REPORT TO CONGRESS

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Current State of Technology-Enabled Collaborative Learning and Capacity Building Models

U.S. Department of Health and Human Services

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Introduction

The healthcare marketplace is continually evolving in terms of technological innovation, payment models, delivery of care, and in addressing population health. These trends have implications for the healthcare workforce with regards to the demand for various types of services and the capacity of the workforce to meet this demand. Some challenges faced by the healthcare system are long-standing, such as shortages of providers in certain geographic regions and locales and improving quality of care, while others, such as the opioid epidemic are more recent. The nation continues to look for innovative ways to address both types of challenges, including mechanisms that enable the efficient dissemination of clinical knowledge throughout the healthcare system.

The primary means of training healthcare providers is through medical education which prepares trainees for certification and/or licensure in their healthcare professions. Such training provides practitioners with a broad knowledge base that is ideally current upon entering the workforce, and addresses conditions they are likely to treat. However, the current pace and breadth of innovation is remarkably fast moving, especially in primary care where providers are tasked with diagnosing, triaging, and treating patients presenting with a wide array of conditions. Moreover, the needs of local populations vary and in remote locations where access to specialists is limited, primary care practitioners may need to address conditions or problems that are within their scope of practice, but for which they would benefit from consultation with more knowledgeable health care professionals.

Addressing this perceived need for a continuing learning network is the primary motivation behind the relatively recent development of technology-enabled collaborative learning and capacity-building models that Congress asked the Department to examine. Such models connect primary care providers, often located in remote areas, with specialist teams that help mentor these providers in treating real patients with a given condition. Mentoring sessions typically involve the anonymous presentation of cases, discussion around options to treat or triage (when it becomes evident a patient requires the care of the specialist) such cases, and a didactic webinar similar to a continuing medical education session. Such models have the potential (and in certain circumstances have been shown) to help address important gaps in care for underserved populations. The ECHO Act (see Attachment A) speaks to other potential benefits of such models including improving provider retention, quality of care, and public health, and alleviating wait times, which Congress asked the Department to examine.

In this report, we share what we have learned about: (1) how such models are being used to address healthcare workforce capacity-building and quality improvement objectives; (2) what the existing evidence base tells us about the effectiveness of these models in achieving these objectives; and (3) where there are gaps in the evidence base that warrant further evaluation. The report, "Evaluation of Technology-Enabled Collaborative Learning and Capacity Building Models," prepared by the RAND Corporation and found at Attachment B, addresses these topics.

Congressional Charge

On December 14, 2016, the President signed into law the Expanding Capacity for Health Outcomes (ECHO) Act, Public Law 114-270, a freestanding piece of legislation that requires the Secretary to submit a report to Congress that examines "technology-enabled collaborative learning and capacity building models" and their impact on addressing a range of health conditions, health workforce issues, implementation of public health programs, and the delivery of health services to rural and other underserved populations. The Act also called for the Department to provide

recommendations on opportunities for increased adoption of such models and the role of such models in continuing medical education. The materials here respond to these requests.

Preparation of the Report

Given the cross-cutting nature of technology-enabled collaborative learning and capacity building models funded across the Department, the Office of the Assistant Secretary for Planning and Evaluation (ASPE) prepared this report in consultation with agencies across the Department.

ASPE contracted with the RAND Corporation to assist the Department in meeting this Congressional requirement, and working closely with the Department, prepared the report, "Evaluation of Technology-Enabled Collaborative Learning and Capacity Building Models," (see Attachment B below) which is summarized below along with the Department's assessment of potential future work that could contribute to further developing the evidence base for such models. In short, this report provides a brief history of such models, describes examples of implementations of the model (and one additional model that is similar in nature), reviews the current status of the evidence base for such models as of December 2018, and reports on input provided by a panel of technical experts on potential evaluation options.

The report that RAND prepared, along with the Department's related work, responds to the legislative requirements in the ECHO Act (see pg. 11 for greater detail on how the requirements in the ECHO Act were addressed).

Key Findings of the RAND Report (Attachment B)

- While the use of technology-enabled collaborative learning and capacity building models is widespread across the Department, the existing empirical evidence for their impact on patient and provider outcomes remains modest, though the evidence consistently shows positive effects in the areas that have been measured.

- An absence of standardized information collection, both in terms of the characteristics of individual implementations of the intervention as well as measurement of health outcomes, around these models hampers research on their effectiveness. This gap can be addressed as new efforts are put in place.

- To date, funders' efforts addressing technology-enabled collaborative learning and capacity building models have focused on their implementation, although some funders have devoted additional resources to evaluation in recent years. Given the modest evidence available on the effectiveness of this type of intervention, the Department believes that strengthening the evidence base on the effectiveness of such models would be helpful to determine how best to encourage expanded use of such models.

Summary of the RAND Report

Brief Overview of ECHO and ECHO-Like Models (EELM):

The ECHO Act defines a ''technology-enabled collaborative learning and capacity building model'' as a "distance health education model that connects specialists with multiple other health care professionals through simultaneous interactive videoconferencing for the purpose of facilitating case-based learning, disseminating best practices, and evaluating outcomes."

By providing links to specialists and a forum for case-based learning, such models are designed to equip generalist providers, many of whom are practicing in remote locations, with the confidence to treat patients in their practice who present with complex or unfamiliar conditions that are still within the scope of primary care. The original model of this type, Project ECHO (Project Extension for Community Healthcare Outcomes) originated in 2003 at the University of New Mexico through the work of Dr. Sanjeev Arora as a way of expanding access to care for hepatitis C (HCV) in rural New Mexico. Project ECHO established the key components of technology-enabled collaborative learning and capacity building model: a hub and spoke organization with a specialist or other clinical content expert who tele-mentors generalists in the care of a specific condition through a teleconferencing link, on a regular and recurring basis combining a didactic component with case study presentations by participants. Implementation of the Project ECHO model (and close variants) has since been expanded to address a wide variety of disease conditions across the US and internationally. Many of the replications are under the aegis of the ECHO Institute at the University of New Mexico which provides training in its model and maintains a data base on its participants. However, there are other examples of technology enabled learning models that share similar characteristics but may not be tracked through the ECHO Institute. Hence, throughout this document (as well as in RAND's report) we refer to technology-enabled collaborative learning and capacity building models as "ECHO and ECHO-like models" (EELM).

The use of technology-enabled collaborative learning and capacity building models is widespread across the Department. For purposes of this report, an intervention is considered to be an EELM if it provides interactive mentorship for participants who are often in remote areas through videoconferencing technology. EELM use a hub-and spoke model with an interdisciplinary mentor team at the hub site. EELM sessions are built on a case-based approach where participants present and discuss cases. An EELM project consists of multiple sessions at regular time intervals, usually bi-weekly for a fixed time period. Some EELM are time-limited to a set number of sessions. Others continue indefinitely. While recently the EELM approach has been applied to a growing number of disciplines, this report is limited to the use of EELM whose goals are health-related.

RAND's report includes an inventory of EELM implementations funded by the Department and a variety of other sources, arranged by the site of the EELM hub. These programs vary by content area; target mentees; number, frequency and duration of sessions; whether an intervention ends after a fixed number of sessions or is open ended; whether an intervention is geographically targeted; and how it is funded. This variation raises many interesting questions as to where EELM are most effective as an intervention and how EELM should be structured for best results, but also poses challenges in terms of evaluating such models. Given the diversity of EELM no single study or targeted suite of studies will answer all the questions raised by Congress in the ECHO Act.
The RAND report consists of these major parts:

- Nine case studies which illustrate some of the diversity across EELM programs in topical area, organizational placement, geographic focus and funding sources. (Appendix E of RAND report)
- An inventory of current and recent EELM projects supported by the Department and other funders in the United States, as well as examples of EELM programs in other English-speaking countries. (Appendix F of RAND report)

- A systematic review of the evidence of the effectiveness of EELM in affecting both provider- and patient-relevant outcomes.
- The results of a Technical Expert Panel held April 2018 that considered gaps in the evidence of the effectiveness of EELM and evaluation options for addressing these gaps.

Inventory:

The inventory describes the current landscape of EELM. RAND identified 585 ongoing and recent EELM for improving access to care and enhancing the quality of health care across the United States and in several international locations. Of these, 469 were based in the United States and 116 were international.

- As of 2018, Project ECHO had 165 affiliated hubs in 35 states and 24 countries; 101 of these hubs are located in the United States. Project ECHO also coined the term "superhub" to describe a site which has developed the capacity to train and mentor new hubs in the ECHO model. As of January 2018, there were nine superhub sites in addition to UNM listed worldwide on the Project ECHO website.
- A number of other EELM exist. For example, the Veterans Health Administration and the Department of Defense support their own EELMs (VA SCAN-ECHO and various DoD programs, respectively) covering a wide variety of conditions, with the largest offerings in the areas of HCV, pain management, and opioid use disorder.
- Within the United States, the average number of identified EELM was 9 programs per state, ranging from a low of 1 in states such as Mississippi and Louisiana to a high of 50 in Colorado. Numbers of EELM have been climbing rapidly in recent years, with 76 new programs identified in 2017 alone.
- The ten most common health content areas covered by EELM in our inventory were mental health, opioid use and other substance use disorders, chronic pain management, hepatitis C, autism spectrum disorders, cancer care, palliative care, HIV/AIDS, and diabetes. Together these accounted for almost half of all programs identified. Many of these topics correspond closely to conditions that are common and impactful for patients, and that many clinicians feel under-equipped to address.

The total amount of funding being devoted to EELM is difficult to discern. Most websites featuring EELM highlight a program name, topical area, training dates, location, and general objective. However, the funder was reported in only about half of all cases and the total dollar amounts from funding sources such as grants devoted specifically to EELM were seldom available. An EELM model is often part of a larger effort being funded.

Case Studies:

Appendix E of the RAND report contains nine case studies of EELM that collectively provide a snapshot of the diversity of such programs across target conditions, organizational locus, funding sources, geographic reach and other key aspects. Cases studies include: Project ECHO, the University of Washington; ECHO-Chicago; ECHO efforts based at the University of Rochester; VA SCAN-ECHO; Vermont Hub-and-Spoke; Oregon ECHO; Show-Me ECHO; ECHO Colorado, and the Weitzman Institute. The case study reports contain much more detail than what is summarized below.

- Many EELM exist alongside other telehealth-related mechanisms, including direct-care telehealth, e-consults, and other mechanisms. This suggests that EELM can be implemented as part of a suite of strategies for telehealth delivery frequently used alongside and complementing these other strategies.
- Human connections are important in making EELM "work" for generalist mentees, both in terms recruiting and retaining participants. Key informants frequently commented on how different subject areas require different designs, different implementations, perhaps different frequencies and durations of sessions, and even different approaches to evaluation.
- An important source of variation is the geographic spread of these programs. Some programs use EELM as a way to recruit specialist mentors from far away or to deliver content across state lines. Others limit their offerings to a particular state due to funding. One program explicitly mentioned the importance of local knowledge by ECHO specialist mentors as being important for generalist mentees to absorb not only how to practice, but also how best to access locally available resources and feel part of a practice community.
- The case studies also illustrate challenges and opportunities for evaluation within these programs, in part, due to the interests and requirements of their funders.

Evidence Review:

The evidence review was designed to identify and evaluate the current state of published evidence on the effectiveness of EELM, as of December 2018, including evidence of impact on providers, on the care provided, and on the outcomes patients experience from care. The evidence review examined academic and gray literature, targeting peer-reviewed publications that evaluated EELM. Studies included in the evidence base are found in Appendix C of the RAND report.

- The empirical evidence for the impact of EELM on patient and provider outcomes remains modest, though the evidence consistently shows positive effects in the areas that have been measured.
- The great majority of the 52 articles found with empirical results on the effects of EELM addressed only provider outcomes, such as provider satisfaction, changes in provider knowledge, changes in provider confidence or self-efficacy, and changes in self-reported provider behavior. Of these 43 articles, 34 provided no between-subjects comparison group, raising questions as to what the observed outcomes would be in the absence of intervention, or what the outcomes would be after participation in an alternative intervention, such as online self-guided coursework. Several other limitations were apparent in these studies, including the possibility of the lack of baseline data and publication bias. No studies evaluated whether change in care provision continues after the conclusion of training through EELM.
- Fifteen studies examined patient-related outcomes associated with EELM implementation, such as sustained viral response for hepatitis C, but none of these studies were randomized. Although these studies had limitations they provide evidence that EELM can improve outcomes, at least in some cases.
- More evidence is required before conclusions can be drawn about the efficacy of EELM interventions. The quality of evidence for the effectiveness of EELM is generally rated as "low" or "very low," according to a standardized system for grading evidence. However, in the field of health services research (of which the evaluation of EELM is an example),

implementation complexities and constraints can contribute to adoption of less rigorous evaluation study designs. This, in turn, may contribute to low quality of evidence scores.

- Only a small number of studies to date have included measurements of cost, including the cost of implementing EELM and the costs of patient care delivered under these programs, as well as comparison costs in the absence of EELM. Such information would be especially useful to funders as they consider potential expansions of EELM.
- Published evaluations frequently do not include details of how EELMs are implemented (e.g., frequency and duration of sessions), which would be helpful in identifying under what conditions EELMs may be successful.

Technical Expert Panel:

On April 9, 2018, RAND and ASPE hosted a technical expert panel (TEP) meeting in Washington, DC to examine the evidence base for EELM, identify gaps and explore a potential research agenda to expand that evidence base. Participants included representatives from EELM hubs, researchers who had studied EELM, evaluation methodologists, and Federal personnel familiar with EELM.

- The TEP identified seven categories of research gaps: implementation and dissemination; impacts on health (and other) outcomes for patients; impacts on provider/workforce outcomes; effects on population health and health equity; health system impacts, such as cost, efficiency, and access; policy and funding considerations; and optimal study designs.
- The TEP also identified key themes to consider in developing an EELM evaluation portfolio including:
  - EELM programs have different goals/purposes requiring unique metrics.
  - Heterogeneity in implementation, with varying degrees of fidelity to a "model" implementation.
  - Limited methodological rigor in studies conducted to date.
  - Barriers to high quality evaluation of EELM include: lack of resources, the perceived urgency to implement rather than evaluate, limited evaluation capacity or expertise, challenges with collecting or obtaining high-quality data, and challenges with defining and collecting meaningful measures of impact.
  - It is important to balance enthusiasm for the promise of EELM, which led to significant demand for this model, with the need for a strong evidence base.
- The TEP identified potential short and longer term strategies for addressing these themes through future work and studies.
  - Building consensus around EELM's various intended purposes and better understanding the different ways it is implemented.
  - Developing a ready-to-use (but customizable) "evaluation kit" for sites to use.
  - Carrying out qualitative evaluations that use existing programs as the unit of study, to answer questions such as "What makes a hub successful?"
  - Conducting pre-post studies with a control group, with specific attention to choosing comparators and patient outcomes that are clinically meaningful.
  - Building evaluation components into grant funding, both public and private.
  - Building capacity related to evaluation of EELM through annual seminars/conferences or the creation of a resource center.
  - Conducting studies of the persistence of EELM's impacts on various outcomes.
  - Performing stepped-wedge trials rolling out the intervention over time.
  - Establishing policies to support more consistent funding for evaluation.

Recommendations

The proposals in this section were developed within the Department and were considered in light of the findings in the RAND report. RAND's report highlights the need for additional evidence on the situations in which EELM may be effective at achieving goals such as building new capacity amongst primary care providers practicing in underserved areas to treat various conditions and improving quality of care for treatment of conditions that are already frequently addressed by such providers. Although the existing evidence base shows some promising signs of this type of intervention's effectiveness, more evidence is needed to better understand the extent of this type of intervention's effectiveness in addressing various conditions and purposes. Hence, the recommendations that follow focus on expanding what is known about the effectiveness of EELM. Building this evidence base will help illuminate where and under what circumstances EELM are effective interventions, which could inform any future considerations regarding further adoption of such models. The recommendations that follow are based on these principles:

- Consider approaches that make use of existing government resources and other mechanisms that facilitate and harness creative thinking of private individuals and organizations.
- Tie the quality of evidence generation to available funding.
- Focus on a priority set of conditions where expanded provider knowledge is particularly pertinent and whose evaluation may be generalizable to varying extents to other similar types of conditions.
- Give attention to EELM's role in both capacity building and quality improvement.[a]

The intent of such a research portfolio would be to identify how EELM may improve both access to care and the quality of care by better understanding under what circumstances and for what purposes EELM "works" and when it does not including consideration of its potential to build capacity and improve quality; to identify attributes of successful EELMs, the duration of the EELM effect, and whether detectable positive effects of EELM extend beyond participants to other providers in their practices.

Activities that could be helpful in strengthening the EELM evidence base include:

- Enhancing the capacity to perform evaluations –
  This activity could take multiple forms. One finding of the RAND report is that evaluations that have been performed have often not reported on key details related to how a particular implementation of the model has been designed (e.g., frequency and duration of trainings, number of attendees, costs of the program, and funding sources). Use of a standardized EELM data set would facilitate comparisons across EELM programs. TEP participants also thought it would be helpful to assemble a list of evaluation outcomes and define best practices for their measurement, which could help improve the consistency and rigor with which they are analyzed. Hence, development of an EELM "evaluation toolkit," which could be customized for use in specific circumstances given the varied contexts within which such models are implemented, could help facilitate future evaluations. Another option to enhance evaluation capacity would be to directly fund organizations implementing EELMs

[a] The RAND report indicates that EELM may be used to either expand existing capacity to treat various conditions or improve the quality of care for conditions that are already widely treated in primary care. These represent distinct use cases of EELM to be evaluated.

to develop in-house expertise in evaluation and provide technical assistance in evaluation through a training center.

- Directly supporting evaluations –
  As noted above, in the past, funders have focused most of their resources on supporting implementation of EELMs, and with rare exceptions such as the Center for Medicare & Medicaid Innovation funded effort, discussed in the full report, have generally devoted little or no funding to evaluation. Through our various consultations with stakeholders, some funders expressed to us that their organizations were focused on identifying "disruptive innovations" that could potentially result in dramatic improvements in care delivery. They saw EELM as a potential game changer and wanted to rapidly expand its availability. At the same time, now that the model has spread geographically and addresses a relatively wide variety of conditions, some funders have taken a greater interest in evaluating its impact.

  To maximize existing resources, an evaluation could be built on top of one or more existing or planned implementations of EELMs. Generally, evaluation is more effective when planned in advance of implementation for reasons discussed in greater detail in RAND's report. In the case of federally-supported EELMs, they are often supported as one intervention among others that may serve as substitutes or complements. This makes distinguishing the unique contribution of EELM to observed outcomes challenging in an evaluation, unless site level data have been collected and it is possible to identify sites that only implemented EELM. Even when such information is available, it is possible that there may be something unique about sites that elect to implement EELM, which causes the sites to be more or less successful in addressing a healthcare priority (regardless of whether they had chosen to implement EELM). Hence, without randomization around which sites implement the intervention, drawing firm conclusions on causality is not possible. Regardless, evaluations of many interventions in healthcare involve various methodological limitations for similar reasons, and there is still value in retrospective evaluation in building the evidence base.

  More broadly, future research could specify the types of evidence that funders are interested in generating on EELM. Funding could be made available for implementation and/or evaluation. A portfolio of methodologically rigorous proposals could be solicited from academic institutions and other appropriate parties.

- Conditions to evaluate –
  Future evaluation efforts could focus on EELM applications that improve the ability of primary care providers to address conditions with which they may lack familiarity or confidence in treating (e.g., substance use disorders, pain management), as this was a key originating intent of EELM, but attention could also be given to evaluating the ability of EELM to improve quality of care for conditions regularly treated in primary care, as this potentially applies to a wider set of conditions. For example, priority areas could include substance use disorders, behavioral health, pain management, diabetes, HIV/AIDS, or palliative care, which would help fill gaps in evidence on EELM identified in the RAND report. Depending on the level of funding available, secondary evaluations could be pursued in areas that have not received as much attention to date or are using study designs that are more robust. For example, the effectiveness of EELM in addressing children with medical

complexity could be evaluated, in particular children affected by Zika who are expected to have extensive long-term healthcare needs. Another option would be to compare knowledge gained and/or treatment competency improvements resulting from use of traditional models of CME versus EELM case-based and didactic learning sessions.

How This Report Addresses Requirements in the ECHO Act

Section 3 of the ECHO Act sets out its requirements for examination of ECHO and ECHO-like models (EELM), consultation with stakeholders, and submission of a report with prescribed contents. RAND's report, "Evaluation of Technology-Enabled Collaborative Learning and Capacity Building Models," including its accompanying evidence review, inventory of EELM activities, case studies, and the recommendations contained in the Department's summary statement address various elements of these three requirements. The below sections describe in greater detail how requirements around examination, inventorying, and consultation were addressed. Following this discussion is a table that maps where specific elements are addressed in the RAND report.

Examination:

The Act called for examining the impact of EELM on addressing "mental and substance use disorders, chronic diseases and conditions, prenatal and maternal health, pediatric care, pain management, and palliative care; addressing health care workforce issues, such as specialty care shortages and primary care workforce recruitment, retention, and support for lifelong learning; the implementation of public health programs, including those related to disease prevention, infectious disease outbreaks, and public health surveillance; and the delivery of health care services in rural areas, frontier areas, health professional shortage areas, and medically underserved areas, and to medically underserved populations and Native Americans."

The Department's consultation efforts combined with research performed by RAND have touched upon many of these topics. The Department focused its examination efforts on the following tasks: (1) understanding the breadth and diversity of EELM interventions and (2) reviewing the existing evidence base on the impact of EELM on provider and patient outcomes.

EELM Activity Funded by the Federal Government and Other Sources:

In addition to assessing the evidence for EELM, the Act also called on the Department to analyze "efficient and effective practices used by States and communities that have adopted such models, including potential cost-effectiveness of such models" and provide a "list of such models that have been funded by the Secretary in the 5 years immediately preceding" publication of this report, including "Federal programs that have provided funding for such models." The inventory of EELM activities (including federally funded and EELMs receiving funding through other sources) and case studies of local implementations of EELMs, which include discussion of ongoing evaluation work (where applicable), some of which includes potential cost savings, are intended to address these requirements.

Consultation:

In performing the above examinations, the Act required the Department to consult with "public and private stakeholders with expertise in using technology-enabled collaborative learning and capacity building models in health care settings." These consultations took many forms. In September 2017, Department staff attended the 2017 Meta-ECHO conference in Albuquerque, New Mexico. This meeting convened approximately 650 people with interests or involvement in EELM. During this

conference, staff met individually with an array of attendees from state governments; academic institutions, including many EELM "hubs;" the health care sector, including safety net providers; foundation funders; insurance companies; and the ECHO Institute staff. Contacts made through attendance at this meeting helped refine how best to proceed with this report.

Following Meta-ECHO, Department staff attended two ECHO sessions, one on care for HIV and one on HCV, to better understand the dynamics of an EELM intervention. Staff also met with representatives of several EELM projects.

