diabetes support coaches for participating spoke clinics for additional patient-level engagement [5]. These coaches offer individualized peer support for interested patients, as well as providing other local diabetes management support services.

While the primary aim of Project ECHO Diabetes is to demonstrate the impact of this intervention on the ability of PCPs to provide specialty-level diabetes care and improve outcomes for people living with diabetes, individual patient and population outcome data will not be available until the project has completed the follow-up of all enrolled cohorts. As such, in this report, we focus on supporting a secondary goal of Project ECHO Diabetes, namely facilitating the replication of Project ECHO Diabetes in clinical, non-research settings. To provide timely information to decision makers considering replicating Project ECHO Diabetes programs, we analyzed the specific costs of maintaining a Project ECHO Diabetes hub. Specifically, we report on the estimated costs for a hub to deliver a standardized 6-month, 24-session Project ECHO Diabetes tele-health education program to a cohort of five community primary care clinics.

## METHODS

### The Project ECHO Diabetes Intervention

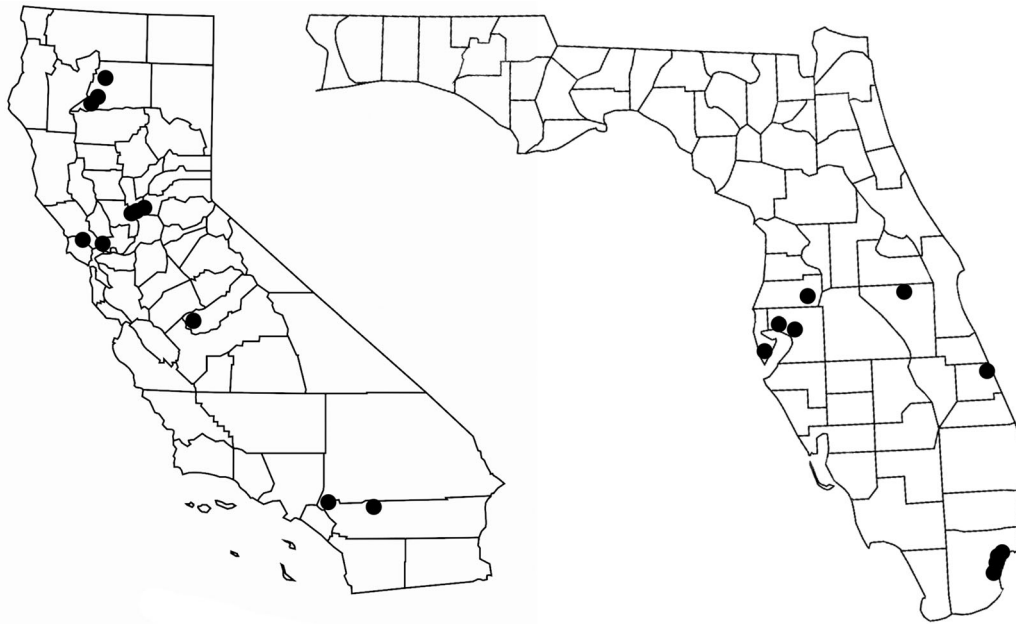
We used data from the primary Project ECHO Diabetes trial for the period June 2021 to June 2022. The main Project ECHO Diabetes study included a 1-year stepped-wedge clinical trial in which two programmatically identical 6-month Project ECHO Diabetes program modules were run sequentially in both Florida and California between June 2021 and June 2022 [5]. Six spoke clinics in California and four spoke clinics in Florida participated in the first module between

June 2021 and November 2021 (cohort 1). Five different spoke clinics in California and five different spoke clinics in Florida participated in the second module from December 2021 to June 2022 (cohort 2). Consistent with the intent to reach populations in geographic areas distant from the academic medical centers that served as the hubs, the recruited spoke clinics were distributed widely across both Florida and California and served a diverse population of patients. The names of participating clinics from both states in this study are given in Supplementary Table 1, and locations are shown in Fig. 1. Spoke clinics reported the numbers of their patients with diabetes on spoke intake forms collected prior to onboarding. Both hubs assembled multidisciplinary teams of adult and pediatric endocrinologists, certified diabetes care and education specialists (CDCESs), psychologists, nurse practitioners, dietitians, project managers, and others, with some differences between the institutions in the compositions of these teams. In addition, guest speakers provided educational sessions on topics relevant to their specific area of expertise. The weekly hour-long educational sessions, which included a didactic presentation and case-based discussions, were offered remotely via Zoom.

