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Research Article

A Pilot Study of a Diabetes Project ECHO for Healthcare Trainees

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Abstract

Background: As the prevalence of diabetes increases and the number of specialists, decline advanced diabetes training for those joining clinical practice is needed. One model to improve access to care for diabetes may be the tele-mentoring ECHO model. ECHO programs have traditionally targeted primary care providers, but no one has evaluated its use in those in pre-clinical practice such as physician assistant students (PAS).

Methods: Over 3 cycles of ECHO sessions from 2018-2021, we engaged 42 PA students. Using didactics and case-based learning via videoconferencing, the ECHO model allowed participants to receive tele-mentoring from an endocrinologist, a diabetes educator, and rotating specialists. Pre and post course surveys measured self-efficacy (13 questions), confidence in management (6), factual knowledge (12) and prescribing practices (11).

Results: Twenty-three PAS completed at least 50% of sessions; 18 completed both evaluations. On a Likert scale, self-efficacy increased from 3.18 (slightly competent) pre-intervention to 4.79 (competent) post ($p<.0001$). Confidence increased from 3.32 (neutral) to 5.33 (somewhat confident) ($p<.0001$). PAS correct answers for factual knowledge increased after intervention to 5.76 ($p<0.01$) Students' anticipated frequency of prescribing diabetes medication (n=12) increased from 1.73 (rarely) to 3.11 (sometimes) ($p<.001$) and of technology from 1.46 to 2.79 ($p<.001$).

Conclusions: Our ECHO model is the first to evaluate healthcare trainees. PAS showed improved DM self-efficacy, knowledge, and comfort prescribing medications. However, overall participation of students in live sessions was low. Further research is needed to assess incorporation of pre-recorded/ "OnDemand" ECHO sessions into healthcare trainee curriculum and evaluate patient level benefit.

Introduction

It is no secret that diabetes and its complications, deaths, and consequent societal burden have significantly impacted the United States over the last 30 years. Between 1990 and 2010, the prevalence of diabetes tripled and incidence doubled, with nearly half of the US diabetes population having poorly controlled diabetes. [1, 2] Specifically in Washington D.C., approximately 12.3% of the district's adult population were reported to have diabetes in 2014 and it was the fifth leading cause of death with 144 deaths, above chronic respiratory lower diseases, Alzheimer's, HIV/AIDS, or homicides. [3,4] Despite this urgent need to aggressively address the diabetes epidemic, studies demonstrate a shortage of adult endocrinologists to satisfy current and future demand. [5]

While the number of endocrine specialists continue to decline, NP and PA providers numbers continue to grow [6] and rapidly join the primary care work force. These providers' training in complex diabetes management is limited. Lack of endocrine expertise is concerning as it is well established that early, active endocrinologist involvement in longitudinal diabetes care results in delayed development of diabetes-related complications and improved survival. [4, 5]. In contrast, individuals with poor access to care are closely linked with poor glycemic control and consequent higher morbidity and mortality due to a multitude of sociodemographic barriers, including financial struggles, lack of social support, and educational insufficiency. [7-11] Therefore, there is growing interest worldwide in shifting the paradigm of healthcare delivery to connect complex endocrine patients in underserved communities with limited specialty expertise.

Recently, telemedicine has been increasingly implemented as a means to improve access to quality care for those who face geographic barriers. [12] With regards to diabetes care, incorporation of telemedicine has resulted in better glycemic control and high patient satisfaction. [13,14] A recent review of telemedicine and diabetes showed that the telemedicine platform was feasible and effective but also concluded that telehealth in diabetes should focus on how to leverage technology "to increase access to marginalized patient." [13] Project ECHO (Extension for Community Healthcare Outcomes) may be one way to improve access to care in vulnerable populations. ECHO, an innovative and collaborative telemedicine model, was first established at the University of New Mexico Health Sciences Center to improve access to treatment for hepatitis C in rural communities. [15] After being recognized as safe and effective, the model has been utilized for a myriad of health conditions, including HIV, osteoporosis, chronic pain, autism, behavioral health in geriatric populations, dermatological disease, and diabetes. [15-21] Using a specialized didactics framework and practice-based learning via videoconferencing technology, Project ECHO allows front-line clinicians and healthcare workers in underserved areas to receive "tele-mentoring" from trained specialists in academic centers and thereby, gain confidence and support to manage complex chronic diseases. The method has not only been deemed cost-effective, but also sustainable, as it engages primary care provided in a learning system, where they can go on to serve as knowledgeable resources in their communities. Project ECHO is currently being adopted globally in efforts to dramatically increase access to specialty treatment in both rural and urban underserved regions. In this article we are the first to report on the use of the ECHO model for health care professional students or those in pre-clinical practice.