In April 2018, the Department convened a Technical Expert Panel (TEP) meeting, facilitated by RAND, to explore existing evidence on the effectiveness of EELM programs, evidence gaps, and how they might be addressed. Attending the TEP were representatives of EELM programs, health services researchers, evaluation methodologists, foundation representatives, and Department staff involved in EELM. Advice from the TEP helped shape the Department's research recommendations.

On November 16, 2017, the Health Resources and Services Administration focused part of its 2017 Rural Health Day on ECHO activities, with several grantees participating. This was also an opportunity to share thoughts on the report to Congress. Moreover, throughout the year, input on examination activities and preparation of the report, including its recommendations, was sought from staff across the Department.

Table Mapping Requirements to Contractor Report:
The below table identifies specific examples illustrating how elements of the Act's requirements for the report to Congress are addressed in the RAND report. The examples are not exhaustive. Given the numerous requirements contained in the Act, the Department pursued work thought to be most informative, given available time. Recommendations required in the Act are discussed above.

Report Requirement	Where Addressed	Comments
Analysis		
Sec. 3(b)(2)(A)(i): Use and integration of models by health care providers	Addressed throughout the RAND report. Chapter 2, "EELM in Context" (pps. 3-20) gives an overview of EELM, how defined, their history, recent trends, and strengths and weaknesses	The case studies found in Appendix E, beginning on Page 118 illustrate the ways EELM models have been used to address various conditions in different settings
Sec3(b)(2)(A)(ii) Impact on provider retention including in Health Professional Shortage Areas	Addressed in a separate report prepared by The Lewin Group, "Impact of Participation in Technology-Enabled Collaborative Learning and Capacity Building (ECHO) Models on Provider Retention," to be posted on the ASPE website	
Sec. 3(b)(2)(A)(iii): Impact of models on the quality of	Quality of Care: The RAND report cites studies examining the impact of EELM on	The case studies describe experiences addressing quality of care: see, for example, ECHO

and access to care	the quality of care for patients with HCV (p. 9) and care for dementia/ gerontology (p.40). The HCV study found quality of care to be similar at hubs and spokes. Access to Care: EELM's potential to increase access to care is discussed throughout the report. Specific examples addressing HCV are found on pps. 6-9 and pain management on pps. 39-43. Studies citing impact on access to care and for a range of conditions are listed in Table C.1. that begins on page 79.	Chicago's work with HCV on page 126, and the Vermont hub and spoke program on pages 142-143. Reports on EELM's ability to increase access to specialty care are found in the case studies of ECHO Chicago (p 125-127) and the Veterans Health Administration (p. 134-136). Expanding access to opioid use disorder care is discussed in the Vermont hub and spoke example on p. 144. The Weitzman Institute has expanded access to many types of specialty care, including HCV, HIV, MAT, complex care management, and LGBT health (p. 161). Similarly, the University of Washington also provides access to a wide range of specialists (p. 122). Both of these programs serve large geographic areas.
Sec. 3(b)(2)(A)(iv): Barriers faced by health care providers, States, and communities in adopting such models	Barriers to adoption of models are discussed throughout the report and summarized on pps. 17-19. A discussion of barriers to high quality evaluation of EELM is found beginning on p. 50.	
Sec. 3(b)(2)(A)(v): Impact of models on the ability of local health care providers and specialists to practice to the full extent of their education, training, and licensure, including the effects on patient wait times for specialty care	EELM's ability to expand the capacity of individual providers to practice to the full extent of their education, training and licensure is presented as one of the two major "poles" upon which EELM are organized (p.46).	The ECHO Chicago case study is a good example of the reported effect of EELM on wait times (p. 126): The prevalence of diagnosed ADHD was only approximately 1 percent among the pediatric populations of the FQHC partners, epidemiological data suggested an actual prevalence of ADHD closer to 7–9 percent. Providers explained that they were not screening or diagnosing given that wait times were more than a year for referrals to specialists. Three years into the ECHO-Chicago Pediatric ADHD program, data showed that 4–6 percent of pediatric populations in the spoke clinics were being

		diagnosed with ADHD, which is closer to the estimated prevalence.
Sec. 3(b)(2)(A)(v): Efficient and effective practices used by States and communities, including potential cost-effectiveness		Examples of state support for EELM can be found in the case studies, including the University of Washington ECHO which receives support from the state health department (p. 124), the Oregon ECHO network (p. 146) and Show Me ECHO in Missouri (p. 152).
Inventory		
A list of models that have been funded by the Secretary in the 5 years immediately preceding such report	Executive Summary, p. ix Methods, pps. 21-22 Findings, pps. 28-34 Appendix F is a listing arranged by State of EELM activity supported by the Department and others.	

Attachment A

Public Law 114-270, the ECHO Act

SECTION 1. SHORT TITLE.

This Act may be cited as the “Expanding Capacity for Health Outcomes Act” or the “ECHO Act”.

SEC. 2. DEFINITIONS.

In this Act:

(1) Health professional shortage area.--The term “health professional shortage area” means a health professional shortage area designated under section 332 of the Public Health Service Act (42 U.S.C. 254e).

(2) Indian tribe.--The term “Indian tribe” has the meaning given the term in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 5304).

(3) Medically underserved area.--The term “medically underserved area” has the meaning given the term “medically underserved community” in section 799B of the Public Health Service Act (42 U.S.C. 295p).

(4) Medically underserved population.--The term “medically underserved population” has the meaning given the term in section 330(b) of the Public Health Service Act (42 U.S.C. 254b(b)).

(5) Native Americans.--The term “Native Americans” has the meaning given the term in section 736 of the Public Health Service Act (42 U.S.C. 293) and includes Indian tribes and tribal organizations.

(6) Secretary.--The term “Secretary” means the Secretary of Health and Human Services.

(7) Technology-enabled collaborative learning and capacity building model.--The term “technology-enabled collaborative learning and capacity building model” means a distance health education model that connects specialists with multiple other health care professionals through simultaneous interactive videoconferencing for the purpose of facilitating case-based learning, disseminating best practices, and evaluating outcomes.

(8) Tribal organization.--The term “tribal organization” has the meaning given the term in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 5304).

SEC. 3. EXAMINATION AND REPORT ON TECHNOLOGY-ENABLED COLLABORATIVE LEARNING AND CAPACITY BUILDING MODELS.

(a) Examination.--

(1) In general.--The Secretary shall examine technology-enabled collaborative learning and capacity building models and their impact on--

(A) addressing mental and substance use disorders, chronic diseases and conditions, prenatal and maternal health, pediatric care, pain management, and palliative care;

(B) addressing health care workforce issues, such as specialty care shortages and primary care workforce recruitment, retention, and support for lifelong learning;

(C) the implementation of public health programs, including those related to disease prevention, infectious disease outbreaks, and public health surveillance;

(D) the delivery of health care services in rural areas, frontier areas, health professional shortage areas, and medically underserved areas, and to medically underserved populations and Native Americans; and

(E) addressing other issues the Secretary determines appropriate.

(2) Consultation.--In the examination required under paragraph (1), the Secretary shall consult public and private stakeholders with expertise in using technology-enabled collaborative learning and capacity building models in health care settings.

(b) Report.--

(1) In general.--Not later than 2 years after the date of enactment of this Act, the Secretary shall submit to the Committee on Health, Education, Labor, and Pensions of the Senate and the Committee on Energy and Commerce of the House of Representatives, and post on the appropriate website of the Department of Health and Human Services, a report based on the examination under subsection (a).

(2) Contents.--The report required under paragraph (1) shall include findings from the examination under subsection (a) and each of the following:

(A) An analysis of--

(i) the use and integration of technology-enabled collaborative learning and capacity building models by health care providers;

(ii) the impact of such models on health care provider retention, including in health professional shortage areas in the States and communities in which such models have been adopted;

(iii) the impact of such models on the quality of, and access to, care for patients in the States and communities in which such models have been adopted;

(iv) the barriers faced by health care providers, States, and communities in adopting such models;

(v) the impact of such models on the ability of local health care providers and specialists to practice to the full extent of their education, training, and licensure, including the effects on patient wait times for specialty care; and

(vi) efficient and effective practices used by States and communities that have adopted such models, including potential cost-effectiveness of such models.

(B) A list of such models that have been funded the Secretary in the 5 years immediately preceding such report, including the Federal programs that have provided funding for such models.

(C) Recommendations. Recommendations to reduce barriers for using and integrating such models, and opportunities to improve adoption of, and support for, such models as appropriate.

(D) Opportunities for increased adoption of such models into programs of the Department of Health and Human Services that are in existence as of the report.

(E) Recommendations regarding the role of such models in continuing medical education and lifelong learning, including the role of academic medical centers, provider organizations, and community providers in such education and lifelong learning.

Attachment B

RAND Report

Research Report

Evaluation of Technology-Enabled Collaborative Learning and Capacity Building Models

Materials for a Report to Congress

Shira H. Fischer, Adam J. Rose, Ryan K. McBain, Laura J. Faherty, Jessica Sousa, Monique Martineau

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Preface

Technology-enabled collaborative learning and capacity-building models, such as Project ECHO (Extension for Community Healthcare Outcomes), have spread rapidly over the past 15 years across the United States, as well as into other countries. However, little is known about the optimal conditions under which these models improve care and achieve other objectives, such as improving workforce retention in medically underserved areas. This report is the culmination of the project "Expanding Capacity for Health Outcomes (ECHO) Act Report to Congress: A Study of Technology-Enabled Collaborative Learning and Capacity Building Models." The Office of the Assistant Secretary for Planning and Evaluation (ASPE) engaged the RAND Corporation to assist in developing a report to Congress that responds to the ECHO Act.

This research was funded by ASPE and carried out within the Payment, Cost, and Coverage program in RAND Health Care.

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Summary

Across the United States and internationally, multiple health care sites have embraced technology-enabled collaborative learning and capacity-building models. Such models connect generalist providers, often located in remote areas, with specialist teams that help train these providers to deliver care for patients with conditions that they might not feel adequately prepared to handle but are nevertheless within their scope of practice. The first implementation of this model, Project ECHO (Extension for Community Healthcare Outcomes), launched in 2003 in New Mexico. Project ECHO began with a focus on supporting the management of patients with the hepatitis C virus (HCV) in rural regions of the state. This model has since been adapted to many different sites within the United States and other countries, and these programs now address a wide range of medical conditions and other issues that providers face. We refer to such adaptations as ECHO and ECHO-like models (EELM).[1]

Although the publication of a landmark journal article (Arora, Thornton, et al., 2011) describing the impact of Project ECHO generated much enthusiasm within the medical and health care policy communities, the evidence base to date for whether or how EELM work remains modest. Many efforts have focused on rapidly diffusing the original model or closely related adaptations, with much less attention to conducting systematic evaluations of its effect on key outcomes.

This report is the culmination of efforts by our team of researchers at the RAND Corporation on behalf of the Office of the Assistant Secretary for Planning and Evaluation to collect and analyze information on what is currently known about EELM, what knowledge gaps remain, and how to address those gaps.

What We Did

To document what is known about EELM, we first gathered an inventory of active EELM across the United States and in select international countries, as well as the most frequently addressed topic areas and funding sources. Secondly, based on an extensive literature search, we summarized the findings of 52 peer-reviewed articles presenting empirical evidence for the effectiveness of EELM. We also conducted discussions with key informants to gain a more detailed understanding of nine specific implementations of EELM, presented as case studies in Appendix E.

In addition, RAND convened a day-long Technical Expert Panel (TEP) meeting to gain insight on research and evaluation options that would help fill the information gaps on EELM and inform potential future evaluations. We also gathered data on a set of recently completed

[1] All references to ECHO that do not refer explicitly to the ECHO Act refer to those programs based on Project ECHO.

evaluations to illustrate a range of possible methodological choices for future EELM evaluations of varying complexity.

Inventory Findings

In total, we identified 585 ongoing and recent EELM for improving access to care and enhancing the quality of health care across the United States and in several international locations. Numbers of EELM have been climbing rapidly in recent years; we identified 88 new programs in 2017 alone. The ten most common health content areas covered by EELM in our inventory were mental health, opioid use disorder and other substance use disorders, chronic pain management, HCV, autism spectrum disorders, cancer care, palliative care, human immunodeficiency virus/acquired immune deficiency syndrome, and diabetes. Together, these accounted for almost half of all programs identified.

Evidence Review Findings

RAND reviewed the evidence for the effectiveness of EELM to impact both provider-relevant outcomes and patient-relevant ones. We found that the empirical evidence for the impact of EELM on patient and provider outcomes remains modest, though the evidence consistently shows positive effects in the areas that have been measured.

The great majority of the 52 articles we found with empirical results on the effects of EELM addressed only provider outcomes, such as provider satisfaction, changes in provider knowledge, changes in provider confidence or self-efficacy, and changes in self-reported provider behavior. Of the 43 articles that addressed provider outcomes, 34 provided no between-subjects comparison group, raising questions about what the observed outcomes would be in the absence of intervention or what the outcomes would be after participation in an alternative intervention, such as online self-guided coursework. Several other limitations were apparent in these studies, including the possibility of publication bias and the lack of baseline data. It is unclear whether EELM are truly building generalists' capacity to operate independently, and at least one study suggested that generalists remained dependent on specialist advice to deliver advanced care (Beste et al., 2016). No studies evaluated whether change in care provision continues after the conclusion of training through EELM.

A smaller subset—15 studies—examined patient-related outcomes associated with implementation of EELM, including both processes and outcomes of care. Conditions studied included HCV, chronic liver disease, dementia care, chronic pain management, opioid addiction, and diabetes. Examples of process measures studied included frequency of opioid prescriptions among patients managed for chronic pain and frequency of initiating treatment for HCV. Examples of outcome measures included sustained viral response for HCV and decreased average blood glucose levels (hemoglobin A1c) for diabetes. Notably, none of the 15 studies used randomization. This lack of randomization means that it is more likely that the findings could be because of study bias and

might not be attributable to true findings. Nevertheless, these studies support the general notion that EELM can improve processes or outcomes of care, at least in some cases.

Overall, we found that significantly more evidence is required before conclusions can be drawn about the efficacy of such interventions. The quality of evidence for the effectiveness of EELM is generally rated as "low" or "very low," according to a standardized system for grading evidence. The problem of low scores for evidence quality is by no means limited to EELM; in the field of health services research (of which the evaluation of EELM is an example), implementation complexities and constraints could contribute to adoption of less-rigorous evaluation study designs. This, in turn, could contribute to low quality of evidence scores. Nevertheless, it is important for those evaluating EELM to strive to generate higher-quality evidence, despite challenges in producing such evidence. Similarly, in order to generate a more robust evidence base, it is important that entities funding implementation of EELM incorporate dedicated funding to support evaluation.

TEP Findings

In examining the evidence base, TEP members identified many gaps, which we organized into seven categories: implementation and dissemination; impacts on health (and other) outcomes for patients; impacts on provider/workforce outcomes; effects on population health and health equity; health system impacts, such as cost, efficiency, and access; policy and funding considerations; and optimal study designs.

After discussing these gaps, the panel confirmed stakeholder enthusiasm for EELM and observed that the primary purposes of EELM vary among programs, as does implementation. The panel noted that existing evaluations do not provide a sufficiently robust evidence base; structural barriers impede progress in collecting high-quality evaluations, and rigorous evaluation methods have been used infrequently.

A relatively weak evidence base in the academic literature does not necessarily imply that EELM are ineffective. More data are needed to assess the impact of EELM and, despite the significant challenges of studying this model of care delivery, the panel was supportive of the potential for more-rigorous evaluation. The panel also observed that the primary purposes of EELM vary among programs, as does implementation.

From these discussions, RAND developed 16 potential strategies to strengthen the evidence base for EELM, organized by stakeholder and possible time frame. Here, these are summarized as four main points about advancing the evidence base on the impact of EELM:

1. Developing a **clear understanding of EELM** is critical. Building the evidence base requires a recognition of the diversity of EELM and how they vary in their fidelity to the original ECHO model. Evaluations should account for this diversity and attempt to identify the core components of EELM.
2. An **expanded focus on rigorous reporting of program characteristics of EELM** would help evaluators assess how the model is put into practice and what "ingredients" might lead to better outcomes and are worth replicating.

3. **Building capacity to evaluate EELM** is a third critical opportunity and is two-pronged. Building such capacity could help implementers design EELM to facilitate improved evaluations, and it could help researchers more effectively choose populations for study, outcomes, comparators, and study designs.
4. Implementers and evaluators can **engage with policymakers, funders, and others** to explore mutually beneficial mechanisms for supporting rigorous evaluation. Such mechanisms would ideally address care delivery imperatives in the near term and enable rigorous evaluations that would expand the evidence base to support longer-term investments in EELM.

Examples of Evaluation Design

Evaluations of EELM are likely to differ in terms of resources and context, and some might be more rigorous than others. Nevertheless, a key finding of the TEP was that even relatively simple evaluations could be more rigorous than they have been historically. RAND examined three possible types of evaluations that varied in complexity, rigor, and likely cost to conduct. Key program features that would affect evaluation complexity include the length of the intervention, the scope of the population from which the sampling frame is drawn, the content area of study, the type of site leading the implementation, funding sources, and the degree of difficulty in collecting data.

Lessons Learned from Case Studies

RAND conducted case studies of ten EELM. These case studies provided important insights into the origins of EELM in different settings, the unique and the common features across programs, the challenges that programs have faced and the approaches taken to address these challenges, and the ways that programs have approached the evaluation of their work. Key lessons learned, which could be useful for policymakers and implementers alike, included the challenges of financial sustainability; the importance of champions, institutional support, and creation of demand among generalist participants to receive educational offerings from EELM; and the need for and challenge of conducting rigorous evaluations of program impact.

Looking Ahead

This work makes clear that stakeholder enthusiasm for EELM should be balanced with the need for rigorous evaluations of their impact on key outcomes. Future evaluations will need to consider the four overarching aims for advancing the evidence base, as already described. Well-designed evaluations can help policymakers, researchers, and clinicians understand how and under what circumstances EELM can be effective, thereby identifying their appropriate role in expanding and enhancing health care delivery.

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This report would not have been possible without these individuals' support and input.

Abbreviations

ACO	Accountable Care Organization
ADHD	attention deficit hyperactivity disorder
AHRQ	Agency for Healthcare Research and Quality
AIDS	acquired immunodeficiency syndrome
APM	alternative payment mechanism
ASPE	Office of the Assistant Secretary for Planning and Evaluation
CCO	Coordinated Care Organization
CDC	Centers for Disease Control and Prevention
CHC	Community Health Center, Inc.
CME	continuing medical education
CMS	Centers for Medicare and Medicaid Services
CU	University of Colorado
DoD	Department of Defense
ECHO Act	Expanding Capacity for Health Outcomes Act
EELM	ECHO and ECHO-like models
EHR	electronic health record
FFS	fee-for-service
FQHC	federally qualified health center
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HbA1c	hemoglobin A1c
HCV	hepatitis C virus
HepCCATT	Hepatitis C Community Alliance to Test and Treat
HHS	U.S. Department of Health and Human Services
HIV	human immunodeficiency virus
HR	hazard ratio
HRSA	Health Resources and Services Administration
IAP	Integrated Addiction and Psychiatry
IHS	Indian Health Service
LGBT	lesbian, gay, bisexual, and transgender
LTC	long-term care
MAT	medication-assisted treatment
MDS	Minimum Data Set
MUA	medically underserved area
MUP	medically underserved population
NEJM	*New England Journal of Medicine*
NHLBI	National Heart, Lung, and Blood Institute

NIA	National Institute on Aging
NIDA	National Institute on Drug Abuse
NIH	National Institutes of Health
NMAETC	New Mexico AIDS Education and Training Center
NYU	New York University
OBOT	office-based opioid treatment
OEN	Oregon ECHO Network
OHSU	Oregon Health and Science University
ORPRN	Oregon Rural Practice-based Research Network
OTP	Opioid Treatment Program
OUD	opioid use disorder
PCMH	patient-centered medical home
PCORI	Patient-Centered Outcomes Research Institute
PCP	primary care provider
PICOTSS	Populations, Interventions, Comparators, Outcomes, Timing, Settings, and Study design
Project ECHO	Project Extension for Community Healthcare Outcomes
RCT	randomized controlled trial
RWJF	Robert Wood Johnson Foundation
SAMHSA	Substance Abuse and Mental Health Services Administration
SCAN-ECHO	Specialty Care Access Network–Extension for Community Healthcare Outcomes
SUD	substance use disorder
SWOT	strengths, weaknesses, opportunities, and threats
TB	tuberculosis
TEP	Technical Expert Panel
TLC	tertiary liver clinic
UNC	University of North Carolina
UNM	University of New Mexico
USNLM	U.S. National Library of Medicine
UW	University of Washington
VA	U.S. Veterans Health Administration
VAMC	U.S. Veterans Health Administration Medical Center
VISN	Veterans Integrated Service Network

1. Introduction

To achieve healthy lives and wellbeing for all, the right knowledge must get to the right place at the right time for those who need it most.

—Struminger et al., 2017

Expanding access to care, particularly in areas where there are shortages of providers, has been a long-standing goal of policymakers. One tool for expanding access is the use of technology, such as videoconferencing, to allow specialists to reach patients and providers in areas that lack specialty care, either directly or through their generalist providers. In December 2016, the Expanding Capacity for Health Outcomes Act (ECHO Act) was signed into law. This act mandated an evaluation of the evidence base for technology-enabled collaborative models of care (Public Law 114-270, 2016). Quoting the ECHO Act:

> The term "technology-enabled collaborative learning and capacity-building model" means a distance health education model that connects specialists with multiple other health care professionals through simultaneous interactive videoconferencing for the purpose of facilitating case-based learning, disseminating best practices, and evaluating outcomes. (Public Law 114-270, 2016, Sec. 2)

The original such program, Project Extension for Community Healthcare Outcomes (Project ECHO), launched in 2003 at the University of New Mexico (UNM) as a way to expand access to hepatitis C virus (HCV) treatment for people in rural settings in that state (UNM, undated-a). Several health care providers have also deployed Project ECHO, using technology to facilitate medical education and care management collaboration, with the intent to increase the capacity of the medical workforce to deliver high-quality care and reduce health disparities. Other providers have created programs using the ECHO structure but are not directly affiliated with Project ECHO. Here, we will refer to such programs as ECHO and ECHO-like models (EELM).[2] In Project ECHO and other EELM, front-line clinicians, typically located in underserved areas, are paired with specialist mentors at academic medical centers or hubs to help manage a particular condition. EELM have now expanded across the United States and the world, encompassing numerous areas of expertise. The general model also has expanded its remote mentoring via technology, or "telementoring," to include nonmedical uses in education, policing, and other non-health applications (Agency for Healthcare Research and Quality [AHRQ], 2017). This report focuses on medical applications of the model.

[2] All references to ECHO that do not refer explicitly to the ECHO Act refer to those programs based on Project ECHO.