### Cost Calculations

The principal investigators of both the Stanford and UF study teams developed the personnel rosters and time budgets for hub staff that were needed to operate a 6-month, 24-session Project ECHO Diabetes program. These time and personnel budgets were based on the principal investigators' experience running variations in the program from 2019 to June 2022 and were further informed by information from interviews with and time diaries provided by Project ECHO Diabetes hub staff. Time spent in activities related to the research aspects of Project ECHO Diabetes (research training, data collection, patient recruitment, etc.) were excluded from the implementation cost analysis.

To value the time spent in hub activities, each member of the hub team was assigned an



**Fig. 1** Map of community health centers participating in Project ECHO Diabetes. In cohorts 1 and 2, UF worked with 9 and Stanford with 11 spoke clinics as Project

ECHO Diabetes research sites. All participating clinics were either Federally Qualified Health Centers or in an area of high deprivation [4]

hourly wage from national databases of wages in healthcare and academic/research organizations [8, 9] based on the team member's credentials and role in the project. Detailed wage information is provided in Supplementary Table 2. Assigned wages were multiplied by the estimated hours worked by each team member and summed over all the team members to get the wage costs of delivering a 6-month, 24-session Project ECHO Diabetes program. Total wages were increased by 36% (the mean fringe benefit rate at both UF and Stanford) to obtain total hub personnel costs.

In a similar fashion, each guest presenter was assigned an hourly wage based on their credentials. That wage was multiplied by 1.5 h, the estimated time needed to develop and present a 30-min ECHO didactic presentation, and summed over all the guest presenters to yield the value of the guest presenters' time during a 6-month Project ECHO Diabetes program. The price of a Zoom Business license for non-profits (\$20 a month) was multiplied by six to yield the cost of using Zoom for the teleECHO sessions [10]. For both UF and Stanford, personnel costs

were combined with the guest presenter and Zoom costs to get total hub costs for a 6-month Project ECHO Diabetes program.

Total hub costs were divided by the number of spoke clinics and the number of spoke clinic patients with diabetes to get the average cost per spoke clinic and average cost per spoke clinic patient with diabetes, respectively. The means of the UF and Stanford cost measures are referred to as the average hub costs for the intervention and are estimates of the hub costs of a Project ECHO Diabetes program delivered from a single hub.

### Diabetes Support Coaches Cost Calculation

Peer coaches are not a standard element of Project ECHO programs. As such, the costs of diabetes support coaches are reported as both standalone costs and as costs incorporated into the total cost of hub operations, as subsequent funding models for Project ECHO Diabetes may or may not include funding for diabetes support

coaches. The costs of the diabetes support coaches are reported on a per spoke clinic basis.

### Compliance with Ethics Guidelines

The Project ECHO Diabetes intervention and assessment is approved by the Stanford University and University of Florida institutional review boards (IRBs) and conducted in compliance with the standard of Good Clinical Practice and the Declaration of Helsinki of 1964 and its later amendments. Participating spokes and PCPs signed a “spoke articulation agreement” that outlined expectations for participation. Consent to participate was obtained from enrolled participants in the study. The consent process detailed the risks and benefits of participation in the study, along with an acknowledgement of future publication possibilities. The protocol number for Stanford University’s approved protocol is 54198 and the protocol number for the University of Florida’s approved protocol is UF IRB201800382.