Methods

Building Partnerships

In September 2018, George Washington University launched the first ECHO project in the National Capital Area supported by the MERCK Bridging the Gap grant titled: Reducing Disparities in Diabetes Care with the La Clinica Del Pueblo's (LCDP) Primary Care Providers. LCDP is a non-profit, federally qualified health center (FQHC) that primarily serves the Latino and immigrant populations of the Washington, DC region. This then expanded to multiple federally funded healthcare systems across the national capital area for a total of 3 cycles of ECHO with PAS participating in each cycle and further educational grants from Merck and Novo Nordisk with last cycle being completed at University of Washington given faculty movement but highlighting to ability to remotely give these programs.

Echo Sessions Development and Operation:

Using the Zoom telecommunication platform, specialists were able to engage with FQHC providers and PAS. The chronic disease targeted was diabetes. The core team of mentors included an endocrinologist and a diabetes educator, who led tele-mentoring sessions and case-based discussions on complex diabetes management. There were also rotating specialists from cardiology, mental health, podiatry, renal, ophthalmology that discussed prevalent diabetes-related complications with primary care providers. Over the course of 6 months and 14-16 total bi-monthly sessions, providers (n=65) (result reported elsewhere) and PA students (n=42) enhanced their diabetes knowledge and confidence in providing high quality care to underserved individuals with the disease.

Structure of an ECHO Session:

Didactics: After participant attendance is noted, the endocrinologist or another specialist, gives brief lectures on a diabetes-related topic. Topics covered range from insulin initiation and management to diabetes and co-morbid depression, to individualizing HbA1C goals, to cultural sensitivity in the Latino community. Each topic held specific learning objectives that were delineated for participants before the sessions. Topics were selected by specialists and then reviewed by primary care clinic directors prior to finalizing the curriculum.

Case presentations: During each session, a de-identified, multi-disciplinary patient case relating to the week's topic was discussed among PCPs and students with recommendations made for management by the specialists for cased based learning.

Evaluation

ECHO participants completed a survey before and after taking the course. The survey was designed to measure 1) self-assessed competency in providing high-quality diabetes care, 2) confidence in complex diabetes management, and 3) factual knowledge. For the 2nd and 3rd cycles, questions about current and anticipated prescribing practices were added. Survey items were developed following literature review of identifying quality care standards in diabetes management and evaluations used by previous diabetes ECHOs. 2, 21,22 Specific surveys included 20 measures of self-efficacy and confidence in individualized diabetes care, awareness of patients' socio-contextual determinants of health, screening for diabetes-related (Table 1).

Table 1: Pre-post questionnaire for self-efficacy (14 questions), confidence in management (6 questions) and prescribing practices (11 questions). Questions for self-efficacy and confidence reported on a 5 and 7 point Likert scale respectively and prescribing practices reported on a 4- point Likert scale.

	Self-Efficacy	Confidence	Prescribing Practices
A	Ability to collect a diabetes focused health history	Managing patients with type 2 diabetes?	Basal insulin therapy
B	Ability to educate clinic staff about patients with diabetes	Using the current Diabetes Guidelines (ADA and AACE) in your current practice	Multi-dose insulin therapy
C	Ability to give evidence-based nutritional advice	Managing hypertension and cholesterol in patients with diabetes	Non-insulin Injectable agents (GLP-1 RAs)
D	Ability to provide quality diabetes care	Initiating basal insulin	Sodium-glucose co-transporter-2 (SGLT-2I) inhibitors
E	Ability to discuss complications related to diabetes and how to avoid or delay them	Helping patients achieve their diabetes care/ self-management goals	Metformin GFR >30 and <45
F	Ability to demonstrate empathy toward patients with diabetes	Have an improvement in your quality metrics related to diabetes	Dipeptidyl peptidase-4 (DPP-4) inhibitors
G	Ability to identify social barriers for my patients with diabetes		Thiazolidinediones
H	Ability to provide appropriate interventions for overcoming social barriers for my patients		Continuous Glucose Monitoring
I	Ability to screen for microvascular complications of diabetes and interpret results		Insulin pumps
J	Ability to determine which diabetes patients are appropriate for insulin therapy		Referral of patients with insulin-requiring diabetes to endocrinology
K	Ability to manage insulin in a patient with diabetes		
L	Ability to identify contraindications to diabetes medications		
M	Ability to use the PHQ-9 scale and to recommend evidence-based depression treatment		
N	Ability to serve as an endocrinology resource for other providers in my community		