The ECHO Act called for an examination of "the use of, and opportunities to use, technology-enabled collaborative learning and capacity building models to improve programs of the Department of Health and Human Services, and for other purposes" (Public Law 114-270, 2016). As a result of this law, the U.S. Department of Health and Human Services (HHS), Office of the Assistant Secretary for Planning and Evaluation (ASPE), engaged our research team at the RAND Corporation to provide the following material:

- a conceptual overview and brief history of EELM, focusing especially on major issues likely to be relevant to the evaluation of EELM (Chapter 2)
- a description of the methods used to gather the information for this report (Chapter 3)
- an inventory of ongoing EELM, focusing especially on federally funded programs as of June 2018 (Chapter 4 and Appendix F)
- a review of the evidence base for the effectiveness of EELM, as of December 2018, focusing on the extent of their proven ability to improve processes and outcomes of care, and identifying key gaps in the evidence base (Chapter 5)
- findings from a Technical Expert Panel (TEP), which was conducted in April 2018 (TEP members focused on assessing the state of the evidence for the effectiveness of EELM and considering options to help expand that evidence base through evaluation.) (Chapter 6)
- examples of three potential rigorous study designs for evaluating EELM, varying in complexity and resource requirements (Chapter 7).

As part of this evaluation, we were also asked to deliver brief, illustrative case studies of representative EELM. With input from ASPE, we selected EELM that are noteworthy in terms of program scope, organization, funding, ability to meet local needs, and potential for lessons learned. These case studies are presented in Appendix E. Selected quotations from key informants appear in boxes throughout the text where relevant.

2. EELM in Context: History, Promise, and Challenges

Before considering the evidence base for the effectiveness of EELM, and what can be done to expand that evidence base, it is necessary to understand what EELM are and how they came to be. In this chapter, we briefly describe the history and development of EELM, their potential advantages and disadvantages, the barriers and facilitators to more widespread adoption of these models, and funding sources that have supported EELM to date.

EELM in Health Care

Although EELM have been applied to non–health care needs, such as policing and education (AHRQ, 2017), this report focuses on their application to health and related concepts of well-being, such as child development. Health-oriented EELM combine features of several related models, such as remote provider-to-patient direct care delivery, e-consults, and continuing medical education (Arora et al., 2014). EELM typically involve a specialist or other clinical content expert who telementors generalists in the care of a specific condition via teleconferencing link, on a regular and recurring basis (Arora et al., 2007). The instructional aspect of EELM features both case presentations, submitted and presented by the mentees, and a didactic component. The aim is to increase the capacity of the mentees to treat a given condition themselves, to the top of their scope of practice. Hence, EELM have the potential to expand access to care for specific conditions without requiring patients to travel to a specialist. This also helps free up the specialist's time to address patients with conditions that cannot be treated by a generalist (Arora, Kalishman, et al., 2011). In addition, by generating opportunities for generalists in remote areas to connect with other members of the medical community, EELM might have beneficial effects on job satisfaction and reduce burnout among the health professionals who participate (Struminger et al., 2017).

Although their spread has been rapid, EELM face certain challenges to future growth and perpetuation. EELM might not work equally well for all conditions, and greater adoption of such models could be constrained by current funding limitations. Existing models have largely been supported through grant funding, partly because of the current lack of a reimbursement mechanism in most instances, especially under fee-for-service (FFS) payment modalities. It is worth noting, however, that some Medicaid programs are providing funding to support EELM, either through capitated or lump-sum payments. The extent to which EELM could be incorporated into alternative payment models is still uncertain, although doing so might be a way to expand adoption, as can be seen in the Rochester ECHO case study (see Appendix E). Within HHS, most EELM to date have been funded by grants from AHRQ, the Substance Abuse and Mental Health Services Administration (SAMHSA), the Centers for Disease Control and Prevention (CDC), and the Health Resources and Services Administration (HRSA). Agencies

such as the U.S. Veterans Health Administration (VHA, colloquially referred to as "the VA") and the Department of Defense (DoD) have developed their own EELM.

EELM Criteria

We defined EELM as programs that feature collaboration between one or more specialists who share specialized knowledge with two or more generalists who receive telementoring via videoconferencing. The mentorship is interactive (not simply unidirectional lectures), and it is largely based on discussion sessions that feature cases submitted by the generalist mentees, although sessions typically incorporate a didactic component as well. Mentors are located at one or more "hub" sites, where a collection of expertise exists, whereas mentees are located at one or more "spoke" sites, where access to some types of medical care might be less available. EELM span multiple sessions that occur on a regular and recurrent basis, and they focus on a defined topic, most often a specific disease state. The goal of the mentoring is to enable the generalist mentees to build capacity to independently manage most patients with the focus condition, referring only complex or unusual cases to a specialist.

In consultation with ASPE, we developed the following defining characteristics of EELM:

1. **Specialist-generalist framework:** The intention of the program is to capture translation of knowledge from someone with specialized skills to someone with less specialized skills. Although the usual case is for the mentees to be generalist physicians, there could also be other types of health professionals providing generalist care, who receive mentorship from a mentor with specific expertise. For example, a nutritionist with specific expertise in the care of patients with cystic fibrosis might telementor nutritionists who lack such expertise. The generalist must be a fully trained professional who is in charge of some aspect of care delivery for a particular condition; this expression of the model is not meant to incorporate trainees who are fulfilling orders from an attending physician. A real-life example of this type of model would be mentorship of generalist psychologists by a psychologist who specializes in managing talk therapy for survivors of childhood trauma or abuse (Wonderlich et al., 2011).
2. **Interactive mentorship:** The program incorporates interactive consultations between specialists and generalists, in which the generalists are delivering care—with guidance. The specialists (mentors) are not billing the patients' insurance for this time and are not the providers of record (the specialists are generally paid directly through the program). Although we are not aware of any legal test cases, it would seem that the specialists would not be liable for care provided because they are primarily providing general advice about care management principles and only secondarily discussing how to manage a particular patient. Traditionally, generalist mentees are not charged a fee to attend EELM, and we have not found any counterexamples to date.
3. **Case-based method:** The model of learning includes a case-based component, meaning that it features theoretical examples and knowledge but also addresses real-world anonymous cases, including active cases introduced by generalist mentees.

4. **Use of videoconferencing technology:** Although some generalist mentees might lack video capability, the program should provide videoconferencing to those who can use it.
5. **Hub-spoke model:** EELM typically involve a hub site, which houses a multidisciplinary mentor team with specialized knowledge, and various spoke sites, which sign up to participate as mentees. For the purposes of our review, to be considered among EELM, at least two or more mentees should be involved simultaneously, to be distinguished from a 1:1 mentorship model. In practice, most EELM involve many trainees at many sites.
6. **Multiple sessions:** Sessions occur multiple times over an extended time horizon. Operationally, we defined this as eight or more sessions each lasting at least 60 minutes and occurring at least monthly.
7. **Health-focused:** In this evaluation, we considered EELM that have a goal of promoting health, defined broadly to include social well-being. EELM might also be used in nonhealth areas (education, criminal justice), but such models are beyond the scope of this study.

For the purposes of this report, we considered an *ECHO-like model* to be one that meets all of our criteria but is not formally affiliated with the ECHO Institute in Albuquerque, New Mexico, and therefore does not use the label.

History and Development of EELM

Some populations in the United States are relatively isolated from specialty care by geography or other issues of access, and these populations might rely on generalist providers to deliver most or all of their medical care. Access to specialty care has long been unevenly distributed, with rural or low-income patients especially likely to have difficulties accessing care. Generalists in isolated areas might handle a somewhat wider spectrum of conditions (still within the scope of generalist practice) than their colleagues in areas with many specialty physicians, but these generalists still might consider themselves underqualified to address some conditions that they feel are beyond the scope of their personal training. Underserved communities within urban areas might be in close geographic proximity to specialist care but still have trouble accessing care for various reasons, such as insurance coverage, ability to pay, and transportation.

Over the past 20 years, emerging technologies have been used to address such challenges. In particular, videoconferencing technology has been used to support *telemedicine* (Ekeland, Bowes, and Flottorp, 2010), where a provider located at one site is able to deliver care to a patient located elsewhere. Another innovation is the *e-consult* (Vimalananda et al., 2015), in which a generalist provider and a specialist communicate electronically, perhaps in conjunction with review of the patient's medical chart or history, so that the patient does not need to actually travel to see a specialist. Similar to these other modalities, EELM rely on videoconferencing technology, but also add elements similar to continuing medical education (CME), which aims to "maintain, develop, or increase the knowledge, skills, and professional performance and relationships" of a physician or other health care provider after completing residency or similar

professional training (Barash, 2015). Hence, EELM combine elements of telemedicine, e-consults, and CME, as well as several new elements that none of the aforementioned modalities fully embodies (Table 2.1).

Table 2.1. Comparison of EELM with Other Modalities

Features	EELM	Telemedicine	e-Consult	CME
Didactic presentations	✓			✓
Case-based presentations	✓			+/–
Direct care delivery		✓		
Ability to bill for services		✓	+/–	
Hub-and-spoke model	✓			
Videoconferencing	✓	✓		+/–
Rural/underserved populations	✓	✓	✓	
CME credit	✓			✓
Increases access to care	✓	✓	✓	
Aimed at building capacity	✓			

NOTE: ✓ means present; +/– means present to some extent.

EELM do not involve the specialist delivering care directly (as in telemedicine) or acting as a consultant for a single case (as in e-consults). Rather, EELM are focused on building capacity and self-efficacy over time through a series of both didactic and case-based interactive presentations.[3] Time spent on the training activity is not billable—in general, specialists are paid by the EELM; generalists do not pay to participate but have to find the hours to do so. The generalist continues to provide direct care; the specialist does not have contact with the patient and as a result cannot bill for patient care. This stands in contrast to traditional telemedicine, in which the consulting provider gives direct care to the patient and bills for the services provided. In e-consults, both the specialist and the generalist are considered to be providing direct care and therefore both can bill for the care of the patient. Both telemedicine and e-consults can help increase access to care, but EELM have the additional potential to create new capacity to address a specific clinical area, whereas direct-care telemedicine can allow existing capacity only to reach geographically isolated patients.

The first known EELM, Project ECHO (UNM, undated-e), was created by Sanjeev Arora, a gastroenterologist at UNM who was concerned about access to care for patients with HCV. At the time, in 2003, treatment for HCV lasted an entire year and was associated with considerable

[3] Self-efficacy is commonly defined as the belief in one's capacity to execute behaviors necessary to achieve a goal or an outcome (Bandura, 1977).

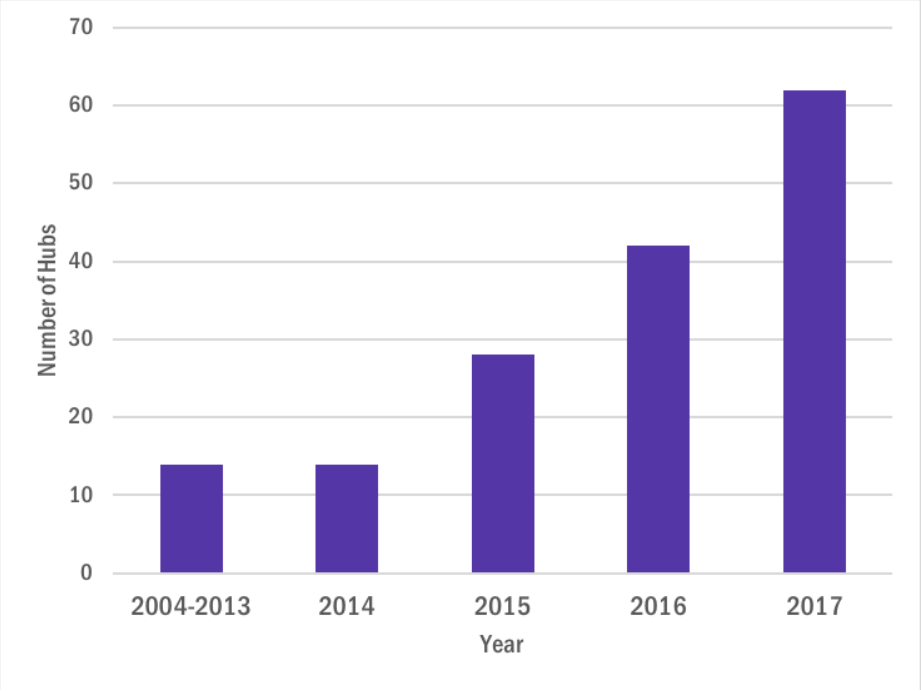
side effects, so it required expert monitoring and ongoing management. At the time of Project ECHO's founding, an estimated 34,000 New Mexicans were infected with HCV, but fewer than 1,600 were receiving treatment for their diseases (Arora et al., 2014). The gastroenterology department at UNM had a months-long wait to be seen for HCV, and some patients needed to drive five hours or more—each way—to be seen. Arora envisioned Project ECHO as a way to help community-based providers treat HCV themselves, which ideally would shorten patient wait times, obviate the need for patient travel, and reduce burden on specialists.

Project ECHO established a hub-and-spoke system to connect specialists and generalists at different medical sites, with mentoring based at the UNM campus and delivered by experts not only in gastroenterology but also other fields relevant to treating HCV. Initially, spoke sites were all located in New Mexico and consisted of prisons, Indian Health Service (IHS) facilities, federally qualified health centers (FQHCs), and other health care providers (Arora et al., 2007). Educational sessions lasting two hours were delivered weekly, including a brief didactic presentation followed by case-based learning involving real (but deidentified) patient cases that had been submitted by the spoke sites. By 2009, more than 1,000 health care professionals had participated in HCV ECHO sessions. In that year, Project ECHO's HCV focus discussed 1,582 cases, each submitted by a clinician from a spoke site (Arora, Kalishman, et al., 2011).

Over time, the focus of Project ECHO expanded from HCV to encompass other areas of expertise. By 2011, ECHO networks had been developed in New Mexico for asthma, chronic pain, diabetes and cardiovascular risk reduction, high-risk pregnancy, human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS), pediatric obesity, rheumatology, substance use disorders (SUDs), and mental illness. Each of these networks had an expert team at UNM, and more spoke sites were added as the areas of focus expanded.

Based on enthusiasm about Project ECHO's early results (Arora, Thornton, et al., 2011), other localities began setting up hubs outside New Mexico, often with help from the team at UNM (Figure 2.1).

Figure 2.1. Establishment of New ECHO-Affiliated Hubs, 2004–2017



SOURCE: Based on data from Arora, 2018.
NOTE: This figure does not reflect EELM established independently from the ECHO Institute.

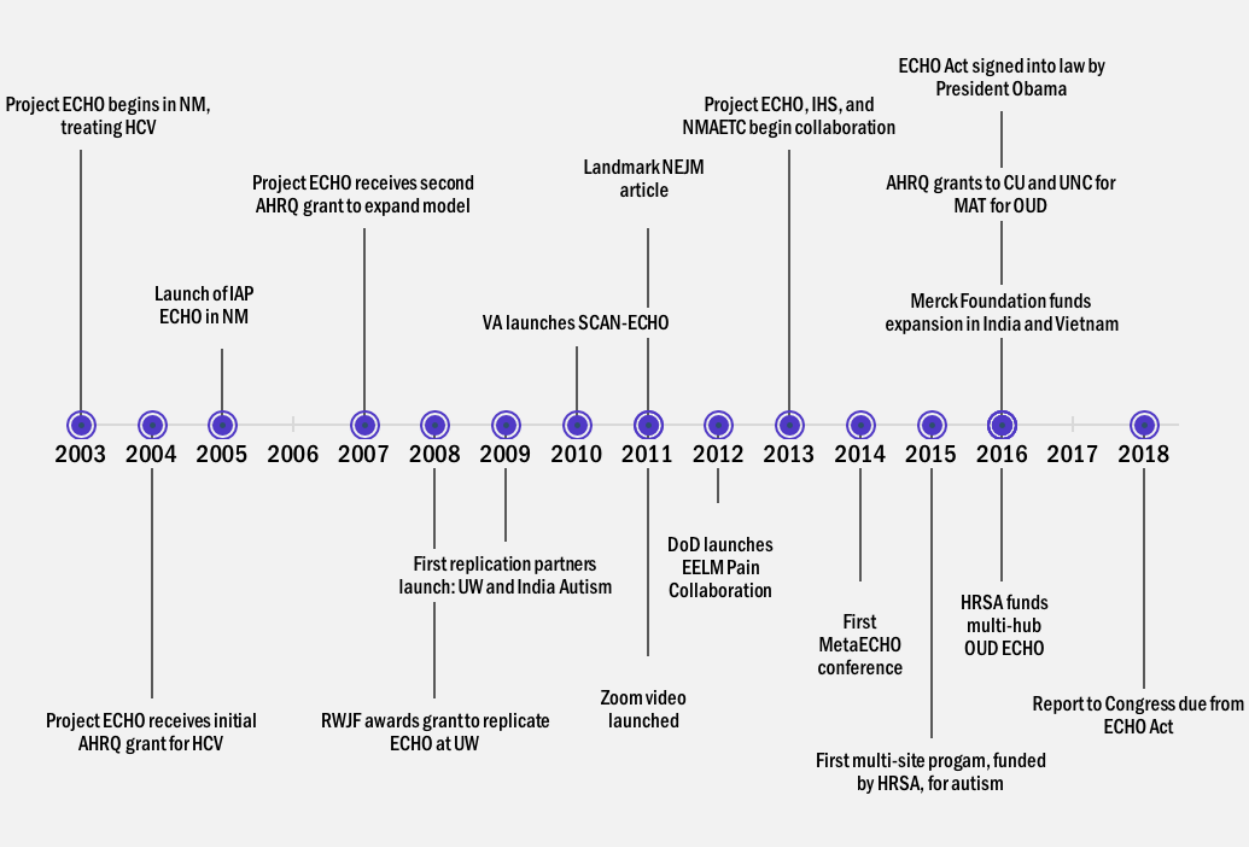
Hubs would often start with one area of expertise and then set up additional networks to meet community needs. The most common conditions addressed by ECHO include mental health conditions, opioid use disorder (OUD) and other SUDs, chronic pain, HCV, autism spectrum disorders, cancer, palliative care, HIV/AIDS, and diabetes. (For more detail, see Table 4.2.)

> *Project ECHO is exactly what we needed.*
>
> Daren Anderson,
> director of the Weitzman Institute (2018)

As of 2018, Project ECHO had 165 affiliated hubs in 35 states and 24 countries; 101 of these hubs are located in the United States (Arora, 2018). Project ECHO also coined the term *ECHO superhub* to describe a site that has developed the capacity to train and mentor new hubs in the ECHO model. As of January 2018, there were nine superhub sites in addition to UNM listed worldwide on the Project ECHO website (UNM, undated-b).

As Project ECHO expanded, other EELM sprouted up (Figure 2.2).

Figure 2.2 Time Line of Key Events in Development of EELM



NOTE: CU = University of Colorado; IAP = Integrated Addiction and Psychiatry; MAT = medication-assisted treatment; *NEJM* = *New England Journal of Medicine*; NMAETC = New Mexico AIDS Education and Training Center; RWJF = Robert Wood Johnson Foundation; SCAN-ECHO = Specialty Care Access Network–Extension for Community Healthcare Outcomes; UNC = University of North Carolina; UW = University of Washington.

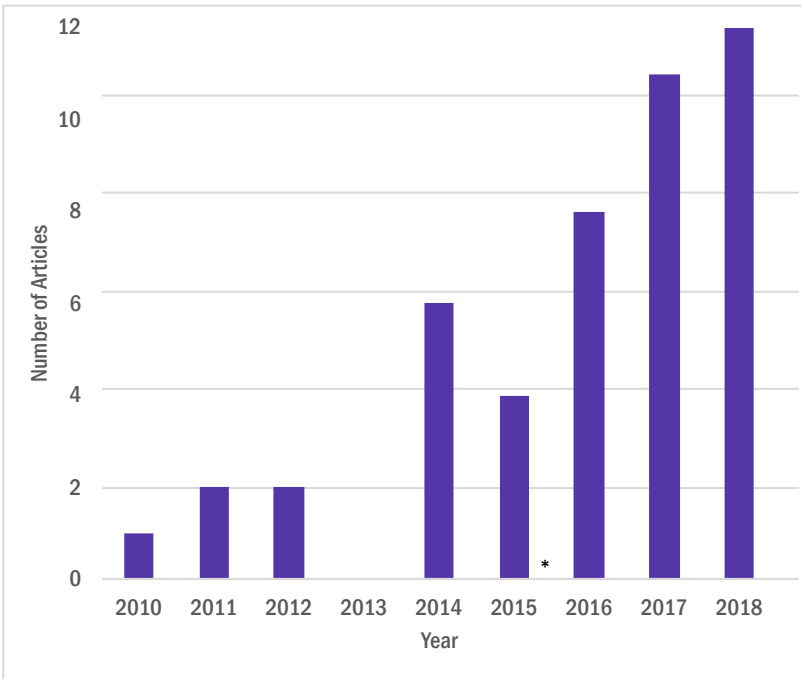
Some EELM were set up in "closed" health care systems, such as SCAN-ECHO in VA. From 2011 to 2014, the specialties with the greatest number of visits, patients, and providers within VA SCAN-ECHO were HCV, diabetes, and pain management (Clancy, 2017). EELM were also set up within the military health system, with specific approaches to implementation of EELM and specific areas of expertise being emphasized by different service branches.

In 2011, the *NEJM* published a landmark study and evaluation of Project ECHO (Arora, Thornton, et al., 2011). This nonrandomized study documented outcomes for patients who began treatment for HCV between 2004 and 2008, comparing outcomes for patients who were treated at the spoke sites with those treated at the hub site. The spoke sites treated more patients than the hub over this period (261 vs. 146), suggesting a significant expansion in the overall capacity to treat HCV in New Mexico. There was no difference in sustained virologic response between patients treated at hub sites and at spoke sites (50 percent vs. 46 percent, $p = 0.57$). This indicates that the outcomes for patients were similar at hub sites and at spoke sites—a reassuring finding regarding quality of care at spoke sites. The rate of serious adverse events was lower at the spoke sites than the hub (7 percent vs. 14 percent, $p = 0.02$). This might be attributable to the younger

age and lower complexity of patients treated at spoke sites, but it is also a reassuring signal regarding the quality of care delivered at spoke sites. The *NEJM* article (Arora, Thornton, et al., 2011), which had been cited 512 times as of the end of 2018, appears to have spurred great interest in more widespread adoption of EELM and might have contributed to many sites seeking to become hubs or spokes in ECHO networks.

Over the next several years (2012–2016), EELM expanded rapidly, developing new hubs and spoke sites, new areas of expertise, and new funding sources—many from within HHS. These years were also characterized by a rapid increase in the number of publications related to EELM (Figure 2.3), likely reflecting interest generated by the 2011 *NEJM* publication.

Figure 2.3. Empirical Publications Evaluating Impacts of EELM Through 2018



NOTE: Empirical publications present empirical data, as opposed to merely describing a program or a conceptual model. There were no relevant publications identified in 2013. Data for 2018 includes articles published only through December 1.

Within this environment of building enthusiasm and a sense that EELM could have the potential to help address unmet health care needs, Congress passed the ECHO Act and the President signed it in December 2016.