## RESULTS

Table 1 shows the hub cost of a Project ECHO Diabetes program excluding the costs of the diabetes support coaches. The mean hub cost of

**Table 1** Estimated hub costs of a 6-month, 24-session project ECHO diabetes program (excluding the cost of diabetes support coaches)

Components of hub costs	Stanford	UF	Mean
Hub personnel including fringe	\$90,725	\$101,308	\$96,017
Guest presenters	\$938	\$534	\$736
Zoom	\$120	\$120	\$120
Total cost	\$91,783	\$101,962	\$96,873
Personnel hours	1200	1562	1381
Cost per hour	\$76.49	\$65.28	\$70.89

delivering a 6-month Project ECHO Diabetes program to four to six spoke clinics was \$96,873. Personnel costs at both Stanford and UF were the principal determinants of total hub cost. Costs at UF (\$101,962) were approximately 11% greater than at Stanford (\$91,783). This difference in cost was driven mainly by the difference in hours reported by the two hubs. Stanford, however, reported hourly costs which were 17% greater than UF. This indicates that Stanford used proportionately more high-wage personnel than UF since the same wage rates were used to value the Stanford and UF budgets.

Table 2 presents the hub costs averaged across spokes and across spoke clinic patients with diabetes. The mean cost per spoke clinic was \$19,673 and the mean cost per spoke clinic patient was \$11.37. These measures of cost are dependent not only on the total costs at each hub, but also on the number of clinics and patients in each cohort of spoke clinics. Because UF had 9 spoke sites and Stanford had 11, the cost per spoke clinic (\$22,658) was 36% greater for UF than for Stanford. However, cost per patient was similar between institutions, as the UF clinics served more patients with diabetes (8656 for UF and 8368 for Stanford).

Table 3 presents the cost of a diabetes support coach for a single spoke clinic and on a per patient basis. Diabetes support coach costs were estimated on a per spoke clinic basis and were considered scalable in that they would increase proportionately to the number of spoke clinics in a Project ECHO Diabetes cohort. The mean cost for a single spoke clinic was \$6,506 and the

**Table 2** Measures of hub costs for Project ECHO Diabetes (excluding the cost of diabetes support coaches)

Measures of hub costs	Stanford	UF	Mean
Total cost	\$91,783	\$101,962	\$96,873
Number of spoke clinics	5.5	4.5	5.0
Cost per clinic	\$16,688	\$22,658	\$19,673
Number of patients	8368	8656	8512
Cost per patient	\$10.97	\$11.78	\$11.37

**Table 3** Diabetes support coach costs per clinic and per patient

Cost of coaches	Stanford	UF	Mean
Cost for a single spoke coach	\$4880	\$8133	\$6506
Hours worked in 6 months	156	260	208
Cost per hour	\$31.28	\$31.28	\$31.28
Mean patients per clinic	1521	1923	1722
Cost per patient	\$3.21	\$4.23	\$3.72

mean cost per patient was \$3.72. The reason for the difference in costs between Stanford (\$4880) and UF (\$8133) was that diabetes support coaches at UF spokes worked 67% more hours than diabetes support coaches at the Stanford spokes (260 versus 156 h in a 6-month program). In addition, UF spoke clinics had 26% more patients ( $n = 1923$ ) on average than the Stanford spokes ( $n = 1521$ ), which narrowed the difference in the cost per patient between the two hubs. The extent of communication between patients and coaches varied greatly by spoke clinic and over time, making it challenging to describe the variation in coach costs among spokes more fully.

Table 4 presents the estimated combined hub and diabetes support coach costs of offering a 6-month, 24-session Project ECHO Diabetes program to a cohort of five spoke clinics using mean costs from Tables 1, 2, 3. These costs represent the cost of a program where hub and diabetes support coach costs are financed through funding from the hub, as in the program offered in Project ECHO Diabetes. The

**Table 4** Mean total costs for a five-spoke, 6-month Project ECHO Diabetes program

Mean cost per hub	\$96,873
Cost for 5 diabetes support coaches	\$32,531
Total cost	\$129,404
Mean cost per spoke clinic	\$25,881
Mean cost per patient	\$15.03

total cost for the program is estimated to be \$129,404, the cost per clinic \$25,881, and the cost per patient \$15.03. It is worth noting, however, that these estimates are only averages and that actual costs could vary, as we have seen in the more detailed parts of this analysis above. Differences in costs at the hubs, the hours worked by coaches, and the number of patients in the spoke clinics could all affect total costs, as well as costs per patient.