Complications, and knowledge of evidence-based medicine guidelines. Furthermore, there were 14 measures of factual accuracy with regards to complex diabetes management. All competency survey measures were reported on a 7-point Likert scale: not competent, vaguely competent, slightly competent, average amongst peers, competent, very competent, and teach others. Confidence survey measures were reported on a 7-point scale ranging from confident to absolutely confident. Factual survey item responses were question dependent as some involved checking all the right answers and others were basic multiple choice. Prescribing and referral practices for diabetes medications and technology were reported on a 4-point scale: always, sometimes, rarely, or never.

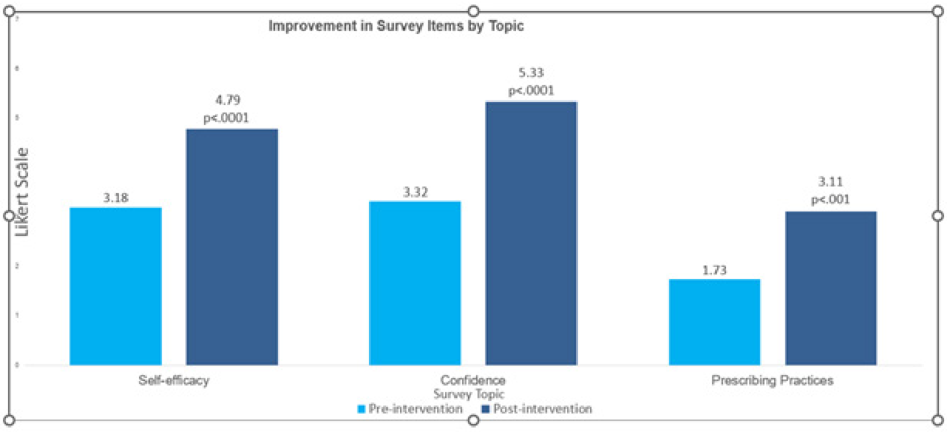

Figure 1: Overall average improvement in Ability (self-efficacy), Confidence, and Change in Prescribing Practices after participation in diabetes ECHO.

Statistical analysis

For each student, we calculated the mean response (competency, confidence, prescribing) or the total number of correct answers (knowledge) for each domain and time period. We compared these summary scores as well as individual survey items between time periods using a one-sample (paired) Student's t-test. In addition to the p value, we report the mean response or number of correct answers by time period and the difference between time periods.

Results

Over 3 cycles of ECHO sessions from 2018-2021, we engaged 42 PA students. The average session participant attendance was 52% (range 0%-100%) for students. Twenty-three PAS completed at least 50% of sessions and eighteen of these completed pre and post evaluation, with average attendance of 76% (range 56%-100%). On a 7-point Likert scale, self-efficacy increased from 3.18 (slightly competent) pre-intervention to 4.79 (competent) post (p<.0001). Confidence increased from 3.32 (neutral) to 5.33 (somewhat confident) (p<.0001) (Figure 1).

On factual knowledge questions, PAS were able to answer an average of 5.67 out of 12 correctly after the intervention, compared to 3.78 before (p<0.01). PAS' belief in their competence to be an endocrinology resource in the community increased from 1.94 to 4.06 (p<.0001). Twelve students completed a pre-post questionnaire on current and anticipated prescribing practices (cycles 2 and 3). Average current referral to endocrine for management of insulin-requiring diabetes increased from 2.36 (rarely) to 3.09 (sometimes) (p=.08). Students' anticipated frequency of prescribing diabetes medications increased from 1.73 (rarely) to 3.11 (sometimes) (p<.001). Specifically, anticipated prescribing practices for newer diabetes medications with cardiovascular and renal indications (GLP-1 receptor agonists and SGLT-2 inhibitors) increased from 1.79 to 3.25 (p<.001) while prescribing for basal insulin went from 1.75 to 3.25 (p<.001), and for multi-dose insulin from 1.67 to 3.00 (p <.001). Anticipated prescribing of diabetes technology (continuous glucose monitoring and insulin pumps) increased from 1.46 to 2.79 (p<.001). Full results are shown in (Table 2).