EELM Strengths, Weaknesses, Opportunities, and Barriers

We evaluated EELM for their potential *strengths*, *weaknesses*, *opportunities* for spread, and barriers (or *threats*) to their success—also referred to as a SWOT analysis. This process was informed by knowledge of the program, a literature review, and conversations with experts. Here, we present the results of this analysis. In many cases, we identified these ideas ourselves;

in some cases, we provide citations for ideas that were raised by others in the published literature. It should be noted that the following is a conceptual review, not a synthesis of the evidence base. (In contrast, we present our summary of the evidence base for EELM, including what research evidence has been demonstrated and what evidence gaps remain, in Chapter 5.)

Potential Strengths of EELM

There are several potential *strengths* of EELM, which are distinct for particular categories of stakeholders. We considered the effects on patients, generalist mentees, and specialist mentors, as well as the effects on quality of care.

Patients

Patients might benefit from reduced travel to see specialists and reduced wait times for care. Although it is recognized that exceptional or complex cases might still require referral for in-person evaluation by a specialist, the aim of EELM is to help generalists develop the expertise and self-efficacy to handle a preponderance of cases themselves. To the extent that this is achieved, many patients will not need to travel to access specialty care. In addition, wait times could theoretically be reduced in two ways. First, the majority of patients, who now can be cared for by a generalist, will no longer need to wait to see a specialist. EELM have the potential to increase the capacity of a clinic to handle more than one complex condition: If all the providers in a health center or clinic join EELM that focus on different clinical topics, the group practice might collectively be able to handle a range of problems without resorting to external referrals and rely instead on internal referrals within the practice. Second, the subset of patients who still need to be referred could encounter reduced wait times if EELM have reduced a specialist's caseload. This sort of effect would require a certain penetration of EELM in the region.

Patients might also receive more patient-centered care from their generalists (who ostensibly already know them and are familiar with their context and circumstances) than they would from a specialist (who might lack such familiarity). This could be especially important for patients who require services in another language or who are members of underserved communities and might experience mistrust or have culturally sensitive needs, such as Native American tribes.

Generalist Mentees

Generalist mentees might gain not only knowledge but also self-efficacy and professional satisfaction. EELM can enable generalists to help new groups of patients while expanding the capacity of the generalists' practice groups to handle a wider range of issues. Thus, EELM have the potential to contribute to professional accomplishment and to provide generalists with a sense of self-efficacy and pride in their work. Job-related burnout is usually defined as emotional exhaustion, depersonalization, and reduced feelings of work-related personal accomplishment (Maslach and Jackson, 1981). Because they might lead to increased self-efficacy and pride in accomplishment, EELM could help reduce burnout. Reduced burnout could, in turn, theoretically lead to increased retention, which is an issue of particular importance in remote and underserved areas. However, EELM also might increase burnout by increasing demands to deliver care for new conditions and by requiring clinicians who attend case discussion sessions to later make up for the time not spent on patient care. The impact of EELM on burnout and retention has not yet been empirically addressed in the literature.

> *Taking the time to do a site visit to a potential spoke before the program begins goes a long way toward obtaining support.*
>
> Brian Wood, director of Project ECHO UW (2018)

In addition, connecting with other generalists (at spoke sites) and with specialist-telementors (at hub sites) could reduce feelings of professional isolation and expand participants' professional networks. Generalists gaining new expertise might also be recognized for their professional growth, which could provide opportunities for further professional accomplishment. Finally, to the extent that patients receive more of their care from generalists (as opposed to being referred out to other providers), EELM might increase revenue among participating generalists.

Specialist Mentors

Specialists might find professional satisfaction in telementoring generalists and helping to expand capacity and serve patients through EELM. Some specialists might feel burdened by a backlog of patients awaiting appointments, as was the case for Dr. Arora when he developed the idea for the first Project ECHO model. To the extent that EELM reduce this backlog, it could also reduce specialist burnout. Specialists might also appreciate changes in the types of cases referred to them. Shifting away from routine, uncomplicated cases and toward more-complicated cases could allow specialists to practice to the full extent of their training, potentially making their practices more professionally rewarding. By mentoring generalists from the surrounding community, specialist mentors could become a favored destination for referrals, which could be beneficial from a business standpoint. Although mentors located at academic medical centers might have many opportunities to teach (medical students, residents, and fellows), community-based specialist mentors might enjoy having an opportunity and a forum to share their

knowledge—especially with fully credentialed providers, who might be particularly gratifying to teach. Finally, specialist mentors might also learn important skills, including not only greater awareness of the realities of practicing in rural or underserved communities but also deeper expertise developed by sharing their knowledge with others. At the same time, these programs could siphon off easier cases, which could pose a problem for specialists. Compensation for time participating might also be less than their payment rate for clinical work.

Technical Quality of Care

The effects of EELM on quality of care could depend on the area of expertise. For some conditions, such as diabetes, generalists already deliver care for this condition, but EELM could improve the quality of care as measured through changes in processes of care or clinical outcomes. For other conditions, such as HCV, generalists have not historically delivered such care, so at first glance EELM might appear to play a larger role in expanding access than improving quality. However, one important aspect of quality of care is the proportion of patients who receive treatment. There are millions of patients in the United States who are candidates for HCV treatment and not nearly enough specialists to treat them all. The proportion of such patients who are offered treatment can be viewed as a quality measure in its own right; by expanding the number of providers able to offer such treatment, EELM can improve quality from this standpoint and thus improve outcomes for these patients.

Overall Cost of Care

EELM have the potential for cost savings at the societal level for several reasons. Generalist care costs less than specialist care, and treating conditions sooner might achieve better outcomes at lower cost. To the extent that EELM reduce wait times, overall cost savings could accrue as patients are treated earlier in the course of disease. It is possible, on the other hand, that EELM could increase the cost of care by providing treatment to more patients than before. Although additional treatment might be cost-effective as measured in cost per quality-adjusted life year gained, the overall total cost might still be higher. In terms of the cost savings or cost-effectiveness of EELM, the bottom line could vary according to both the context of treatment and the condition being treated.

Our analysis so far has focused on the cost to the health system; it might be important to also consider costs from the societal perspective. For example, the time and money that patients and caregivers save by not traveling to see a specialist should also be considered part of the cost savings, from a societal perspective.

Potential Weaknesses of EELM

It is important to understand the potential challenges and limitations of EELM, because these would also be logical topics for measurement and evaluation. Here, we consider financial challenges, generalizability, and implementation issues as a few key potential *weaknesses*. We do not consider the limited evidence base for the effectiveness of EELM as a weakness here; our

review of the evidence base is found in Chapter 5. Here, we consider the likely inherent weaknesses of EELM and tasks that EELM might be ill-suited to address, even if the evidence base were to be augmented.

Payment for EELM

The lack of separate payment for EELM has the potential to negatively affect income among different stakeholders through several mechanisms—especially under FFS models of payment that reward volume of care. To date, a relatively large proportion of participants in EELM are from community health centers, academic centers, or other similar practice configurations in which providers are salaried or otherwise more insulated from immediate financial pressures.

Salaried providers, such as those in health centers, are subject to volume pressures through productivity measures, making it harder to take on obligations that require significant time. To the extent that providers are expected to make up this time later, it could occur after hours, potentially contributing to burnout. A major theme from our case studies (see Appendix E) was that finding ways to cover provider time was one of the greatest barriers to participation in EELM. The potential for EELM to reach such providers might depend on changes in financial incentives over time. With their emphasis on proactive population health management and quality metrics, the incentive to participate in EELM might be higher under alternative payment models.

Another potential issue for generalists is *perverse financial incentives*, which might operate unevenly by condition. Some conditions are challenging to manage and might require longer visits than usual or more care coordination, sometimes with no additional payment. Attracting such patients to one's practice by becoming an expert could be perceived as a money-losing proposition for some providers under FFS. HCV is not a condition typically subject to these sorts of perverse incentives (Langston, 2017). Although generalists had not historically delivered HCV care, it is not a major departure from other forms of medication therapy management that they deliver, it does not require more effort than other conditions, and its services can be billed. It remains an open question, therefore, whether EELM will translate to other conditions with the same degree of success—and, if so, which ones.

For telementors—specialists—the financial risks might be even more acute. Although they share the issue of unreimbursed time, they might also find it undesirable to unload their easier cases. EELM typically have a stated goal for generalists to handle the majority of uncomplicated cases, sending only the most complex patients to specialists. Although this is clearly efficient for the patient and for society, specialists in an FFS framework are often paid almost as much to manage straightforward cases as complex cases—with much less effort. Retaining the easier cases might be particularly desirable for specialists whose schedules are not as full as they would like. In contrast, specialists located at academic medical centers, who usually receive a fixed salary, might be more eager to shed extra patients if they are paid the same amount regardless of the number of patients seen.

Limited Generalizability to Other Conditions

One potential concern about the use of EELM is that this approach might work better for some conditions than for others. The paradigmatic example of HCV has certain advantages. Prior to Project ECHO's launch in New Mexico, generalists already understood the basic idea of medication therapy management; they did not usually treat HCV, likely because they sensed they were not adequately trained to do so but could be trained to do so; reimbursement for HCV treatment was relatively straightforward to obtain; and there were far too many HCV patients for specialists to treat.

However, EELM are increasingly being applied to conditions for which at least one of these factors does not apply. For instance, as already mentioned, EELM are now used for conditions that generalists already treat (such as diabetes or depression), in which case the goal of EELM might be to improve the quality of care and not to expand capacity. Generalists might be less enthusiastic about using EELM in this context because (1) they might feel that they already deliver high-quality care, and (2) participating in EELM for such conditions might be less exciting than learning what is perceived to be a new skill. Langston (2017) raises the possibility that suboptimal outcomes for chronic disease management might be more symptomatic of failures in the organization of and payment for primary care and chronic disease management and less symptomatic of a lack of knowledge and self-efficacy that can be remediated through EELM.

Although the management of such diseases as diabetes and depression is generally thought of as a basic function of generalists, new treatments continue to be developed for both conditions. For example, diabetes can now be treated with DPP-4 inhibitors, GLP-1 agonists, and SGLT-2 inhibitors, none of which existed a decade ago. The skillful and fluent use of newer treatment options might elude many generalists, in which case EELM could help clinicians stay abreast of new treatments.

As EELM continue to expand the list of conditions under their purview (see Table 4.2), it will be necessary to continue to evaluate the conditions and contexts in which EELM work best.

Limited Generalizability to Other Patients

At least one objective of EELM is to expand clinical capacity. For this to come to fruition, clinicians (i.e., generalist mentees) must be able transfer their newly acquired skills to other patients who were not discussed directly with the telementor specialist. It remains to be seen, however, whether generalist mentees participating in EELM alter the management only of patients directly discussed during sessions or whether generalists indeed extend these new skills to patients not discussed. EELM that change the management only of patients directly discussed might be functioning more as e-consult mechanisms than as capacity-building tools. This is an important topic for future evaluations.

Loss of Interest over Time

One feature of the original Project ECHO was the ability to sustain an ongoing program. In other EELM, some mentee participants might have "drifted away" from attendance over time. In some cases, this might be because mentees have a sense of having mastered the skills they had been seeking. In other cases, however, it could have to do with a waning of novelty over time. This sustained participation factor, coupled with limitations of funding or other resources, has led some EELM to design their programs as cohorts, with predefined 12- or 18-week durations. Thus, although the program might be ongoing, the participation of any individual is limited. However, this means that the ongoing mentorship portion of the program is time-limited, so it might also be necessary to address attrition if it is threatening the viability of a project, consider the ideal length of affiliation for those that are ongoing, formalize what it means to complete a program, and find ways to maintain connections between mentors and mentees over time.

Opportunities for Implementation of EELM

Contextual factors, such as alignment with other efforts and needs in primary care, are likely to affect further implementation of EELM. Here we discuss how such factors might be *opportunities* to support EELM.

Alignment with Primary Care

Primary care has been changing rapidly in recent years, and the pace of change seems to be accelerating. One major trend is a shift toward the patient-centered medical home (PCMH); according to AHRQ, PCMHs aim to transform primary care and make it more comprehensive, patient-centered, coordinated, accessible, and of higher quality (AHRQ, undated). Another trend is an increasing emphasis on proactive population health management and preventive health, as opposed to waiting to treat patients when they present with complaints. Health care payers, especially the Centers for Medicare and Medicaid Services (CMS), are working to incorporate incentives consistent with these trends through pilot programs, payment changes to encourage certain behaviors, and testing alternative payment models. EELM appear to be highly compatible with these approaches to payment policy, which could represent one possible facilitating factor for further adoption of EELM.

One major example of this approach is the Accountable Care Organization (ACO). For ACOs receiving shared savings, a portion of such savings could be shared with one or more specialists, partially defraying the costs of the time spent participating in an EELM.

Implementation Support

EELM employ a hub-and-spoke model that is collaborative by design, and—at least for Project ECHO—there is an existing community of people who are actively engaged in its implementation. For those interested in exploring EELM before making the investment in videoconferencing technology, the public availability of informational materials simplifies the process of collecting necessary information. The ECHO Institute hosts regular interactive

orientation programs online, and facilitates a biennial conference, community phone calls, collaborative peer groups, and a biweekly newsletter about Project ECHO (UNM, undated-c; UNM, undated-d).

Clearly Defined Need

EELM generally respond to a clearly defined need. The original Project ECHO program for HCV and the other New Mexico–based programs have all responded to the clear needs of the geographically isolated regions of New Mexico, for which a trip to a referral hospital could require considerable time and effort. In other cases, the need might not be geographically based but oriented around a high-need condition. For example, providers trained to deliver MAT to treat OUD, a major public health crisis, are in short supply throughout the United States (Dick et al., 2015; Rosenblatt et al., 2015). Therefore, increasing generalist capacity to provide MAT is needed in many areas of the country. In general, a review of the EELM we found (Chapter 4) highlights an emphasis on addressing topic areas of mental health and SUD; this could be a particularly useful area of focus for future EELM. Establishing EELM that are based on a clearly defined need might be more likely to generate enthusiasm and persistence by participants.

Technology

A major enabling factor for implementing this kind of intervention is the increasing access to and decreasing cost of the relevant technology, particularly videoconferencing, and has been adopted by many EELM. Increasing access to broadband across the country means that, even in remote locations, internet speeds are high enough to enable seamless video connections. Familiarity with videoconferencing is rising with its increasing ubiquity, now often free and available on handheld devices through a variety of applications. This familiarity paves the way for use of videoconferencing in the clinical context.

For providers without technical expertise, partnership with Project ECHO includes support for technology rollout and maintenance. Having this resource of experts available for implementation or to answer questions when problems arise can ease what might be a hurdle for some practices to engage with EELM.

Threats to the Implementation of EELM

As the final component of our SWOT analysis, we consider *threats* or barriers to the continued implementation of EELM. The status quo plays a large part here, both in terms of payment mechanisms and current medical culture.

FFS Dominance

As detailed previously, several of the most prominent challenges to EELM are related to billing and loss of income. These challenges might lessen to the extent that FFS is replaced by other payment modalities, or if payers begin to allow sessions to be billed or otherwise devote funds to support EELM. A recent study, which did not focus on EELM but rather on nonvisit

care in general, might be instructive. Basu et al. (2017) conducted a simulation-based study showing that, under 100 percent FFS, a shift to proactive team-based and nonvisit care would result in a loss of $42,000 per physician full-time equivalent. This loss became progressively smaller as the proportion of patients under an alternative payment model (APM) increased. The tipping point was 63 percent penetration of APM; above that level, adoption of team-based and nonvisit care would produce a cost benefit to the practice in 95 percent of simulations. By analogy, this could also be the tipping point for making the adoption of EELM financially attractive. It seems that truly widespread adoption might require a shift in financial incentives for large numbers of providers, where the specialists and generalists share the incentive structure. It is worth noting that, to date, four states have received waivers to use Medicaid funds to support EELM (see the section in this chapter on Funding). Such waivers could help push providers to adopt EELM within a state despite the prevalence of FFS payment models.

Leadership and Cultural Support

Adoption of any innovation in care delivery will need to be supported by leaders, including midlevel leaders (immediate supervisors), as well as department chairs and other upper-level leaders. This support can take the form of protected time—during which clinician implementers are explicitly released from patient care responsibilities so they can implement EELM, or clinicians from spoke sites are given release time to attend sessions—or other logistical support (such as access to teleconferencing software). It is also important that leaders generally show support for the implementation effort through statements and actions—or at least not undercut it by demonstrating that it is not a priority.

Beyond the contribution of leaders, any health care delivery organization will have its own culture, which might be more or less supportive of EELM adoption. Depending on how EELM are perceived in a specific location, generalists might want to gain expertise in a commonly treated disease or to distinguish themselves by gaining expertise in an arena their colleagues do not treat. If the culture values this kind of expertise, investment in EELM is more likely. Both the hub sites, which contribute effort by specialists, and the spoke sites, which contribute time and energy from generalists, will need to be invested in EELM for any ongoing project to be successful.

Availability of Funding

Some EELM will be supported by internal funding, which is intimately tied to leadership support, as previously mentioned. However, internal funding might not always be available—and where it is available, it might be limited in scope in terms of what can be addressed. The availability of external funding might sometimes be critical to support ambitious implementation of EELM, especially when reimbursement is not available from payers. External funding could come from federal, state, or local government; foundations; health care payers; or other sources. Funding is needed for implementation of the model—to pay for staff time to organize and facilitate sessions and particularly to cover the time spent away from direct patient care. There are some sources of funding for physician education that could support the generalist's time, but

this would not cover the specialist's time. Lastly, finding funding for evaluation can be a challenge. External funding is critical to support evaluation, which is rarely funded internally and might not be adequately supported by implementation-focused grants.

Funding Sources

Availability of funding can be a key facilitator for implementation of EELM (when available) or a key challenge (when absent), meaning that funding fits into our SWOT analysis both as an opportunity and as a challenge. Funding for EELM varies program to program, with different institutions supporting their implementation in different ways, and often cobbling together multiple funding sources. Of note, funding generally has not replaced revenue that would come from billing clinical services, but rather has been directed at supporting program implementation and, in some cases, program evaluation. Of the programs identified in our mid-2017 inventory of EELM, the majority were located in the United States and supported by HHS. There are also various EELM that are funded through other sources, such as state-based grants, institutional funding, and private foundations.

HHS is the biggest grant funder of EELM in terms of the number of programs funded,[4] with HRSA funding the largest number of programs. Many of the grants are relatively small in size or not entirely focused on supporting EELM, making it hard to compare funding amounts among agencies. The CDC also funds several EELM, many of which support treatment for HIV internationally, particularly in low- and middle-income countries. Other funding agencies include AHRQ, SAMHSA, CMS, IHS, and the National Institutes of Health (NIH). The largest single federal grant was the CMS Health Care Innovation Awards grant to the University of New Mexico, for $8.5 million over three years, beginning in 2013 (Ahn et al., 2017; Miller, 2014). This grant funded not only implementation but also evaluation of an ECHO project targeting high-risk adult Medicaid beneficiaries. Foundations have also been among the important funders of EELM, especially early in development.

Two closed health care systems (VA and DoD) support their own EELM (VA SCAN-ECHO and various DoD programs, respectively; see the case report on VA SCAN-ECHO in Appendix E). SCAN-ECHO and DoD programs address a wide variety of conditions, with the largest offerings in the areas of HCV, pain management, and OUD. These programs are internally funded rather than from a defined grant source; therefore, they can be measured only in terms of the number of programs and not the dollar amounts that have been obligated.

In some states, funding has come directly through yearly appropriations in the state budget (see the case report on Missouri in Appendix E). Others have obtained waivers to use Medicaid funds to support EELM. Waivers are necessary because, under typical Medicaid rules, providers might be paid only for direct health care delivery. The waivers for California, Colorado, New

[4] Throughout the report, we quantify the number of EELM rather than attempting to quantify the total funding devoted to them. In part, this choice was made because some programs devote all of their funding to activities of EELM, while others devote only a small percentage—a percentage that in many cases cannot be known precisely.

Mexico, and Oregon are for EELM that focus on pain management in rural areas, run through Medicaid managed care organizations.

Increased uptake of APMs could therefore help facilitate uptake of EELM. More details on payment for EELM are provided in an in-depth brief from the Center for Health Care Strategies (Howe, Hamblin, and Moran, 2017).

Summary

EELM share characteristics with several related activities (telemedicine, e-consults, and CME) and are facilitated by the contemporaneous availability of specific technology, especially videoconferencing hardware, software, and broadband internet. Project ECHO has spread since its start in 2003, with EELM adopted across the United States and internationally. The use of EELM has expanded from HCV treatment to encompass a range of other conditions. The model poses various potential benefits for patients, physician specialists, and physician generalists, as well as for quality and overall cost of care. However, there are also potential limitations, such as perverse business incentives for some providers and challenges regarding evaluation.

Funding sources also have expanded and now include federal sources (mostly HHS) as well as state-based and private funders. Whether such funding sources will remain a viable source of sustainability for EELM in the future is uncertain. To the extent that existing funding sources, such as grants, become less available or less generous, EELM might need to identify other mechanisms to continue their operations.

This brief overview of the conceptual underpinnings and history of EELM sets the stage for the upcoming chapters looking at the evidence base for these models, key gaps in the evidence, and options for addressing those gaps.

3. Methods

This chapter describes the methods used in this report to support the findings in the following chapters. We compiled an inventory of existing EELM, conducted an evidence review to compile what is known in the published literature about EELM, convened a TEP, and estimated the cost to fully evaluate EELM.

Inventory

The inventory was intended to identify all active EELM in the United States and selected other countries. A summary of findings based on this inventory can be found in Chapter 4, and the full state-by-state and country-by-country inventory of these initiatives can be found in Appendix F.

Methodology

To find relevant EELM, we executed the following steps:

1. We compiled key terms pertaining to technology-based collaborative learning and capacity-building models, through the end of May 2018.
2. We compiled a list of state government agencies functioning as funders and implementers of collaborative learning models in the health sector (n = 417).
3. We compiled a list of medical schools, including schools of osteopathy, in each state (n = 172)
4. We compiled a list of the five largest and five top-ranked medical institutions in each state, including Washington, D.C., and Puerto Rico (n = 520);[5] where there was overlap, we listed additional top-ranked medical institutions such that a list of ten institutions was catalogued for each state.
5. We entered terms from (1) through (4), state by state (Appendix A), into an online search engine using Boolean operators. Each return was reviewed against inclusion criteria to the extent that it was available. Returns deemed to include EELM were added to the inventory.

We supplemented information obtained through internet searches through key informant discussions with investigators and project leaders (for example, administrators of Project ECHO at UNM), key funders, and host organizations (such as DoD).

As part of preliminary work in August and September 2017, ASPE issued a call on behalf of RAND for information about funded ECHO projects. The recipients of this request were AHRQ,

[5] We derived this data based on searches run on the websites for U.S. News and World Report (https://www.usnews.com/) and Only In Your State (https://www.onlyinyourstate.com).