## DISCUSSION

Despite the widespread implementation of Project ECHO<sup>®</sup> programs to address a variety of health care issues, there appear to be few published studies of the costs of these programs [11] and even fewer still with regard to using Project ECHO<sup>®</sup> to improve outcomes in people with diabetes [12]. Moreover, Project ECHO Diabetes employed diabetes support coaches, which is a relatively novel addition to traditional Project ECHO<sup>®</sup> programs [13]. Additionally, some hub team time and resources were spent recruiting, training, and managing the diabetes support coaches in both the capacity of acting as a peer support coach and in research-specific activities. While efforts were made to eliminate all research-related activities from this analysis, it remains challenging to fully compare the “clinical” hub costs documented in this study with the costs of other Project ECHO<sup>®</sup> programs. Nonetheless, the estimated mean hub cost of a 6-month Project ECHO Diabetes program, excluding the costs of diabetes support coaches and research activities, was \$96,873. This is consistent with a previous report suggesting that the average annual costs of implementing an ECHO program are \$200,000 per year [14].

Although the Project ECHO Diabetes programs offered by Stanford and UF used the same curriculum and format, there were differences between UF and Stanford in total hub costs (11%), hub costs per personnel hour (17%), and staff hours (30%). Since the estimates presented here used the same wage rates to value the time of hub personnel, geographic and/or institutional differences in wage rates cannot account

for these differences. Differences in the composition of the hub teams, staff hours, and costs per personnel hour indicate the flexibility in the Project ECHO Diabetes model to deliver the intervention at the two hubs and explain some associated differences in cost. It may be possible to offer the Project ECHO Diabetes program with other combinations of personnel and hours worked and through nonacademic hubs, such as the ECHO Diabetes Action Network [15]. Some of these combinations may be less expensive than the ones used in this project and may be worth exploring in the future.

Stanford and UF hub costs per patient were similar. There were fewer spoke clinics in the UF cohorts but, on average, UF spoke clinics had more patients. Differences in the average size of the spoke clinics in a cohort can have a considerable impact on the cost per patient. For example, the five smallest spoke clinics among all the clinics in cohorts 1 and 2 had a total of 3120 patients with diabetes, while the five largest had 18,014 patients, almost six times as many. Accordingly, all things equal, the cost per patient in a cohort made up of the smallest clinics (\$41) would be almost six times as large as the cost per patient in a cohort made up of the largest clinics (\$7). That said, it is more important to consider the relationship between patient outcomes and the total cost of supporting all patients served by a Project ECHO Diabetes hub. This is an area for further research. Nonetheless, the issue of economies of scale may be an important component when considering real world hub costs, as costs beyond those related to diabetes support coaches are largely fixed.

Although an effort was made to exclude costs related to the research aspects of Project ECHO Diabetes in this analysis, it may be that some costs of the research, such as the time involved with maintaining good relationships with the spoke clinics to facilitate data collection for research, are captured in this analysis. In addition, clinics other than the 11 cohorts 1 and 2 spoke clinics participated in Project ECHO Diabetes during the June 2021 to June 2022 period. Some were education-only clinics which did not provide any data or receive support for diabetes support coaches, and some were from the pilot

period (pre-June 2021). The participation of these clinics may have raised the cost of the intervention, but by an indeterminate amount.