Table 2: Pre and Post Confidence, Ability and Perception of Prescribing Practices in Physician Assistant Students' that participated in ECHO.

Question	N	Pre-ECHO	Post- ECHO	Diff	P_Value
Ability A	18	3.33 (1.03)	4.83 (0.92)	1.50 (1.38)	<.0001
Ability B	18	3.11 (1.13)	4.78 (0.81)	1.67 (1.19)	<.0001
Ability C	18	3.22 (1.17)	4.94 (0.73)	1.72 (1.23)	<.0001
Ability D	18	2.78 (1.00)	4.50 (0.79)	1.72 (1.02)	<.0001
Ability E	18	3.39 (1.14)	4.89 (0.76)	1.50 (1.15)	<.0001
Ability F	18	5.11 (0.83)	5.67 (0.59)	0.56 (0.86)	0.03
Ability G	18	4.22 (1.06)	5.33 (0.59)	1.11 (1.08)	<.001
Ability H	18	3.33 (1.14)	4.83 (0.79)	1.50 (1.15)	<.0001
Ability I	18	2.61 (1.24)	4.67 (0.77)	2.06 (1.16)	<.0001
Ability J	18	2.39 (0.78)	4.39 (0.85)	2.00 (1.08)	<.0001
Ability K	18	2.33 (0.97)	4.33 (0.84)	2.00 (1.08)	<.0001
Ability L	18	2.83 (0.92)	4.50 (0.99)	1.67 (1.37)	<.0001
Ability M	18	3.89 (1.32)	5.33 (0.49)	1.44 (1.38)	<.001
Ability N	18	1.94 (1.00)	4.06 (1.30)	2.11 (1.02)	<.0001
Ability total	18	44.5 (11.44)	67.06(8.49)	22.56(12.39)	<.0001
Ability average	18	3.18 (0.82)	4.79 (0.61)	1.61 (0.88)	<.0001
Confidence A	18	3.06 (1.35)	5.22 (0.94)	2.17 (1.50)	<.0001
Confidence B	18	3.39 (1.61)	5.33 (0.84)	1.94 (1.51)	<.001
Confidence C	18	3.67 (1.46)	5.50 (0.79)	1.83 (1.38)	<.0001
Confidence D	18	2.61 (1.33)	5.17 (0.79)	2.56 (1.38)	<.0001
Confidence E	18	3.33 (1.37)	5.39 (0.78)	2.06 (1.66)	<.0001
Confidence F	18	3.89 (1.71)	5.39 (0.50)	1.50 (1.89)	<.01
Confidence total	18	19.94 (7.44)	32.0(3.76)	12.06 (7.76)	<.0001
Confidence Average	18	3.32 (1.24)	5.33 (0.63)	2.01 (1.29)	<.0001
RX Basal Insulin	12	1.75 (0.97)	3.25 (0.45)	1.50 (0.90)	<.001
Rx MDI	12	1.67 (0.89)	3.00 (0.43)	1.33 (0.98)	<.001
Rx GLP-1 RA	12	1.83 (1.03)	3.25 (0.45)	1.42 (1.00)	<.001

Rx Sglt2-I	11	1.82 (0.98)	3.27 (0.47)	1.45 (0.93)	<.001
Rx Metformin	12	1.75 (0.97)	3.17 (0.72)	1.42 (1.08)	<.001
Rx DPP-4I	12	1.75 (0.97)	3.08 (0.51)	1.33 (0.78)	<.001
Rx TZD	11	1.64 (0.81)	2.73 (0.90)	1.09 (0.83)	<.01
Rx CGM	11	1.55 (0.93)	2.73 (0.90)	1.18 (0.98)	<.01
Rx Insulin Pump	12	1.42 (0.79)	2.83 (0.72)	1.42 (0.79)	<.001
All RX	12	1.67 (0.86)	3.04 (0.44)	1.37 (0.82)	<.001
RX Medications	12	1.73 (0.91)	3.11 (0.44)	1.38 (0.82)	<.001
RX DM technology	12	1.46 (0.84)	2.79 (0.78)	1.33 (0.86)	<.001
Referral to Endo	11	2.36 (1.21)	3.09 (0.30)	0.73 (1.10)	0.08