Office of the Assistant Secretary for Preparedness and Response, Office of the Assistant Secretary for Health, CDC, CMS, IHS, HRSA, SAMHSA, NIH, and ASPE. To maximize the likelihood of response, we asked for minimal information about each project—such as name, contact person, amount of funding, and dates of funding. At the time, we extracted the relevant information from these lists and then filled in remaining fields, where possible, using other sources, such as web searches, government websites, information from publications, and direct contact with researchers. For the current update of this inventory (2018), we improved upon this earlier effort by filling in as many cells as possible, using additional search terms.

Criteria for EELM

In consultation with ASPE, we developed criteria to define EELM. They are detailed in Chapter 4; briefly, the review included only projects with (1) specialist-generalist training, (2) interactive mentorship, (3) case-based presentations, (4) technology-enabling platforms, (5) a hub-spoke framework, (6) multiple sessions over extended time, and (7) a health-focused objective. Where full information was not available, we used our best judgment to determine fitness for inclusion.

Inventory Structure

The inventory is organized alphabetically by state and then by country. Where available, we provided the following specifications: (1) state of implementation, (2) name of the implementing organization(s), (3) topic area of initiative, (4) starting date, (5) funders, (6) brief description of the initiative, (7) web address from which data were extracted, and (8) contact information for inquiries.

Limitations

Online searches for this inventory were conducted between December 2017 and March 2018 and updated in December 2018. This search focused only on hub locations and not on the necessarily much higher number of spoke sites involved with each hub, sometimes located in a different state (or country). Returns were limited to extant websites and relevant online information available during this time period, identified based on the search criteria outlined previously. In the event that search terms were missing from a web page or the initiative was not listed online, it is possible that some initiatives were not captured. Additionally, many initiatives contained minimal information online, making it difficult to determine whether they met the inclusion criteria. This is reflected in the frequency of "unknown" entries in the following pages. Many projects also use different names in different settings, creating risk of duplicate entries. Individuals can refer to URLs and contact information to follow up directly with specific initiatives and inquire about additional content.

The full search approach can be found in Appendix A.

Evidence Review

The purpose of the evidence review was to evaluate the current state of published evidence for the effectiveness of EELM that have been measured in any way. This broadly consists of evidence of any impact on providers, on the care provided, and on the outcomes that patients experience from care. Findings from this work can be found in Chapter 5.

Search Strategy

We conducted a systematic review of academic and gray literature, in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (undated), targeting peer-reviewed publications that evaluate EELM. In consultation with public health experts in the field of telehealth, we operationally defined EELM according to a set of six inclusion criteria as previously described.

Based on these inclusion criteria, we implemented a Boolean search procedure based on key words defined under one or more of three domains: (1) a technology-enabling component, (2) involvement of health personnel, and (3) key terms connoting resource or geographic barriers, which EELM are typically implemented to address (Table 3.1). Each search query was conducted by combining all terms within each column using "or" statements, and then linked across columns 1–3 using "and" statements. As a complementary, independent strategy, we searched for ECHO-specific terminology, linked by "or" statements (Domain 4). Sample search terms can be found in Table 3.1; the full search is detailed in Appendix B.

Table 3.1. Search Term Categories

Domain 1 Technology Component	Domain 2 Health Personnel	Domain 3 Resource Barriers	Domain 4 Echo-Specific Terms
Tele-mentor*	Primary care provider*	Rural	ECHO
Video-conferenc*	Internist*	Remote	TeleECHO
Tele-educat*	General practitioner*	Underserved	SCAN-ECHO
Tele-conferenc*	Nurse or nurse practitioner*	Low-resource	Specialty care access network
Tele-train*	Psychiatr* or psycholog*	Resource-constrained	Extension of community healthcare outcomes
Collaborative learn*	Mental or behavioral health	Community-based	Learning collab*

NOTE: * denotes truncation search terms (all terms that begin with a given string of text). For example, "tele-mentor*" could return "tele-mentor," "tele-mentors," tele-mentoring," "tele-mentored," etc.

For academic literature, we searched Google Scholar in addition to three academic databases: PubMed, Embase, and PsychInfo. Google Scholar was limited to the first 100 returns. In addition, we searched trial registration websites, such as ClinicalTrials.gov, the Cochrane Central

Register (CENTRAL), and Scopus. Using seminal articles identified through this process, including a 2016 review by Zhou and colleagues (2016), we also examined bibliographies.

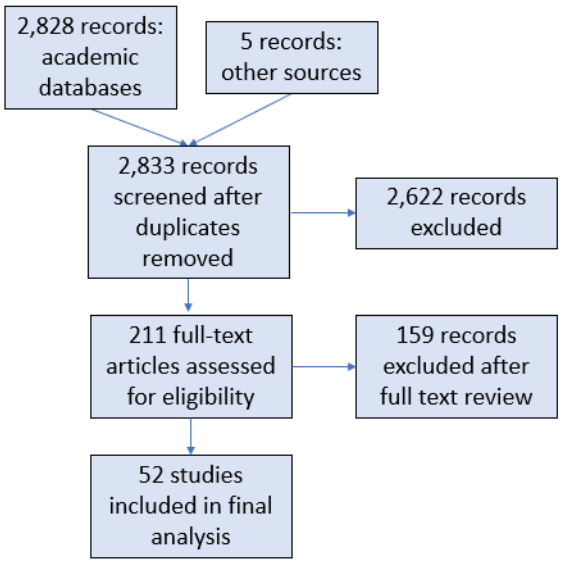
For gray literature, we compiled an inventory of all U.S. medical schools and the 250 largest and top-ranked teaching hospitals in the United States, which represent the principal hub locations of EELM. We then queried all associated hospital-related and medical school–related websites based on this inventory. As a second step, we identified a list of countries implementing EELM and repeated this query. Lastly, we sought direct inputs from key authors, practitioners, and telehealth experts through phone-based and in-person interviews, featuring interviews with experts from VA, which operates SCAN-ECHO (U.S. Department of Veterans Affairs, Office of Public and Intergovernmental Affairs, 2012), IHS, Kaiser Permanente, HRSA, other departments within HHS, and Project ECHO. These interviews alerted us to recent articles and ensured we had not missed any evidence considered relevant by experts in the field.

Document Review

We limited results to peer-reviewed articles published in English between January 2007 and December 2017, and we updated the search results as of December 1, 2018. After identification of articles and reports based on the search procedures already described, we inspected titles, abstracts, and report summaries to determine whether the source addressed topic areas and didactic approaches consistent with EELM. Returns were screened independently by two research team members. In the event that a discrepancy arose, remaining members of the research team were consulted.

A screening form was used to assess each record for agreement with the six inclusion criteria. As a further requirement, articles also needed to report outcomes—whether these were provider outcomes, such as self-reported improvement in self-efficacy, or patient outcomes, such as decreased systolic blood pressure or changes in processes of care. Where one or more criteria were not met, or where results were not reported, articles were excluded (n = 2,622). For situations in which agreement with inclusion criteria was unclear from the title and abstract alone, the full text was obtained and reviewed so that missing information could be completed and so that a determination could be made about eligibility for full data abstraction. For every record that was excluded (2,622 excluded based on title and abstract + 159 excluded after full text review = 2,781 excluded total), the reason for exclusion was documented in the screening form. Records that reported results and were scored as meeting all inclusion criteria were flagged for full data abstraction. Articles that did not meet all inclusion criteria or failed to report outcomes were excluded (see Figure 3.1).

Figure 3.1. Flowchart of Systematic Review



Data Abstraction

For each article that met inclusion criteria, we abstracted the following content: author(s), journal, year, title, health topic, hub name and geographic location, number of spokes, number of trainees, implementation and analytic period, number of training sessions, training session frequency and duration, evaluation design, primary provider outcome measure, primary provider outcome results reported, primary patient outcome measure, and primary patient outcome results reported. We also noted cases where more than one article was published from a single research project.

For both provider-related outcomes and patient-related outcomes, a primary coder assigned a Grading of Recommendations Assessment, Development and Evaluation (GRADE) score for quality of evidence on each article (Ryan and Hill, 2016). In accordance with Cochrane Collaboration conventions, GRADE scores reflect the merit of evidence for each outcome based on six characteristics: study design, risk of bias, inconsistency, indirectness, imprecision, and publication bias. Quality of evidence is assigned an ordinal GRADE score from + (very low) to ++++ (high). An overview of all abstracted data can be found in Appendix C in Tables C.1–C.3. The research team then collectively deliberated the weight of evidence across articles for each patient- and provider-related outcome, rendering a final grade score for these.

Limitations

A few study limitations should be noted. First, although we tried to be comprehensive in our search, it is possible that we missed some articles, particularly if they did not use any of the key words outlined in our search criteria (see Table 3.1). Second, study outcomes presented in Tables D.1 and E.1 are those identified by the authors as primary research findings and do not reflect an exhaustive list of outcomes. For an exhaustive list, we recommend that readers refer to the

bibliography to examine the primary source. Third, we were unable to include works in progress in this review, though there are many underway. Likewise, there were several studies that included five of six inclusion criteria and reported relevant findings, but we were unable to discuss these within the scope of this review. The most common reason for exclusion was that training sessions did not involve a case-based model of pedagogy. This was necessarily the case for many remote surgery training programs, which required real-time coaching.

Evaluation Options: Convening of a Technical Expert Panel

We convened a TEP for the purpose of assessing the state of the evidence for the effectiveness of EELM and discussing the potential options to strengthen the evidence base. In consultation with ASPE, we invited ten individuals to participate in the TEP, representing a range of expertise and backgrounds in implementation science, statistical methods, program evaluation, telehealth policy, clinical research, and leadership and implementation of EELM.

The TEP meeting covered three broad areas: what is currently known about EELM (reviewing and evaluating the existing evidence base), what is not yet known about EELM (identifying key research gaps), and approaches to address those gaps, including potential study designs that could answer the key research questions about EELM and fill the gaps in knowledge. The Populations, Interventions, Comparators, Outcomes, Timing, Settings, and Study design (PICOTSS) framework, which is often used for the identification and evaluation of research questions, was used to guide discussions throughout the day (Davies, 2011).

Our team moderated four discussion sessions, which were audio-recorded with participants' consent. Both high-level and detailed notes were taken, and these were reviewed to extract key themes. Federal observers and representatives of foundations that have funded the implementation, and in some cases evaluation of EELM, attended the TEP meeting to provide additional context as needed.

Findings from this work are detailed in Chapter 6.

Examples of Evaluations of EELM That Vary in Complexity and Rigor

As a companion to the evaluation report, we created examples of evaluations of EELM that varied in complexity and scientific rigor. The findings of this effort are presented in Appendix D as an aid to policymakers considering an investment in such evaluation.

We selected the PICOTSS framework, a common variation on the Population, Intervention, Comparison, and Outcome framework, as already described.

Data Collection

As inputs for our analysis, we identified 41 implementation research studies registered on the U.S. National Library of Medicine's (USNLM's) ClinicalTrials.gov website or on its webpage listing Health Services Research Projects in Progress (2018q) that examined the effects of health interventions on provider- and patient-related outcomes—limited to topic areas overlapping with

the scenarios previously described—specifically, pediatric asthma, OUD, MAT, and dementia care (see Table D.1). Evaluation costs from studies featured both costs associated with implementation and indirect costs.

In addition to topic area, research studies were selected based on proximity to each of the PICOTSS dimensions previously outlined. In other words, we attempted to identify research studies that contained features as similar as possible to those that would be reflected in potential studies of EELM, in terms of content and design. We also limited studies selected to funding mechanisms oriented toward implementation and evaluation of health services, such as R-series grants (large or medium-sized project grants by NIH or AHRQ). We did not consider career development grants, such as K awards, which exist for the purpose of funding development of an investigator more than any particular project.

Study features of the 41 studies are outlined in Appendix D. The appendix also provides source citations for reviewing the original study and funding information.

4. Findings: Inventory

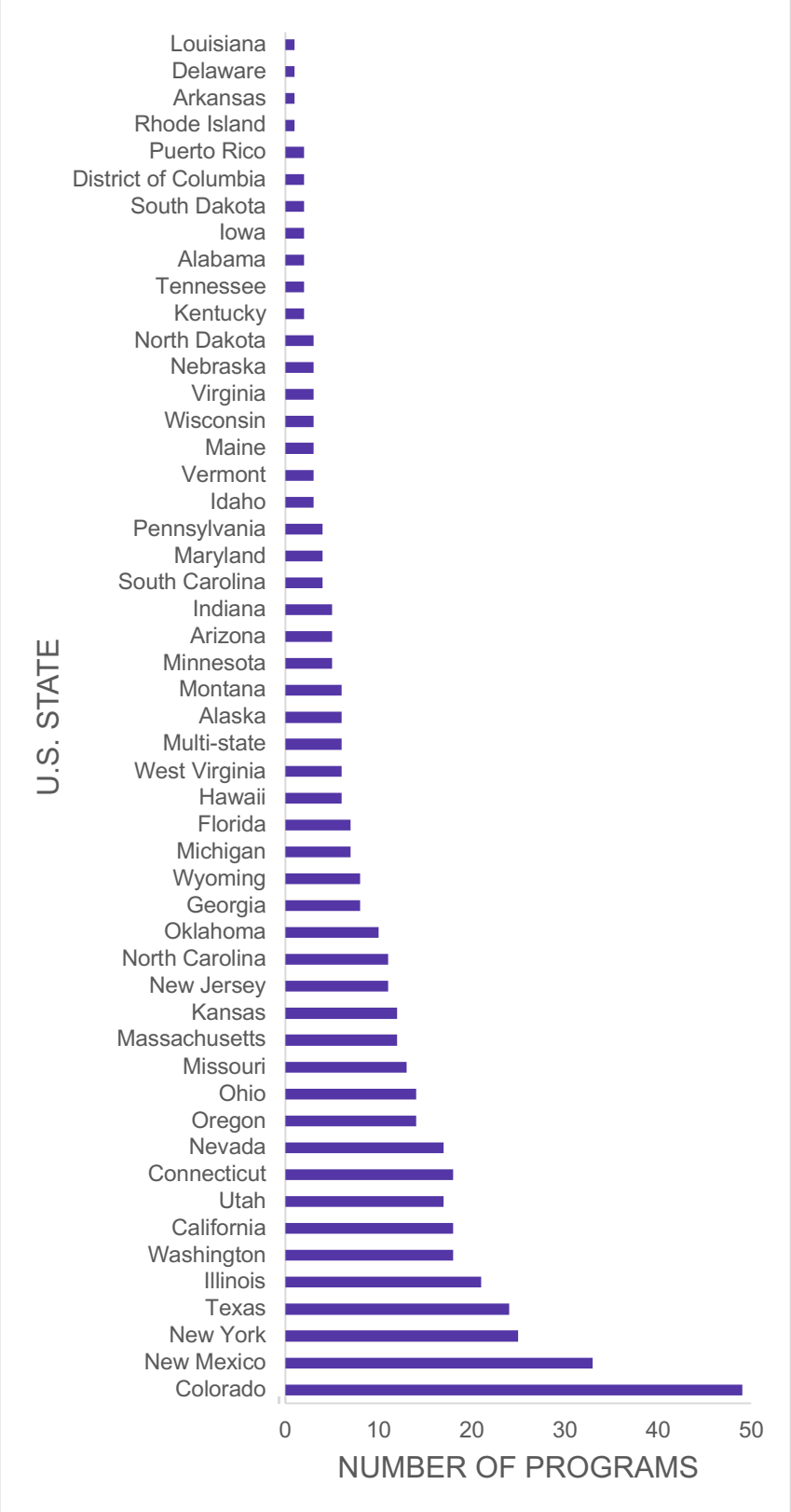
Although EELM have expanded in recent years, there have been limited efforts to systematically document their scope and scale. Given the extent of human and financial capital invested to-date—thousands of trainers and trainees and millions of dollars of grant funding—an overview of scope and scale of EELM in the United States is warranted.

In order to describe the landscape of EELM, we conducted a systematic and wide-ranging search for existing EELM across the United States. (Methods are described in detail in Chapter 3.) For each program identified, we gathered information regarding topic, date of initiation, topics covered, contact person, website, and funding source and amount (where that information was available). Of note, programs were counted based on hubs because spokes frequently enter and leave EELM and are exceedingly difficult to count. The findings are presented here, with further details on individual programs located in Appendix F.

Overview

In total, we identified 585 ongoing and recent EELM for improving access and enhancing quality of community health (see Figure 4.1 for state-by-state numbers). Of these, 469 (80 percent) were U.S.-based; 116 (20 percent) were international (Canada, United Kingdom, India, Australia, and the Caribbean). Within the United States, the average number of identified EELM was nine programs per state, ranging from none in Mississippi and one in such states as Delaware and Louisiana to a high of 49 in Colorado. Internationally, of the countries we searched, the country with the most instances of EELM implemented was India (with 40), followed by Northern Ireland (with 39).

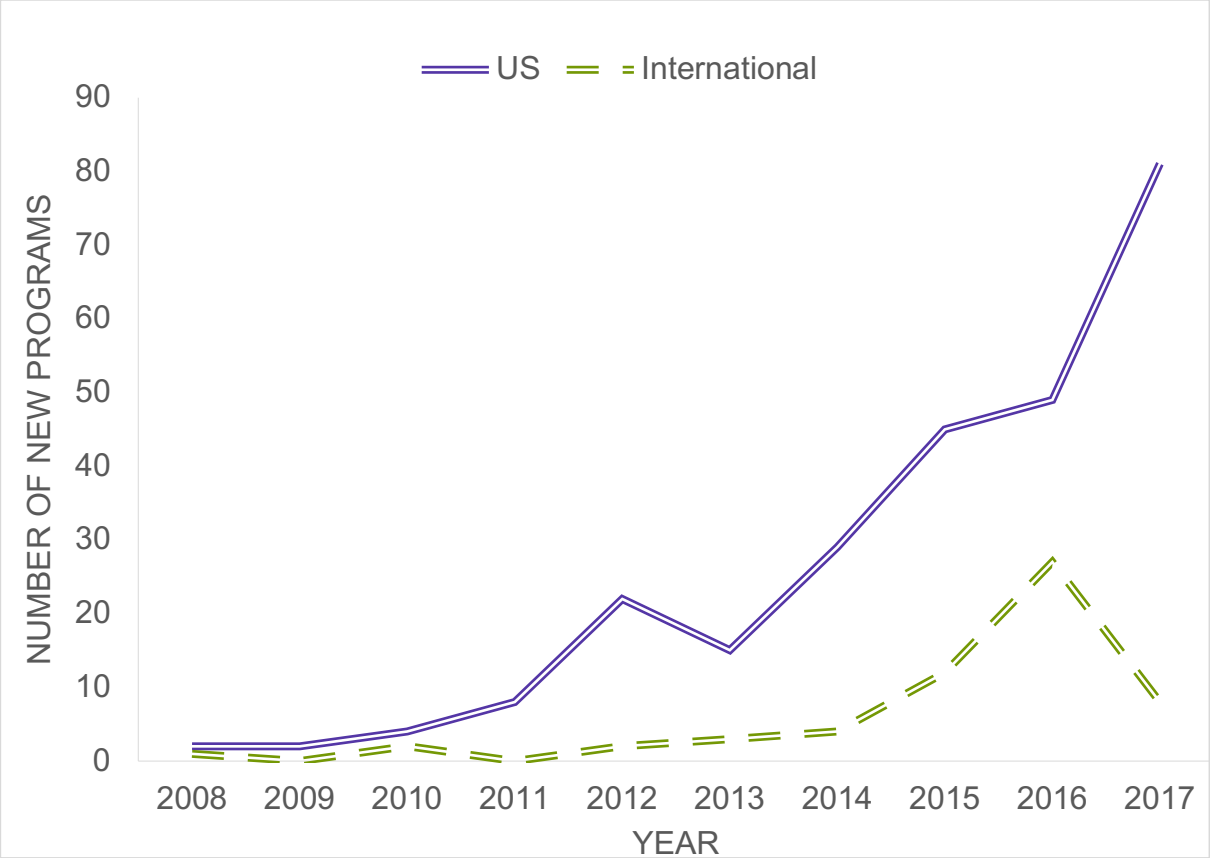
Figure 4.1. Count of EELM Implemented, by State



Trends in Implementation

Time trends. There has been a steady growth in the number of EELM implemented over the past several years: Between 2012 and 2017, there has been an average of 41 new EELM introduced each year—with 76 new programs generated in 2017 alone. The international trend is more modest, but it follows a similar pattern (see Figure 4.2), with an apparent dip between 2016 and 2017 that might simply be due to random variation in the context of low numbers.

Figure 4.2. Number of New EELM Introduced, by Year, 2008–2017



Topic areas. We identified a wide range of topic areas targeted by EELM. In total, we identified EELM covering more than 100 health topics ranging from chronic pain management to control of Zika virus. Table 4.1 provides topic areas of EELM as broken out by states; Table 4.2 presents an overview of the ten most common topics of EELM, representing almost half of all EELM (53.9 percent).

Of the 469 EELM with U.S.-based hubs, 111 (24 percent) focused solely on pediatric issues; a further 11 programs (2 percent) focused on both pediatric and nonpediatric issues.

Table 4.1. State-by-State Topic Areas of EELM

State	Cancer	Cardiovascular Health	Care Transitions/ Care Management	Clinical Leadership	Complex Pediatrics	Dermatologic Conditions	Developmental Behavioral Pediatrics	Digestive & Liver Disorders	Emergency Medicine	Endocrine Disorders	Geriatrics	Health Systems Transformation	Hematologic Disorders	Hepatitis C	HIV	Kidney & Urinary Diseases	LGBT Health	Maternal Health	Mental Health	Mental Health : Other	Mental Health: ADHD	Mental Health: Co-occurring Disorders	Mental Health: Depression	Mental Health: Psychosis-related	Mental Health: Trauma	Neurological Disorders	Obstetrics/Gynecology	Ophthalmology	Opioid Use Disorder	Other Infectious Diseases	Pain Management	Palliative Care	Public Health	Pulmonary Disorders	Quality Improvement	Rheumatologic Disorders	Substance Use Disorder	Surgery	TB	Weight Management
Alabama							1			1																													
Alaska							3																	1		1										1			
Arizona														2															1		1				1				
Arkansas																							1																
California							2		1		1		1	2		1				2							1		2		1	1	2						
Colorado	7		4	2	2		2			3		5		1	2					2			1		2	3			2		1		4		2		1		1	2
Connecticut			1				1							1	1		2			2					1				2		4				1				
Delaware																													1										
District of Columbia																				1															1				
Florida										1					4												1			1									
Georgia	1						1			1													1		3	1													
Hawaii							2			1	1									1						1													
Idaho																						1							1		1								
Illinois	1	2	1				1				2		1	2						2	1			1	1	2			1				1	1					1
Indiana														1	1														1		1						1		
Iowa							1													1																			
Kansas							3													1	1					1			1		1			3					1
Kentucky	1																			1																			
Louisiana								1																															
Maine										1																					1					1			
Maryland							1						1							1						1													
Massachusetts			1				3			1				1	1											1			3							1			
Michigan		1						2								1				1													1		1				
Minnesota							2																						3										
Mississippi														1																									
Missouri			1			1	4							1							1	1							1		1			2					
Montana			1						1											2					1				1										
Nebraska																															1			1				1
Nevada		1		1			1	1	1	1	1	1								3									2	1	2		1						
New Jersey							2			2				1												2					1	1				2			
New Mexico		1	1				4		1	2		2		2	1		1		1	1						3			2	2	1	1		2		2	2		1	
New York			2		1		1			1	4	2		1	1					4									1	1	2	1		1			1			
North Carolina			1				1							3														1		2	1				1	1			
North Dakota	1																											1			1							
Ohio			1							1	1			1										3				1		2			3				1		
Oklahoma														2	1				1	3						1		1										1
Oregon		1	1							1				3		2				4											1			1					
Pennsylvania		1						1																					1								1		
Puerto Rico																														1			1						
Rhode Island																				1																			
South Carolina		1																		2									1										
South Dakota																				1									1										
Tennessee							1																				1												
Texas	8	1		1				1		2				2		1				1										2		1		1		1	1			
Utah	1	1						4	1					2				3		1					2	1							1						
Vermont																													2		1								
Virginia				1			1													1																			
Washington		2								1	1			1	3					1				2		1			2	1	2						1	1	
West Virginia	1													1						1											1			1			1		
Wisconsin																													1								1		
Wyoming			2				2				1	1								2																			

NOTE: For this table, programs were listed in a single state only—specifically, the location of the hub—even if operating multiple states. ADHD = attention deficit hyperactivity disorder; LGBT = lesbian, gay, bisexual, and transgender; TB = tuberculosis.