Personnel time was estimated using hourly wages from national databases of wages. Most ECHO<sup>®</sup> projects are implemented by academic centers. Although the databases did not include detailed wages for all positions in academic organizations, they included wages from health care and academic/research organizations and, therefore, should provide reasonable approximations. Appendix Table 2 provides the specific wage rates used and the sources for each of the hub personnel types. Other organizations seeking to implement Project ECHO Diabetes can evaluate how their local wage rates compare to those used here to inform efforts to extrapolate our findings to their settings.

Since the Project ECHO Diabetes program had been operational for several years before June 2021, the costs reported here may not fully reflect the costs of developing the Project ECHO Diabetes curriculum from scratch and of recruiting the spoke clinics in cohorts 1 and 2, which were recruited prior to June 2021. However, the costs to other organizations seeking to replicate Project ECHO Diabetes may be similar to those reported here. For example, in non-research applications, there may be fewer recruitment costs. The project may originate at the request of payers, such as Medicaid programs or health plans, or through organizational or community self-identification; in these cases, spoke sites may already be identified and do not need to be specifically recruited. However, the hub would still need to devote effort to build relationships and foster a learning community for successful implementation, and these costs should be considered. New Project ECHO Diabetes programs could also adapt existing curricula, such as that developed for the current project, as seen in Supplementary Table 3; consequently, rather than building the curricula from scratch, they would need to factor in only the costs associated with the personnel time required to update and deliver the program.

Project ECHO Diabetes was financed by a grant to the hubs which included funding for diabetes support coaches at each spoke.

Notably, a question on a survey of Project ECHO Diabetes spoke providers asked how much the respondent would be willing to pay to participate in Project ECHO Diabetes. Only 42% (31 of 88) of respondents indicated a willingness to pay to participate in Project ECHO Diabetes, suggesting that charging a fee to defray the hub costs of Project ECHO Diabetes may have a limited chance of success. While philanthropic support has been an important source of funding for Project ECHO programs to date, interest from private insurance companies and state and federally funded health care delivery programs has increased in recent years, suggesting that funding for ECHO programs from non-philanthropic sources may be feasible [16]. Our data, while currently limited to hub costs, provide an important benchmark for those seeking to replicate ECHO programs.

As noted above, a limitation of this study is that it does not include the costs of recruiting spoke clinics and of developing the curriculum for the trial. Both activities occurred prior to the study period. In addition, although efforts were made to exclude research costs, some personnel performed both research and program implementation activities, so it may be that some research costs are included in the reported cost estimates. Also, costs incurred by patients are not a part of this study and would be incidental to the changes in diabetes care offered by providers because of the intervention. Such costs may be important considerations in ECHO replication work, and future efforts should be made to capture that information. Lastly, although Project ECHO Diabetes involved two hubs and 20 geographically dispersed spoke clinics in two different states, it may be that the findings reported herein are not easily generalizable to certain other settings.

## CONCLUSION

Costs at the hubs of delivering Project ECHO Diabetes programs represent one component of the costs of the Project ECHO Diabetes intervention. Other studies are underway to measure spoke costs to participate in Project ECHO Diabetes and the changes in patient health care

costs associated with Project ECHO Diabetes. Those studies, when combined with this one, will present a fuller picture of the total cost of the Project ECHO Diabetes intervention. The total cost data, combined with research into the impact of Project ECHO Diabetes on patient care and health outcomes (in progress), will provide decision-makers with valuable information when they consider the replication of Project ECHO Diabetes.

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**Compliance with Ethics Guidelines.** The Project ECHO Diabetes intervention and assessment is approved by the Stanford University and University of Florida institutional review boards (IRB) and conducted in compliance with the standard of Good Clinical Practice and Declaration of Helsinki of 1964 and its later amendments. Participating spokes and PCPs signed a “spoke articulation agreement” that outlined expectations for participation. Consent to participate was obtained from enrolled participants in the study. The consent process detailed the risks and benefits of participation in the study, along with an acknowledgement of future publication possibilities. The protocol number for Stanford University’s approved protocol is 54198 and the protocol number for the University of Florida’s approved protocol is UF IRB201800382.

**Data Availability.** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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