Abbreviations: prescription (RX), Multi-dose insulin (MDI), Glucagon like peptide receptor-1 receptor agonist (GLP-1 RA), Sodium Glucose Co-transporter-2 inhibitor, Dipeptidyl peptidase 4 inhibitors (DPP-4I) thiazolidinediones (TZD), continuous glucose monitoring (CGM), Endocrinology (Endo)

Discussion

In 2003 the ECHO model was first launched to support access for hepatitis c treatment[15]. It has now been adopted nationally and international as a tool to help combat diseases in multiple specialties including diabetes. There has been and are ongoing evaluations of these programs to shown provider and patient level benefit for use of this tool [22]. A unique feature of our study is its' emphasis on incorporating "early learners" such as PA students into ECHO sessions. We strove to expand our audience beyond PCPs already in clinical practice and target participants in medical residencies, 4th year medical students and also PA and NP students given studies have shown that PAs and NPs are playing an increasingly prominent role in the primary care of medically complex patients. [23] However, despite the wide adoption of the ECHO model, to our knowledge our ECHO for diabetes is the first to evaluation it's benefit for students and use it to increase knowledge prior to clinical practice. Our pilot data shows the PAS students increase their confidence and ability and knowledge to support patients living with diabetes. Additionally, medical and technology inertia in diabetes is high for example despite newer medication and technology for diabetes becoming available use remain low especially in those of lower social-economic means and in minority populations [24, 26]. Our data shows that ECHO may help those such as PA students who rapidly become part of the PCP workforce, especially in rural and underserved be more likely to prescribe these needed therapies for diabetes. Despite increase in confidence and knowledge, Students did report increased anticipation rather than decreased numbers of referrals to endocrine. This may be because this was one of their first true experiences with the complexity of diabetes management and also, they may have been better understanding of appropriate person to refer to a specialist after ECHO. However, we did not ask why they would increase their referrals, so this is speculation.

We also recognize the limitations of our current study. Notably, our sample size of PAS is low and can affect statistical significant. We also acknowledge the overall retention of students and mean attendance for the session also was lower than anticipated. Informal discussion/feedback from students about the lower attendance highlights students' discomfort in asking preceptors during clinical rotations for "time off" from direct patient care in order to attend sessions. Given low attendance, there is ongoing evaluation of using recorded sessions or "on-demand" learning of ECHO sessions as part of the endocrine curriculum for a PA Program. There is also a need to follow students who participated in ECHO and evaluate their comfort and ability as compared to their peers once they are in clinical practice and evaluate if ECHO as part of their pre-clinical educational curriculum translated to improved patient outcomes.

In summary, our diabetes Project ECHO model is the first to evaluate value for healthcare professional students. PAS students did increase their confidence and ability to support patients living with diabetes and anticipated more use of diabetes mediations and technology after participation in the live ECHO session. Further research is needed to assess benefit once in clinical practice and also as an OnDemand/pre-recorded model to make it more accessible for student learning.

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Disclosures

Dr. Ehrhardt has been on an advisory board for Novo Nordisk and Dexcom and received investigator-initiated grants from Dexcom and Educational Grants from Novo Nordisk and Merck.

Ethical Approval

ECHO program was considered exempt from IRB given educational program. This program was reviewed by George Washington IRB for cycle 1-2(2018) and cycle 3 University of Washington (STUDY:00011372: Diabetes ECHO (10/16/2020). All data was kept secure in the REDCAP database. All pre-post surveys were conducted by Redcap. At the beginning of pre-post surveys participants could select "I do not wish to be included in research" if desired" and were excluded from analysis if box was checked.

Previous Presentations

These data from cycle one was present at the Annual Conference on the Science of Dissemination and Implementation in Health, co-hosted by the NIH and Academy Health Dec 2019 as a poster and then combined cycles at The American Diabetes Association national meeting in June 2022 as a virtual poster presentation.

Author Contributions

Nicole Ehrhardt, MD led the design of the study, reviewed the data analysis, drafted the manuscript and tables and figures, and completed all revisions and final review of the paper. Nicole Ehrhardt performed all duties of the primary author. Sanjana Rao contributed significantly to data analysis review and to the manuscript and completed all revisions and final review of the paper. Annette Aldous was the lead on the data analysis and significantly contributed to the manuscript and completed all revision and final review of paper.

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Conflict of Interest

No Conflict of interest.

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