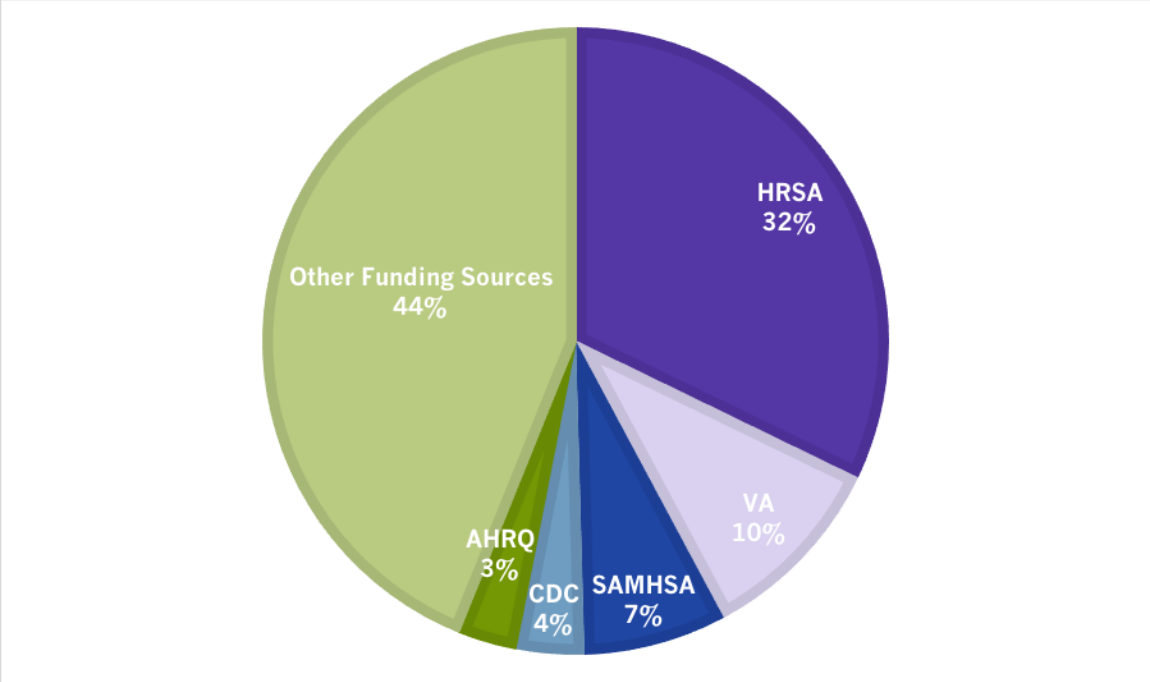
Table 4.2. Most Frequent Health Content Areas Covered by EELM

Health Content Area	Number of Programs	Percentage of Total EELM
Mental health	51	8.7
Substance use disorders	40	6.8
Chronic pain management	39	6.7
Opioid use disorder	35	6.0
Hepatitis C	35	6.0
Autism spectrum disorders	30	5.1
Cancer care	24	4.1
Palliative care	22	3.8
HIV/AIDS	20	3.4
Diabetes	18	3.1
Other	271	46.3
Total	**585**	**100**

NOTE: Based on number of programs, not number of publications.

Funding. The most common funder based on number of programs, when reported (n = 292 programs), was HRSA (n = 74, or 25.3 percent). This significantly surpassed the frequency of other funding sources reported, with the next closest being VA (n = 23 programs, 7.9 percent). It should be noted that the funder was reported in 49.5 percent of cases, and that the total dollar amounts were seldom available (see Figure 4.3).

Figure 4.3. Funding Sources for EELM



NOTE: These data come from the 49.5 percent of programs with available funding information. Percentages reflect the number of programs funded, not the total funding amount, which was often not available.

Key Messages

There are three clear take-away messages from surveying the online evidence around implementation of EELM:

1. There has been substantial growth in the number of EELM over time, counted by the number of hubs, both within the United States and abroad. Reported EELM have increased from 24 new programs introduced in 2012 to 90 new programs in 2017, and expansion continues to accelerate.
2. Within the United States, there are focused pockets of activity both geographically and topically. The two most prolific states for implementing EELM—Colorado and New Mexico—account for more activity than the bottom 25 states combined. Similarly, the top ten topic areas for EELM account for a preponderance of programs, with a long tail of topic areas that have been presented only once or twice. These most common topic areas, such as pain, mental health, and SUD, correspond closely to the conditions that are most common and impactful for patients, and those that many clinicians feel under-equipped to address.
3. The quality of documentation associated with most EELM is minimal. Most websites featuring EELM highlight a program name, topic area, training dates, location, and general objective. Beyond this, it is difficult to infer a wide range of other characteristics

about ongoing programs, such as frequency and duration of trainings, number of attendees, funding sources, programmatic costs, and results of the program.

Summary and Looking Forward

The growing physician shortage and aging of the population in the United States are likely to generate ongoing interest in potential interventions, such as EELM, to expand the capacity to deliver care. The number of new EELM has increased in recent years for a variety of reasons, and if EELM are ultimately shown to effectively address existing gaps in provider capacity, this trend could continue. To support the evidence base, it will be important for EELM to better describe the characteristics of their programs when publishing outcomes.

5. Findings: Evidence Review

Though Project ECHO has undoubtedly expanded its scope and scale, the question of whether EELM are having an impact still remains. An investigation of the evidence was therefore warranted, given the extent of human and financial capital invested to date.

Part of the mandate associated with the ECHO Act is to report on the state of the science associated with EELM, including analysis of their use, integration, and impact. Impact can be assessed in terms of two broad categories of outcomes: provider-related outcomes and patient-related outcomes. Provider-related outcomes include satisfaction with training, improved confidence providing care, measures of clinical knowledge, behavior-related changes in care provision, and patient retention. Patient-related outcomes include changes in processes of care (such as frequency of treatment initiation, referrals, and prescriptions) and in direct outcomes (such as rates of treatment success and failure and reductions in morbidity and mortality). EELM could also impact costs by replacing visits to specialists with visits to primary care providers (PCPs), increasing capacity of specialists to see additional patients with more complex conditions, and broadening the kinds of patients that PCPs can manage, thereby adding additional streams of revenue. Although it is important to measure all of these outcomes, some might be more compelling than others. For example, demonstrating improved patient outcomes, such as reductions in morbidity and mortality, is more compelling than demonstrating that participants of EELM are satisfied with the programs.

Here we present our findings of a systematic review of peer-reviewed evidence of the impact of EELM on provider- and patient-related outcomes between January 1, 2007, and December 1, 2018. We followed the Cochrane Collaboration's GRADE framework to examine the quality of evidence to date and use this review as a basis for highlighting potential next steps (Ryan and Hill, 2016). (Methods are described in detail in Chapter 3.)

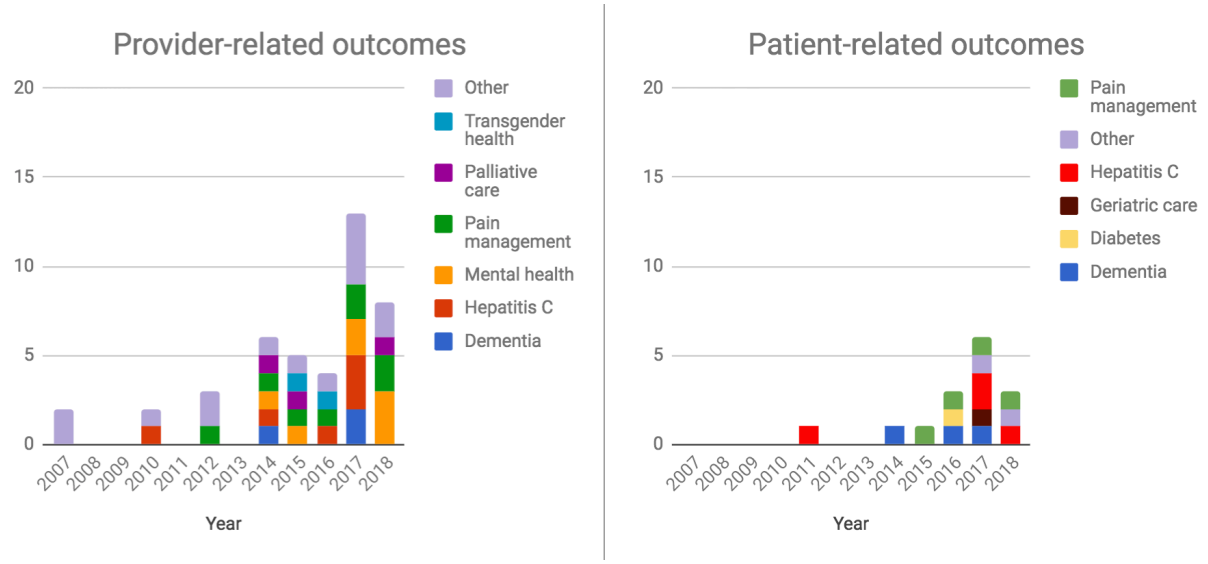
Results

After implementing search procedures, we reviewed 2,833 records—2,828 from database searches and an additional five from bibliographic reviews and all other searches. There was an acceptable degree of interrater reliability between screeners on whether articles should be excluded from full text review: Raters agreed 97.3 percent of the time. Following screening, 211 articles were identified for full-text review for eligibility based on general topical relevance to EELM. Based on inclusion and exclusion criteria, a total of 52 articles met eligibility for inclusion based on presenting results of a study of the impact of EELM on some sort of outcome (see Table C.1). The most frequent reasons for exclusion were either because the authors discussed a telemedicine intervention in which specialists met remotely with patients rather than

with providers, or because the trainings in the intervention did not use an interactive, case-based method of pedagogy.

The most common health topics addressed by EELM were HCV, chronic pain management, and dementia and elderly care. Of 52 articles, 39 focused on EELM implemented in the United States, with Canada and Australia as the next most common countries. Year by year, there has been a steady increase in the number of published evaluations of EELM (see Figure 5.1).

Figure 5.1. Publication Count on Provider- and Patient-Related Outcomes, by Health Topic by Year



NOTE: "Other" category consisted of sleep medicine, oncology, nutrition, hypertension, osteoporosis, dermatology, HIV care, smoking cessation, chronic liver disease, and multiple sclerosis. The figure includes data through December 1, 2018.

Occurrence of discussion sessions held by EELM typically ranged from weekly to monthly, lasting 60 to 180 minutes per session, with wide variation in the total number of sessions conducted—in part because of the continuous nature of many intervention protocols. Similarly, there was significant variability in the number of trainees and the number of patients served by those trainees. In some instances, these numbers were not reported. Studies largely fell into one of two categories, reporting either provider (trainee) outcomes or changes in processes of care or patient outcomes as a consequence of provider trainings. Here, we present a topical synthesis of these articles, organized by provider-related outcomes and patient-related outcomes.

Provider Measures

Of the 52 articles published between January 1, 2007, and December 1, 2018, 43 articles presented quantitative and qualitative evidence outlining provider-related effects of EELM. Studies most frequently measured outcomes in one of four areas: (1) provider satisfaction with quality and content of trainings (n = 17; 40 percent); (2) provider knowledge acquired (n = 18;

42 percent); (3) enhanced provider confidence or self-efficacy associated with care delivery (n = 18; 42 percent); and (4) changes in self-reported provider behaviors associated with patient care (n = 7; 16 percent). Additionally, study-specific provider outcomes apart from these four groupings are referenced in Table C.2. In terms of study design, 23 of 43 (53 percent) involved a counterfactual—either within subjects (pre versus post) or between them. Although only one of the studies included an element of randomization, three studies involved both within-subject and between-subject comparisons.

Provider satisfaction. Assessment of provider satisfaction has largely entailed administration of post-intervention structured surveys, in which trainees are asked to assign ordinal or yes/no responses to a range of prompts (Beste et al., 2016; Chaple et al., 2018; Cordasco et al., 2015; Covell et al., 2015; Farris et al., 2017; Katzman et al., 2014; Kauth et al., 2015; Mehrotra et al., 2018; Oliveira, Branquinho, and Goncalves, 2012; Rahman et al., 2010; Shipherd et al., 2016). The median response rate was low (under 50 percent); however, self-reports consistently convey positive ratings, at both the item level and the survey level. In several instances, satisfaction was framed in terms of participation benefits, such as "Because of [EELM], I have expanded my practice to include new skills" (Beste et al., 2016). In addition to structured surveys, a handful of authors conducted focus group discussions (Carlin et al., 2018; Katzman et al., 2014; Volpe, Boydell, and Pignatiello, 2014) and semistructured interviews (Cordasco et al., 2015; Fisher et al., 2017; Ní Cheallaigh et al., 2017; Van Ast and Larson, 2007) to solicit more-detailed feedback on aspects of EELM that worked well and less well—often with a focus on the acceptability of the technology platform used. Here, responses were also generally positive, although—given the nature of the design—samples were purposively selected and therefore small.

Provider knowledge. In one study, Meins et al. (2015) evaluated provider knowledge on topical content simply by asking participants after training to self-report whether they perceived their knowledge had improved. More often, studies implemented a pre-post design in which providers were asked to self-assess their knowledge at baseline and again at endline, with statistically significant changes observed (Ball et al., 2018; Komaromy, Ceballos, et al., 2018; Marciano et al., 2017; Masi et al., 2012; Mehrotra et al., 2018; Sockalingam et al., 2017; Swigert et al., 2014; Wood et al., 2016). In a subset of pre-post assessments, specific assessments of knowledge on the topic area of interest were constructed by the authors and administered (Anderson et al., 2017; Masi et al., 2012; Rahman et al., 2012). Authors found significant improvements in objectively measured content knowledge. In one instance on pain-related knowledge, change scores among trainees were compared with a control group that had not participated in sessions; improvements among trainees were significantly greater (Anderson et al., 2017). However, a cluster randomized controlled trial (RCT) on the same topic did not find any knowledge benefit among providers at participant clinics compared with those at nonparticipant clinics (Eaton et al., 2018).

Provider confidence. Self-reported changes in confidence and self-efficacy were largely focused on patient treatment; i.e., whether providers felt more confident in their ability to

diagnose and treat patients following participation (Ball et al., 2018; Chaple et al., 2018; Haozous et al., 2012; Johnson et al., 2017; Kauth et al., 2015; Mehrotra et al., 2018; Ray, Fried, and Lindsay, 2014; Swigert et al., 2014; Wood et al., 2016). Metrics along these lines were reported in most studies—post-intervention self-reported changes that were purely descriptive (Johnson et al., 2017), within-subjects change from baseline to endline (Ray, Fried, and Lindsay, 2014), and between-subjects comparisons in perceived competence among trainees versus a nonparticipant comparison group (Haozous et al., 2012). In most instances for which comparisons were made, results were positive and statistically significant; a notable exception came from the cluster RCT on chronic pain management that found no statistically significant differences (Eaton et al., 2018).

Provider behavior change. Several studies administered surveys in which providers were asked to self-report behavior change as a result of case presentations. For example, Komaromy, Ceballos, and colleagues (2018) found that 77 percent of participants reported that case discussion changed their patient care plans for comorbid mental health and substance use disorders. Likewise, Catic and colleagues (2014) observed recommendations for dementia treatment were incorporated 89 percent of the time by case presenters. Qaddoumi and colleagues (2007) reported that 91 percent of case presenters on pediatric neuro-oncology cases followed recommendations by trainers. In other studies, providers were simply asked through a survey or interview whether participation in EELM had altered or would alter their provision of care (Beste et al., 2016; Ní Cheallaigh et al., 2017; Wood et al., 2018); on such occasions, providers generally responded positively.

> *We wanted to do a good evaluation and speak to sustainability beyond the grant.*
> –Michael Hasselberg, program director of Rochester ECHO (2018)

Patient Measures

In total, 15 of 52 identified studies (29 percent) discussed patient-related outcomes, including changes in care processes and outcomes of care. Few studies examined costs of care as an outcome. As anticipated, outcomes were particular to the health condition addressed in the context of the study (see Table C.3). Results are presented by condition, separated into five categories: (1) HCV; (2) chronic liver disease; (3) chronic pain management and opioid addiction; (4) gerontology, including geriatric mental health and dementia; and (5) diabetes management.

Hepatitis C. Four studies presented patient outcomes related to HCV. Arora and colleagues (2011) compared sustained virologic response of patients treated at a central training site versus at trainee sites and found no difference ($p > 0.05$). This was a positive finding, indicating that generalists performed at a level comparable to specialists in managing HCV such that patient outcomes were similar. They also found a lower rate of serious adverse events at trainee sites ($p = 0.02$), likely attributable to selective referral. These findings were similar to those of a more

recent study by Mohsen and colleagues (2018). Here, authors compared 100 patients of providers who participated in an EELM with 100 patients who received care in a tertiary liver clinic (TLC). Initiation of direct acting antiviral therapy was similar between groups (EELM, 78 percent; TLC, 81 percent), as was completion of treatment (EELM, 89 percent; TLC, 86 percent) and—to a lesser extent—sustained virologic response (EELM, 87 percent; TLC, 96 percent). However, this study did not report whether these comparisons were statistically significant.

Beste and colleagues (2017) identified PCPs participating in EELM that focused on HCV and providers who had not participated and then compared the likelihood of the PCP initiating medication treatment for the patient. The authors found that treatment initiation was higher among trainees (hazard ratio [HR] 1.20, $p < 0.01$), but this effect was a result of increased initiations among only those patients who were presented in case discussions (HR 3.30, $p < 0.01$). By contrast, there was no difference in treatment initiation rates between the other patients of ECHO-participating clinicians and patients of non-ECHO clinicians (HR 1.03, $p = 0.54$), implying that ECHO sessions were functioning less like a capacity-building model and more like a kind of e-consult that only changes care for patients who are presented; there was no evidence of attendees increasing capacity to manage HCV independent of expert help. Lastly, Ní Cheallaigh and colleagues (2017) conducted a series of semistructured interviews with trainees. Interviewees reported that the patients attending their practices were beneficiaries of their ECHO training. For example, in discussing an apparent freeing-up of specialist time by the model, one trainee remarked, "Now, access to specialist clinics has improved. [The local specialist] has actually taken back some people that he discharged. He's also seen a couple of new people" (Ní Cheallaigh et al., 2017, p. 149).

Chronic liver disease. We identified two studies on chronic liver disease that examined patient-related outcomes. The first, a study by Glass and colleagues (2017), found that training through EELM allowed patients to access care sooner and travel less distance compared with those seeking in-clinic specialty care. The study did not examine changes in processes or outcomes of care. A second study, by Su and colleagues (2018), examined the effect of receiving a virtual consultation through the Ann Arbor VA SCAN-ECHO program on chronic liver disease. Between 2011 and 2015, a total of 513 veterans with chronic liver disease received a virtual consultation from a provider participating in the SCAN-ECHO program; 62,237 veterans with chronic liver disease received no visits over this same time period. After propensity score matching on characteristics predictive of receiving a visit, researchers found the HR of all-cause mortality among those receiving a virtual consultation to be 0.54 (95-percent confidence interval 0.36–0.81, $p = 0.003$), meaning that those receiving the intervention were much less likely to die than those who had no SCAN-ECHO consultation over the same time period.

Chronic pain management and opioid addiction. Four studies focused on pain management, including among patients with opioid misuse. Anderson and colleagues (2017) compared providers at community health centers who participated in training through EELM with those who did not participate. They found that, among those who participated, frequency of opioid

prescription declined significantly; with no such decline observed in the comparison group ($p = 0.02$). Additionally, the number of opioid prescriptions per patient increased significantly more among those in the control group ($p = 0.001$). Furthermore, patient referrals for both behavioral health and physical therapy, both ways to address pain and opioid addiction, increased among those with providers who participated in trainings, but not among those in the comparison group ($p < 0.001$). Frank and colleagues (2015) compared the likelihood of referrals among patients presented as cases with those not presented as cases. The authors observed greater odds of patient referral to physical therapy among participants presented as cases ($p < 0.05$), as well as greater odds of patients receiving an antidepressant ($p < 0.05$).

In a third study, Carey and colleagues (2016) performed a spatial reach analysis, concluding that greater patient distance from home to specialty pain care was associated with slightly lower odds of access to a provider trained through an EELM ($p = 0.01$), compared with much lower odds of being seen in person at a specialty care clinic ($p < 0.001$). This implies that, although EELM do not completely erase the adverse impacts of distance on access to specialty care for pain, they do attenuate this impact. A fourth study, by Katzman and colleagues (2018), examined opioid prescription rates across 1,382 clinics associated with the Army and Navy, 99 of which participated in an EELM between 2013 and 2016. Compared with patients of a provider who did not participate in EELM trainings ($n > 1{,}000{,}000$), those with a provider who did participate ($n > 50{,}000$) observed a greater decline in prescriptions—from 23 percent to 9 percent ($p < 0.001$). This finding remained even after employment of propensity score matching. Taken together, data from these four studies consistently indicate that trainings positively affect care processes for patients; but no evidence addresses direct patient outcomes, such as patient-reported reductions in pain, or lower likelihood of opioid-related hospitalization or overdose.

Gerontology, including geriatric mental health and dementia. Three studies examined elderly care for those with mental health conditions, including dementia; one additional study examined transitional care among elderly populations. Catic and colleagues (2014) examined the effect of adhering to expert recommendations during case presentations, specifically for long-term care (LTC) residents with dementia and behavioral issues, and found that providers who followed recommendations were more likely to report "clinical improvement" among patients ($p = 0.03$). Fisher and colleagues (2017) examined the relative change in care utilization and costs among geriatric patients with non-dementing geriatric mental health conditions, compared with geriatric patients without such conditions, before versus after their providers participated in training through EELM. The authors found that those with a mental health condition observed a reduction in emergency department costs—from \$406 to \$311 ($p < 0.05$), which was not observed in the comparison group. Over the same period, those without mental health conditions observed significant increases in outpatient care utilization and costs ($p < 0.05$) not observed among those with mental health conditions.

Gordon and colleagues (2016) compared patients at facilities of providers who were trained through EELM with those who were not by inspecting 11 quality of care metrics, two of which were considered primary outcomes (restraints and antipsychotic use). They observed

nonsignificant differences on these two primary measures ($p > 0.05$) but did find lower rates of urinary tract infections among patients seen at facilities with providers who were trained through EELM ($p < 0.05$), a secondary outcome of the investigation. In a final study, by Moore and colleagues (2017) examining transitional care, the authors concluded that patients with providers at a skilled nursing facility who had been trained through EELM had shorter lengths of inpatient stay ($p = 0.01$), lower 30-day hospital readmission rates ($p = 0.03$), and lower 30-day care costs ($p < 0.001$) compared with providers who had not participated. This difference was significant even after adjusting for baseline differences in patient composition between facilities.

Diabetes management. Watts and colleagues (2016) trained two PCPs on diabetes management through a framework similar to EELM. Providers reported that among patients with poorly controlled diabetes (i.e., all patients with hemoglobin A1c [HbA1c] > 9), the mean HbA1c level decreased from 10.2 before training sessions to 8.4 after training ($p < 0.001$) five months later, a clinically significant difference.

GRADE Scores

Patient-related and provider-related outcomes outlined in Table 5.1 reflect consensus assignments mutually determined by all six members of our research team. Individual members independently evaluated the quality of evidence for each outcome across the 52 studies that met inclusion criteria based on Cochrane's GRADE rubric (see Chapter 3). Because only one of the studies involved randomization, baseline GRADE scores were ++, indicating low quality. Research team members were in uniform agreement about the GRADE scores. We now provide a brief rationale for the scores assigned.

Provider-related outcomes. To date, provider outcomes have relied heavily on self-reports for providers self-selected (1) to participate in EELM, (2) to maintain participation in trainings over time, and (3) to opt to complete feedback surveys. Only one study to date includes randomization, although this is relatively common in the context of health services research where the principle of *equipoise* (when the value of a new treatment compared with the alternative is genuinely unknown) might otherwise be violated. The one RCT also concluded a null result—meaning that the EELM did not demonstrate a positive effect on outcomes, though the study might have been underpowered. Among those studies that collected data before and after trainings, most offered no control comparison, raising the question of what would have happened in the absence of training, or if trainings were substituted with a different set of learning tools. In addition, many studies tested multiple endpoints without corrections for multiple testing, which could lead to Type I error (finding evidence to support an effect when in fact no effect existed) (Noble, 2009). Furthermore, studies might have been subject to publication bias, the well-known phenomenon wherein studies with "null" findings (for example, that EELM did not improve provider knowledge) would be less likely submitted for publication, and less likely to be accepted once submitted (Easterbrook et al., 1991).

Table 5.1. GRADE Scores on Patient-Related and Provider-Related Outcomes Associated with EELM

Category	GRADE Score	Quality of Evidence
Provider measures		
Provider satisfaction (*n* = 15)	++	Low
Provider knowledge (*n* = 18)	++	Low
Provider confidence (*n* = 18)	++	Low
Provider behavior change (*n* = 7)	+	Very low
Patient measures		
Hepatitis C (*n* = 4)	++	Low
Chronic liver disease (*n* = 2)	++	Low
Chronic pain management and opioid addiction (*n* = 4)	++	Low
Gerontology, including mental health and dementia (*n* = 4)	+	Very low
Diabetes management (*n* = 1)	+	Very low

NOTE: GRADE scores range from 1 (+) to 4 (++++).

Patient-related outcomes. The quality and quantity of patient-reported outcomes varied widely between and within health content areas. Although mental health and substance use disorders are the most frequently implemented EELMs (as shown in Table 4.2), we found no literature that specifically describes the impacts of EELMs on patient outcomes associated with these conditions. With respect to such health content areas as osteoporosis, for which there were reported provider outcomes, we identified no articles indicating patient outcomes. For HCV, chronic pain management, dementia care, and diabetes, there was at least one article published on patient measures in which a counterfactual comparator was presented. Two studies, one by Anderson and colleagues (2017) and one by Katzman and colleagues (2018), employed quasi-experimental approaches to examine multiple outcomes over time. In the majority of instances, authors identified statistically significant results in favor of EELM, although the limitations of multiple comparisons and publication bias might partly explain this, as discussed earlier. With the exception of virologic suppression in the context of HCV and HbA1c levels in the context of diabetes, reported outcomes are process measures. Ideally, studies would examine changes in both processes of care and direct patient outcomes: With only outcome measures, there are few assurances of the causal pathway. By contrast, with only process measures, there are no assurances about actual benefit to patients.

Summary

Based on our analysis, the empirical evidence for the effects of EELM on patient and provider outcomes remains modest but often shows positive effects in the areas that researchers

have measured. A discussion of the results of this evidence review, putting the results into a broader context, can be found in Chapter 8.

6. Findings of Technical Expert Panel: Evaluation Options

On April 9, 2018, RAND and ASPE hosted a TEP meeting in Washington, D.C., with the goal of evaluating the evidence base for EELM and identifying opportunities to inform a potential research agenda to expand that evidence base. Details on our methods and approach for the TEP are described in Chapter 3.

Although formal consensus was not a goal of the TEP meeting, seven key themes emerged from the panel discussions. This chapter describes those key themes, which cover goals of EELM, implementation considerations, limitations of existing evidence, resultant knowledge gaps, barriers to conducting high-quality research and evaluation, proposed evaluation approaches for addressing the gaps, and the balance between enthusiasm and evidence.

Well-designed evaluation studies can help policymakers, researchers, and clinicians gain a better understanding of how EELM can be effective and under what circumstances. Potential strategies to build the evidence base, mapped to the key themes, and linked to the intended audience for each, are detailed in this chapter. Time frames for these potential strategies are also considered.

Key Themes

Key Theme 1: Multiple Goals Exist Across EELM, So This Type of Intervention Should Be Evaluated Using a Variety of Metrics Depending on the Intended Purpose(s) of a Particular Program

Throughout the TEP discussion, participants identified several potential goals of EELM, which means that evaluations should be tailored to address the particular intended purpose of the particular model being studied. Examples of these purposes include:

- improved health of the population
- improved provider self-efficacy
- increased provider job satisfaction and sense of belonging to a community of practice
- improved provider retention in remote locations
- improved access to care
- improved quality of care
- support of the PCMH
- reducing unnecessary referrals to specialists
- improved efficiency of care (e.g., enabling providers to work at the top of their licenses)

- reduced stress, including financial stress, for patients and families, based on reduced need to travel and miss work for specialist appointments
- maintaining the capacity to rapidly bring networks of providers up to date in order to respond to public health emergencies, as occurred with the Zika ECHO.

There was agreement among TEP members that Moore's framework (Moore, Green, and Gallis, 2009) is useful to convey a hierarchy of outcomes for any CME program, ranging from rates of participation (level 1) and satisfaction (level 2) to patient health (level 6) and community health (level 7) (see Table 6.1). Moore, Green, and Gallis (2009) note that most assessments of CME tend to focus on levels 1, 2, 3A, and 3B. However, there has been increasing emphasis on the importance of measuring outcomes of educational interventions that fall within levels 4–7. The goal of CME activities is not simply that a provider is satisfied or even that he or she can state the lesson that the CME activity intended. Rather, improved health at the community level is the ultimate CME outcome, and each of these levels can be seen as an intermediate step along the pathway toward this goal (Moore, Green, and Gallis, 2009).

Table 6.1. Moore's Framework: An Outcomes Framework for Planning and Assessing CME Activities

CME Outcome	Level	Description	Source of Data for the Measures
Participation	1	The number of physicians and others who participated in the CME activity	Attendance records
Satisfaction	2	The degree to which the expectations of the participants about the setting and delivery of the CME activity were met	Questionnaires completed by attendees after a CME activity
Learning: Declarative knowledge	3A	The degree to which participants state what the CME activity intended them to know	Objective: Pre- and post tests of knowledge. Subjective: Self-report of knowledge gain
Learning: Procedural knowledge	3B	The degree to which participants state how to do what the CME activity intended them to know how to do	Objective: Pre- and post tests of knowledge Subjective: Self-report of knowledge gain
Competence	4	The degree to which participants show in an educational setting how to do what the CME activity intended them to be able to do	Objective: Observation in educational setting Subjective: Self-report of competence; intention to change
Performance	5	The degree to which participants do what the CME activity intended them to be able to do in their practices	Objective: Observation of performance in patient care setting; patient charts; administrative databases Subjective: Self-report of performance
Patient health	6	The degree to which the health status of patients improves due to changes in the practice behavior of participants	Objective: Health status measures recorded in patient charts or administrative databases Subjective: Patient self-report of health status
Community health	7	The degree to which the health status of a community of patients changes due to changes in the practice behavior of participants	Objective: Epidemiological data and reports Subjective: Community self-report

SOURCE: Based on Table 1 in Moore, Green, and Gallis, 2009.

The panel reflected that existing studies of EELM have been primarily focused on level 1–3 outcomes, with very few addressing outcomes in the 4–6 range, and virtually none reaching the level 7 outcome of community health.

Relatedly, the scope of EELM is the subject of some debate among experts in the field, who question how broadly or narrowly EELM should be defined. Must providers who participate in EELM be the definitive providers (i.e., the prescribing physician or the clinician with ultimate authority to treat the patient) to be included in interventions? Or are community health workers, clinical social workers, and allied health professionals also part of this definition?

To grapple with the diversity of ECHO-like implementation and purposes, the panel distinguished between two "poles" or groupings of models:

- EELM that aim to increase **access to care** for a condition that generalist providers do not feel comfortable managing (e.g., HCV, MAT for OUD, HIV, sickle cell anemia, and other relatively rare or complex conditions). Although the treatment of these conditions is unquestionably within their legal scope of practice, generalists do not typically deliver care for these conditions without additional support or training. This was referred to as *capacity-building*.
- EELM that aim to improve care for conditions that are considered the "bread and butter" of what generalists commonly manage (e.g., diabetes mellitus, asthma, depression). Generalists treat these conditions on a regular basis, they feel comfortable with uncomplicated cases of these conditions, and they will continue to do so with or without EELM. The purpose of EELM in this instance is to help generalists improve the **quality of care** for the most-complex cases they see and to improve their ability to manage more-complex or more-severe cases. For example, generalists might be comfortable managing diabetes with oral medications; a program could then aim to help them become more comfortable managing insulin as well. Alternatively, in a context of rapidly evolving treatments, EELM might aim to help them master the use of newer medications, such as DPP-4 inhibitors, GLP-1 agonists, and SGLT-2 inhibitors, none of which existed a decade ago.

Some conditions, such as ADHD, could fall somewhere along the continuum between these two poles, with some clinicians comfortable managing only simpler cases and others not comfortable managing it at all. It was also noted that some programs do not address direct care delivery at all, but rather such activities as building capacity for quality improvement. These EELM are probably not part of the continuum between improving access and supporting the management of complex cases of common conditions; they occupy a separate space. Another group of EELM aims to scale up a rapid response to an emerging health crisis, as happened with the Zika ECHO. Again, these programs might not fall on the usual continuum. Nevertheless, despite these counterexamples, the continuum between access and quality improvement was felt to be a useful model to describe the vast majority of EELM.

Key Theme 2: EELM Have Been Implemented in Diverse Ways, with Varying Fidelity to the Original Project ECHO and for a Wide Range of Clinical Conditions and Populations

Because of the variability in implementation of the model and the wide variety of use cases, experts at the TEP meeting noted that it is difficult to draw overarching conclusions about whether EELM "work." Rather, the experts said they believed that designs of EELM should be evaluated based on how they are implemented around a given topic. EELM are heterogeneous; their implementation differs greatly from condition to condition and from context to context, and definitions of success differ depending on the condition, on whether one is examining outcomes at the level of a hub together with all its spokes or considering each spoke on its own, and on who is doing the assessing (e.g., patient, provider, health system, or community). This heterogeneity of implementation complicates evaluation but also leads to several of the key questions for evaluation (see Key Theme 4).

Key Theme 3: Evaluations of EELM Have Generally Been Limited in Methodological Rigor, Lack Appropriate Comparators, and Have Been Conducted over Short Time Frames, All of Which Limit Confidence in Evaluation Reports of Their Effectiveness

The TEP noted that, as of April 2018, there had been no RCTs of EELM. (One by Eaton and colleagues was published in September 2018.) RCT study design is considered the gold standard in terms of methodological rigor, and the panel recognized that variations on the "classic" placebo-controlled RCT could be conducted, as could other study designs that do not involve randomization (see Key Theme 6).

Related to methodologic rigor, evaluations of EELM have not, in general, included appropriate comparators (i.e., what the nonintervention group receives). The TEP emphasized the importance of an appropriate counterfactual in evaluations of EELM, without which, as one TEP member noted, an intervention such as ECHO might appear to be "good for everything." In many studies to date, the comparator (typically usual care) has not been consistently defined. The panel questioned whether usual care is the ideal comparator, or whether EELM should (also) be compared with direct telemedicine, e-consults,[6] traditional CME, or some combination of these. The choice among these different possible comparators might depend, in part, on the goal that the particular program is trying to achieve. Using three arms of comparison (usual care versus telemedicine versus an ECHO-type program; alternatively, usual care versus CME versus ECHO-type program) might be the ideal structure, in some cases. Some evaluations of EELM have also compared the quality of care delivered at the hub sites and the spoke sites, to examine the question of whether spoke clinicians are delivering a comparable quality of care to specialists at the hubs. This can be an additional level of comparison.

[6] Note that e-consults are distinct from EELM because they are not intended to increase PCPs' overall capacity to treat patients with a given condition. They are intended to directly address the needs of a single patient with a given condition.

Evaluations of EELM have typically been conducted over short time frames, limiting our understanding of the durability of effectiveness. Many studies of EELM compare provider knowledge after the model ends with knowledge before the model began. This study design provides minimal information about whether knowledge improvements are retained or "decay" over time (i.e., when providers are no longer attending regular ECHO sessions). The effects of EELM on job satisfaction, sense of belonging in a community of care, self-efficacy, and other provider-related outcomes could also be sensitive to decay over time. Similarly, for those EELM that have demonstrated improved processes or outcomes of care, such as improved HbA1c in the case of diabetes, it is important to know whether these improvements persist. Previous studies have not addressed these questions about the longevity of benefits due to EELM and how they can be isolated, given other changes over time.

The strength of the evidence for EELM, or any intervention, can be assessed using the GRADE framework (Ryan and Hill, 2016). Using this framework to examine the quality of evidence for EELM, our evidence review found the quality to be "low" or "very low" for all outcomes assessed at both the patient and provider levels. The TEP agreed with our assessment. It should be noted that it is not unusual for the evidence for health services delivery intervention to be of "low" quality; EELM are not unique in this regard.

Key Theme 4: In Addition to the Question of "Does ECHO Work?" There Are Important Gaps in Knowledge About EELM

> *A big barrier to expanding ECHO beyond one's state is that advice that works in one place may not work in another.*
>
> –Rachel Mutrux, senior program director for the Missouri Telehealth Network, parent organization of Show-Me ECHO, telephone communication with the authors, February 15, 2018

After considering the existing evidence base, TEP members articulated several unanswered research questions about EELM. These questions can be grouped by themes as in Table 6.2. From this extensive list, the panel identified several unanswered questions as priorities to address, which will be discussed further in the next section on potential strategies.

Table 6.2. Gaps in Evidence Base: Themes and Research Questions

Theme/Category	Illustrative Questions
Implementation and dissemination	• What are the characteristics of successful EELM, and how replicable are they? In particular, how much of the success of a specific program is attributable to the quality of the facilitator? • What are appropriate conditions or topic areas for EELM, and how are they selected? • What motivates hubs and spokes to participate? What explains the rapid increase in demand for EELM across the United States (i.e., what is the source of this popularity)? • What limits the potential spread of EELM? Of those sites and clinicians who decided not to participate in EELM, what factored into that decision? • What is the optimal number of sessions, minutes per session, or time in the program (i.e., dose–response analysis)? How does it vary across topic areas? Why? • How can EELM help health care providers interface with non–health institutions in the local community (e.g., municipalities) to address social determinants of health? • To what extent is it important for hubs and spokes to be located in roughly the same geographic area in order for hubs to make locally relevant recommendations for patient management?
Impacts on health (and other) outcomes for patients	• For what conditions do EELM improve health outcomes, and which outcomes? • To what extent are EELM a "force multiplier"? For example, if providers present some of their patients as cases but not others, does care improve equally for all patients because of providers' participation, or only for the patients presented as cases? Does care for patients improve at the practice (as opposed to individual provider) level? Does this vary by clinical condition? • Besides improved health, what are the other potential benefits to the patient, including savings in terms of lost work days, cost of travel, family burden, etc.?
Impacts on provider or workforce outcomes	• Do EELM lead to better provider retention (in a particular geographic area or underserved setting)? • For whom do EELM "work best" in terms of provider satisfaction, retention in EELM, avoidance of burnout, or connection to a care community? • What are the characteristics of spoke providers or spoke sites that promote successful participation in EELM? • What are the characteristics of hubs that promote increased spoke participation, measured in terms of the number of spokes that join, the retention of spokes over time, or consistent attendance on the part of spoke participants? • How do spoke providers accommodate or make up for the time taken out of clinical work to participate in EELM?
Impacts on population health and health equity	• Do EELM exacerbate existing disparities within the United States' health care system? • Given limited resources, what would be the most effective application of EELM for population health (i.e., in the largest possible population)? • How do EELM impact patient-provider relationships? For instance, to what extent do EELM facilitate PCPs continuing to manage patients in a PCMH model?

Theme/Category	Illustrative Questions
Health system impacts, such as cost, efficiency, and access	• How cost-effective are EELM for different conditions and populations? • What is the return on investment for EELM? • What are the consequences, both intended and unintended, with respect to referrals and potentially shifting groups of patients to certain locations or providers with known capacity to manage different conditions, such as chronic pain? • Do EELM lead to more efficiency in the system? Do they "unclog" the system and lead to shorter wait times? • Do EELM actually lead to better access to care? • Do EELM increase the number of patients who receive high-value treatments that are currently underused (e.g., MAT, HCV treatment)?
Policy and funding considerations	• Can EELM create large-scale change in the U.S. health care system? • How do EELM fit into national health policy priorities? • At what level, and how, do federal, state, and local policies impact implementation and outcomes of EELM? • What are funders paying for related to EELM? • What is the funding stream? • How do EELM work in different funding models (i.e., FFS or managed care arrangements)? • To which providers are services of EELM being supplied? • What characteristics distinguish the patients cared for by providers that participate in EELM from those of nonparticipants?
Optimal study designs	• To what should EELM be compared? Traditional CME? E-consults? Telemedicine? Standard of care, meaning existing care without any educational or consultative intervention? • How should the effects of ECHO/EELM be isolated for evaluation, when programs are often implemented as part of a multipronged approach that might include e-consult, telemedicine, and other initiatives?

Key Theme 5: There Are Several Barriers to High-Quality Evaluation of EELM

Several barriers exist to high-quality evaluation of EELM. Some of these barriers are unique to EELM, but most would apply to any evaluation of a health services intervention. These barriers include lack of resources, perceived urgency to implement rather than evaluate, limited evaluation capacity or expertise, challenges with collecting or obtaining high-quality data, and challenges with defining and collecting meaningful measures of impact.

The First Barrier Identified by the Panel Was a Lack of Resources for Evaluation

Specifically, the panel noted that existing funding streams tend to focus on implementation of EELM, and resources for evaluation tend to be more limited. This challenge is not unique to EELM: Funding models that support the implementation of programs rarely include resources for evaluation, necessitating such support to come from elsewhere.

As with Other Innovations in Health Care Delivery, There Is a Perceived Urgency to Implement, Not Study, EELM

The panel noted a significant emphasis to date on implementation, scale, and spread of EELM. Enthusiasm for the model has led to fairly rapid uptake—yet without what the panel viewed as a strong evidence base for the impact of EELM. The reasons for this relative emphasis on implementation rather than evaluation are complex—and, again, not unique to EELM. The panel did note that a focus on implementation rather than evaluation often comes from the top and is often determined by funding priorities. When early results look promising or there is conceptual validity for a given model, leadership of health care systems often prioritize implementation and rapid uptake of care delivery innovations over evaluation or research, for a variety of reasons. The clinician's role is to care for the patient, and often this means implementers are hesitant to delay rolling out a promising new intervention for a portion of their eligible patient population to ensure the presence of a control group. Indeed, the time and resources required for evaluation are likely to compete for resources needed for implementation, absent specific funds dedicated to evaluation.

Many EELM Lack Evaluation Capacity or Access to Such Expertise

Even where there is interest in evaluation, some programs lack evaluation expertise, so there is a clear need for capacity-building around conducting rigorous evaluations of EELM. This gap is not unique to EELM; as previously mentioned, implementing institutions often focus on implementation and therefore lack the expertise to conduct evaluations. Conducting evaluations of education programs can be difficult, and evaluating programs over short time periods requires careful study design. Multiple interventions are often rolled out at once, further complicating evaluation. An additional complication, previously discussed, is that many EELM have not clearly defined their goals. Supporting training and assistance for evaluation efforts is important.

> *We had a need to demonstrate the impact of our program to justify continued support.*
> –Susan Kirsh, former acting director of the VA Office of Specialty Care Transformation (2018)

Efforts to Evaluate EELM Could Be Limited by Access to High-Quality Data

The panel noted the difficulty of obtaining reliable data (both for processes and clinical outcomes), particularly on patients or providers who did not participate in the intervention. Although electronic health records (EHRs) have the potential to provide some relevant data, there are limitations to the ability of these records to provide a window into other relevant process measures (for example, changes in provider behaviors, such as opioid prescribing) or adherence to evidence-based care guidelines, without a significant investment in data abstraction. When programs span different institutions, incompatible EHR systems make it difficult to collect

and aggregate consistent data. When a program is implemented within a single institution, it can be hard to collect comparable data on a control population outside that institution for the same reason.

Claims data are another option for evaluations of EELM, but these have their own limitations related to accessibility, misclassification bias, and lack of clinical details. Statewide surveillance data can be a source of outcomes data for certain conditions, especially for programs initiated at a state level, but these data might lack the level of clinical detail available in many EHRs or in prospectively collected data.

Additionally, the question of burden came up at the TEP meeting in considering who would be primarily responsible for documenting the information to be abstracted for the evaluation, outside of the regular clinical workflow. Would PCPs, who are already overstretched, have the ability to collect yet another set of data elements for an evaluation of EELM? Who, at the spoke sites, would be charged with documenting details of the model's implementation, such as attendance at regular sessions or reasons for provider attrition? Thus, although prospective data collection can address the issues of completeness and accuracy, it is usually more resource-intensive. The panel suggested various potential approaches to address this challenge, which are discussed in the next section.

Clear Outcome Measures Are Not Apparent for Many Conditions Addressed by EELM, and There Are Challenges with Defining and Collecting Meaningful Measures of Impact (Both Process and Outcome)

The panel discussed metrics to consider when evaluating EELM. There was agreement that most EELM could measure common aspects of implementation, such as the proportion of sessions attended or the duration and number of sessions. However, more-specific metrics vary by disease state or condition (e.g., HbA1c change over time for diabetes, viral load for HIV), and by the intended audience. For instance, it was noted that the research questions and outcomes that are of interest to a clinical researcher (e.g., improvement in depression score, as measured by the Patient Health Questionnaire [PHQ-9]) might differ from those important to a payer (e.g., demonstration of cost savings).

Several provider-level constructs (such as job satisfaction) and health system-level constructs (such as appropriateness of referrals) can be complex to quantify. To some extent, this challenge can be successfully addressed through the use of thorough surveys and in-depth qualitative interviews to provide additional context. The TEP members expressed concern about the use of self-reported measures, which are subject to both social desirability bias and recall bias.[7] One of the themes of the TEP meeting was that even relatively simple measures (such as changes in

[7] Social desirability bias results from the tendency of some respondents to answer in a way they deem to be more socially acceptable than their "true" answer would be. Recall bias arises from mistakes in recollecting events, both from memory failures or from changing one's recollection when looking at things with hindsight (Lavrakas, 2008; Cochrane Collaboration, undated).

provider knowledge or self-efficacy) are often marred by being measured in ways that are not sufficiently rigorous.

Key Theme 6: Opportunities Exist to Use a Wider Variety of Study Designs, Some That Involve Randomization and Some That Do Not, to Conduct Rigorous Evaluations of EELM

As with other evaluations of real-world health care delivery models, the rigor of published studies has been limited by challenges with randomization. Specifically, sites might not be willing to be randomized and potentially not receive the intervention because of a perceived need for immediate action (or the preconception that the intervention represents an improvement over the status quo). Additionally, even if sites agree to be randomized, there might be differential buy-in between intervention and control arms, which could in turn lead to less complete data collection by control practices.

Randomization might be possible in certain situations and should be used when possible. When randomized designs prove infeasible, however, there are rigorous nonrandomized study designs that could be used in evaluating EELM and that could help compensate for the challenges with randomization. However, the full spectrum of possible study designs has not been used to evaluate EELM. TEP members cited a notable example of a well-designed study by Anderson and colleagues (2017). In this study, the authors evaluated changes in pain management from an ECHO-like model, incorporating a pre-post design with a control group (one of the panel's preferred options for causal inference in the absence of randomization). The study encapsulated several of the options proposed by the panel for how to conduct a high-quality evaluation with limited resources, including the following:

- a strong design for causal inference despite not randomizing
- use of available data from an EHR
- a mixed-method evaluation, with qualitative inquiry to provide additional context with which to understand the results of the effectiveness study
- measurement of outcomes relevant to the condition, including not only patient outcomes but also changes in provider knowledge, and changes in practice.

Key Theme 7: It Is Important to Balance Enthusiasm for the Promise of EELM, Which Led to Significant Demand for This Model, with the Need for a Strong Evidence Base

The panel members agreed that there has been an emphasis to date on implementation and dissemination of EELM, with a focus on scale and spread, with less attention to rigorous evaluation of impact. However, the experts also noted that the enthusiasm for EELM is likely based on some measure of effectiveness as perceived by end users, and one of the important tasks ahead will be to understand the extent to which EELM is filling a perceived need—and if so, whether EELM improve clinical outcomes. Multiple TEP members emphasized that a lack of published evidence does *not* indicate that the model is ineffective; it simply means that there is a

lack of evidence demonstrating that it is effective. They stressed that something about EELM has generated growing demand and enthusiasm and that this should not be discounted in a quest for rigorous evidence of impact on patient outcomes. The panel urged balance in interpreting the thin evidence in light of the continued demand for this intervention across the United States and internationally, and it noted that many health care interventions lack a strong evidence base.

The next section describes potential strategies to address each of these seven themes.

Potential Evaluation Strategies

Various potential strategies emerged from the TEP meeting that could address the key themes discussed in the previous section. These are first mapped to each key theme and their intended audience, then discussed in more detail individually, and finally organized by possible time frame for implementation.

Potential Strategies by Intended Audience

With input from the panel, we identified 18 potential strategies to address the key themes that emerged from the TEP meeting. Some of the options are specifically geared toward implementers of EELM as they design their programs, with an eye toward the needs of future (or even concurrent) evaluations of program impact. Others are more relevant to those conducting the evaluations. Still others primarily apply to funders and policymakers as they consider the big picture of how to facilitate building the evidence base for EELM to inform future investments in this model. Although some of the suggested approaches that came out of the TEP meeting could be addressed by only one of the stakeholder groups, many of them require collaboration among different groups. Therefore, continued engagement and communication among the various stakeholders is important when deciding how to move forward with these options.

Potential Strategies Organized by Key Theme

Key Theme 1: Diversity of Intended Purposes of EELM

Potential Strategy 1a: Build Consensus Around Definitions and Purposes of EELM

Although it was not the charge of the TEP to produce a consensus definition, more consensus might help address the current lack of focus on a common set of outcomes to measure. The panel observed that there are different intended purposes for EELM (e.g., increasing access to care for patients with less common conditions, improving care for complex presentations of common conditions, and potentially others). Reaching consensus about the purpose or purposes of EELM would be an important first step toward evaluating the accomplishments of EELM.

Potential Strategy 1b: Structure Evaluation Outcomes to Reflect Intended Purposes of Particular Types of EELM.

Given the various intended purposes of EELM, it will be important to facilitate the appropriate measurement of key outcomes in the context of diverse implementations of the model (e.g., management of a particular disease and/or improving workforce retention). This approach might not allow for robust cross-study comparisons because evaluations of some types of EELM might not easily generalize to other types, but it might facilitate a more targeted approach to answering the priority research questions that the TEP members identified (see Potential Strategy 4a). One approach could be to assemble a list of evaluation outcomes and define best practices for their measurement. For example, there is considerable variation regarding how an outcome as simple as session attendance by generalist mentees is recorded and analyzed. A basic recommendation on such metrics as this could help improve the consistency and the rigor with which they are analyzed. These outcomes could be sorted by types of EELM and purposes of the interventions (i.e., improvement target).

For instance, EELM that aim to increase access to a particular kind of care (e.g., HCV treatment) might wish to focus on documenting expanded access and scope, such as an increase in the number of patients treated. It might also be a priority to document that the quality of care for this condition at the spoke sites is acceptable, as when the team from UNM demonstrated that HCV outcomes (measured by sustained viral response) were at least as good at the spoke sites compared with the hub (Arora, Thornton, et al., 2011). In contrast, EELM that aim to support the management of complex cases of common conditions (e.g., diabetes) should focus on documenting improvements in the processes, outcomes, or both of the care being delivered (e.g., improved HbA1c). Some EELM address conditions that fall somewhere between these two types of programs (e.g., ADHD) or fall outside of this continuum (e.g., Zika virus, quality improvement facilitation). These EELM might have to choose appropriate outcomes to measure that are necessarily situation-dependent.

Finally, as previously noted, if the ultimate purpose of EELM were to address isolation and burnout among PCPs, then the outcomes to be measured would be very different and might include job satisfaction, retention, or a sense of belonging in a community of care.

Key Theme 2: Variable Implementation of the Model

Potential Strategy 2: Document Details of Model Implementation

Although not all EELM have the expertise, time, or money to conduct complex evaluations of efficacy, it would be within the reach of almost any program to document certain basic parameters of implementation. This would include the number of participants in each session and the distribution of the number of sessions conducted; the type of provider(s) receiving the intervention; attrition rate and reasons for noncompletion of sessions; how long the sessions last; how frequently sessions are held; how many cases are presented at each session; a description of how a didactic component was incorporated; how technology is used and how the end-user experience is optimized; and the number of eligible patients treated before and after the

intervention. The availability of certain materials (a ready-to-use "evaluation toolkit" consisting of standardized but customizable consent forms, data collection instruments, and study protocols) could help ensure consistency in the collection of these basic sorts of data about program implementation and participation and would allow comparison across studies.

Key Theme 3: Limited Confidence in Evaluations

Potential Strategy 3a: Choose Meaningful Comparators

Various possible comparators were mentioned by the panel, including a more conventional and lower-effort quality improvement intervention (e.g., audit and feedback)[8] or an educational intervention (e.g., a purely didactic webinar similar to a continuing medical education session). These would seem to be apt choices to evaluate a program dedicated to supporting generalists in managing the more complex cases of a condition they commonly treat (e.g., diabetes). For a program dedicated to expanding access to a rarer condition (e.g., HCV), usual care might be an appropriate comparator. Other potentially instructive comparators might be direct-care telemedicine or e-consults; a comparison with these other forms of telemedicine might be more useful for establishing which approach seems to work best in a given situation or for a particular condition. In a multimodal evaluation with several sources of data (e.g., provider surveys, patient interviews, and data abstraction from an electronic medical record), it might be necessary to define several different comparators, each of which might be well-suited to addressing one study question.

Potential Strategy 3b: Document Persistence, or Waning, of Effects of EELM over Time

Previous evaluations of EELM have typically collected "post-intervention" data—for example, data about provider satisfaction, knowledge, self-efficacy, and behavior change—very soon after the intervention ended. It might be useful to build in additional assessments after the immediate post-intervention period to assess how long the impacts of EELM on various outcomes persist when providers are no longer attending weekly or biweekly ECHO sessions. In other words, how long does it take for the benefits of EELM to "decay" (if in fact this occurs), and when might refresher sessions be needed?

Of note, options for using a variety of study designs to increase the methodological rigor of evaluations of EELM are addressed in this report under Key Theme 6.

Key Theme 4: Numerous Knowledge Gaps

Potential Strategy 4a: Focus on Four Priority Research Questions for EELM

The panel identified several knowledge gaps around EELM, which can be broadly categorized as questions around (1) implementation and dissemination; (2) patient, provider, and

[8] Audit and feedback is a quality improvement strategy based on the belief that health care professionals modify their practice when provided with feedback on their performance showing how their clinical practice meets, or fails to meet, a desired target (Ivers et al., 2012).

health system outcomes; (3) population health and health equity; (4) policies; and (5) study designs. We synthesized this discussion into four high-level questions that can help guide future evaluations of EELM:

1. What is the evidence for the impacts of EELM on patient health?
2. Across which conditions are EELM most effective in improving patient health?
3. For which conditions do EELM provide the most value (outcomes improvement/cost)?
4. To what degree do EELM achieve their intended purpose(s)?

Potential Strategy 4b: Prioritize Clinically Relevant Patient Outcomes over Processes of Care

Related to the first three of the above four priority research questions, the panel observed that the majority of existing evidence around EELM focuses on the experience of participants in EELM and changes in their knowledge and self-efficacy, which are important to understand but serve as intermediate steps toward the true health outcomes of interest. Our systematic review found that out of 52 studies, only 15 examined changes in process of care measures or patient outcomes. In addition, the majority of the studies in the ECHO Institute's research overview report reach only level 1 of Moore's framework, with none reaching level 7 (community health). Thus, there is a need to increase focus on measuring the impacts of EELM on processes and outcomes of care. More detail on measuring different types of outcomes can be found in Key Theme 5.

Key Theme 5: Structural Barriers to High-Quality Evaluation

Potential Strategy 5a: Support Sustainable Funding Streams for Evaluations of EELM

Specific funding streams could be created to support evaluations of EELM, or existing streams for implementation could include portions earmarked for evaluation. In addition, some EELM have been successfully implemented and evaluated in partnership with payers. Payers are interested in demonstrating value and, as an added benefit, could provide data for evaluation purposes. One way to stimulate more evaluation work could be to align EELM with emerging value-based payment models and evaluate their potential contribution when value is generated by these broader models. One potential complication of this strategy, however, is that it might be difficult to separate the effects of EELM from those of other contemporaneously deployed strategies.

Potential Strategy 5b: Enlist Champions to Promote Evaluations of EELM

Strong, committed administrative and clinical leaders (at spoke sites, such as health centers, in addition to a hub) are needed to ensure that evaluation of EELM goes hand-in-hand with implementation. Specific actions could be (1) ensuring that job descriptions and performance review criteria for clinical personnel include participation with evaluations of relevant programs, such as of EELM; (2) providing implementers of EELM with opportunities to gain expertise with evaluation through mechanisms described in Potential Strategy 5c (capacity-building seminars and access to networks of other researchers); and (3) ensuring funding support for researchers'

time spent on evaluating EELM. These types of approaches would be very context-specific, but the theme of supporting the evaluation of innovations within health care delivery systems is a broader goal.

Potential Strategy 5c: Provide Technical Assistance and Build Capacity to Conduct Evaluations of EELM

TEP members discussed several possible approaches to empowering members of EELM who might not currently feel they have sufficient access to evaluation expertise. One approach would be to provide technical assistance through the development of resource centers and the creation of standardized tools to facilitate high-quality evaluation (which could include the toolkit to assist with measuring key outcomes, as described in Potential Strategy 1b). Another possible approach would be to focus on internal capacity-building to decrease reliance on external technical assistance, which could include annual seminars for evaluators or a support network to empower evaluators to share best practices. Analogous examples could be found in the growing field of implementation science, which offers both training sessions (NIH, 2018), which build internal capacity for evaluation, and resource centers (Mittman, 2009), which facilitate access to external evaluation expertise.

Potential Strategy 5d: Support Data-Sharing and Interoperability

The panel identified lack of access to outcomes data for both participants and nonparticipants as a challenge for EELM (and for other health services interventions). Three approaches could be considered to support data-sharing and interoperability.

First, policies requiring improved data exchange and interoperability—whether at the local, state, or federal level—can help facilitate ease of data-sharing for research between spokes and hubs. An example of a relevant federal effort is the 21st Century Cures Act (Public Law 114-255), signed into law in December 2016, which contains health information technology provisions focused on improving interoperability among disparate electronic medical records by envisioning a strong federal role in the regulation and development of health information technology standards. It also directs the federal government to leverage public-private partnerships in creating a Trusted Exchange Framework for health information, which is still in draft form.

Second, the panel suggested that investigators consider how data collection will be accomplished when initially designing the intervention, not well after it has been implemented. For instance, study sites could be selected that use the same or interoperable EHRs when possible, or at least have such systems set up to collect and measure data using the same format, and studies could be designed to examine outcomes that are available in state databases. These strategies facilitate collection of data on both the intervention and comparison groups, making it easier to conduct controlled trials.

Third, the panel noted the benefits of implementing EELM as part of new payment models, which could be beneficial both for providers and payers, as well as for implementation and evaluation, specifically because of data availability. For example, situating the intervention and evaluation within an ACO, and aligning it with the payment model, could facilitate access to

both claims and outcome data—allowing for conclusions to be drawn both about cost savings and clinical impact. This approach might help to encourage implementation of EELM, but it could also complicate efforts to separate the impacts of EELM from those of other strategies that are deployed simultaneously.

Finally, the panel noted that, for some diseases, data availability might be enhanced, providing an opportunity for improved evaluations of EELM. For example, HIV care and cancer care have both benefited from strong research networks and relatively standardized outcomes that are measured across studies. HIV studies almost universally measure viral suppression and time to viral suppression, guideline-concordant use of anti-retroviral therapy, resistance testing before starting therapy, and other relatively well-defined and standardized measures that are often available across a population. Having these measures in common could help facilitate cross-institutional collaborations to evaluate EELM focused on HIV, potentially more easily than could be done with another disease.

Potential Strategy 5e: Focus on Patient-Level Outcomes

As noted in Key Theme 5, the evidence for improved patient outcomes from EELM is limited. The panel suggested several options for capturing the impacts of EELM on patients. First, TEP members noted that retrospective chart abstraction could help measure processes of care, such as rates of guideline-concordant care and rates of initiation of care, but that process measures vary regarding how strongly they have been linked to definitive outcomes, such as morbidity and mortality. CMS's Meaningful Measures Initiative is an example of one government effort to focus on measures that are most meaningful to patients (Durham, 2018). In keeping with a growing emphasis on measuring patient-relevant outcomes, quality of life and disease-free survival were suggested as two patient-specific outcomes for measurement, depending on the condition being studied. General global functioning and health-related quality of life scales, such as the Patient-Reported Outcomes Measurement Information System (PROMIS) (Ader, 2007), were also mentioned as potentially important patient-level measures. Again, qualitative methods—such as in-depth interviews and other creative elicitation techniques such as photo-elicitation—could provide rich data on patients' experiences with their conditions and with EELM specifically (UNM, undated-a).

Some process-of-care measures might also involve the patient perspective. For example, studies could measure the development of a seizure action plan, or an asthma action plan being completed for the patient. Earlier entry into clinical care (for maternal health EELM), earlier diagnosis of developmental delays and autism, and increases in diagnosis rates for conditions thought to be underdiagnosed at baseline (e.g., autism) are other potential measures of increased access to important services.

Potential Strategy 5f: Expand Provider-Level Satisfaction and Engagement Measures

Various underused options exist for measuring provider satisfaction and retention, such as the number of new providers being attracted to a particular underserved area, how long they stay (full-time equivalent years, also known as new provider longevity), and retention rate (the latter

being slightly different than new provider longevity). Measuring the Maslach Burnout Inventory (Maslach and Jackson, 1981) to document the impact of EELM on burnout directly as part of evaluations of EELM could also be helpful. Qualitative research might be a very effective way to measure or, more precisely, learn about provider self-efficacy and some of the other provider-related goals, such as satisfaction and knowledge.

Potential Strategy 5g: Use a Range of Measures to Examine System-Level Outcomes

For *system-related metrics,* the number of providers offering a particular service, such as buprenorphine therapy, could be used; so could the number of cases that were treated versus what would have happened without a program.

Wait time is another potential measure of access but represents just one dimension of the complex issue of access, and this metric is affected by other factors, such as the rate of patients eligible for treatment and provider referral behavior. It is important to take a population-based approach and think about what the counterfactual is when measuring wait times. When comparing shorter versus longer wait times for initiating treatment (or receiving high-quality care, whether delivered by a specialist or a generalist), it is important to consider the alternatives to EELM: seeing a specialist in person, which might require a very long wait time; continuing to be cared for by a generalist who has not received mentorship through the EELM; or not receiving care for that condition at all, as happened with HCV before Project ECHO launched. In many cases, the counterfactual would be that patients are referred to a specialist and the specialist has long waits; therefore, EELM might be able to both eliminate this delay in treatment initiation for certain patients who no longer need to see a specialist (because their generalists received mentorship through EELM) and to reduce the wait time for those patients who do still need to see a specialist (i.e., their PCP does not participate in EELM). One TEP member referred to this effect of EELM as "unclogging the system." The challenge is obtaining the denominator: Evaluations should examine the entire population cared for in a region or catchment area, including patients of providers who do and do not participate in EELM, and look at their rates of treatment and wait times.

To measure appropriateness of referrals, one panelist suggested performing ratings of the appropriateness of referrals to specialists over time, with the assessor blinded to whether the patient's provider is a participant in EELM.

Key Theme 6: Limited Use of a Variety of Possible Study Designs for Rigorous Evaluation

As with any real-world study, designs for evaluating EELM should fit within the context of the participating clinics and providers, including limitations of resources and exigencies of clinical workload at spoke—and hub—sites that are focused on managing operations of the EELM. Furthermore, significant forethought is required in that future plans for evaluation should guide the implementation of EELM because some evaluation strategies are only possible when planned in advance of the start of implementation. There are multiple potential pathways to achieving high-quality causal inference. The panel mentioned several strategies that might be

considered, such as options for designs involving randomization and for designs that do not require randomization.

Potential Strategy 6a: Consider Strategies to Facilitate Randomization

The "classic" RCT, which has intervention and control arms (and is sometimes termed "placebo-controlled" because at least one arm does not receive an active ingredient or intervention), is considered the gold standard for causal inference. Randomization might be ideal from a scientific point of view, but it is not always feasible in real-world settings. TEP members proposed study designs that might enhance the rigor of evaluations while also being more feasible when a classic RCT is not possible: crossover, non–placebo-controlled parallel, and stepped-wedge designs. These variations could help address a hesitancy on the part of sites to enter a study in which they might be randomized to the control group and not receive the intervention. Ultimately, however, the crossover option, in which study sites are randomized to receive one of two programs, then switch and receive the other after a certain period of time, was rejected by the panel. There was concern that the effects of the first program would persist after its conclusion, thereby "contaminating" the measurement of outcomes in a period when the site is supposedly in the control group.

With the non–placebo-controlled parallel design in this context, there are at least two and potentially more study arms examined in parallel, and each arm receives an intervention. In the two-arm example, sites are randomized to implement one of two unrelated programs, such as for HCV and chronic pain. The conditions (and the outcomes to be measured) would have to be chosen carefully to ensure that they are as distinct as possible, lest the efforts of one program affect treatment for the other condition. Every participating site would be guaranteed to receive an intervention in this scenario. All sites would then submit outcomes data relevant to both conditions; every site would therefore serve as both an intervention site (for one condition) and a control site (for the other). This study design could help ensure that participating sites are similar (because all agreed to the same study design and all implemented a program), and it might also help ensure a similar level of enthusiasm on the part of all sites for submitting data. In addition, there would be potential cost savings, in that two programs could be evaluated at a rate of expense or level of effort that likely would not be significantly higher than that required to evaluate one, and certainly less than it would take to run two independent evaluations.

Although this idea generated some enthusiasm, some TEP members expressed concern about possible contamination by patients who have both conditions (in this example, HCV and chronic pain). It would be possible that the management of the unrelated condition might be improved by the EELM—for example, better management of chronic pain at a site randomized to the pain program—might permit better management of the patient's HCV as well. The magnitude of this issue might be small, and if it were a matter of great concern, it would be possible to exclude those overlapping patients in the analysis phase. Alternatively, these patients could be considered as a separate population in the analysis to examine the degree of contamination (which would be an interesting finding in and of itself about the spillover effects of EELM).

Another possible randomized design mentioned at the TEP meeting was a stepped-wedge cluster randomized trial, a method that is increasingly used for studies of care delivery modalities (Hemming, Haines, et al., 2015; Hemming, Lilford, and Girling, 2015). In a stepped-wedge design, the rollout of an intervention occurs in a phased manner that is randomized at the facility level or provider level. This design is typically responsive to the fact that rollout is not always possible across all geographies at once, given logistical constraints. Therefore, randomizing the sequence of rollout provides the ability for more complex causal inference. Although randomized, the control population often eventually gets the treatment; in other cases, a pure control might also be selected.

Potential Strategy 6b: Leverage Nonrandomized Study Designs That Have Advantages over Study Designs That Have Been Used to Date

Finally, although most evaluations of EELM have used pre-post designs *without* a control group, TEP members also proposed a pre-post design with the addition of a control group. The rigor of such a design could be further enhanced with the use of difference-in-differences analysis with a propensity score-matched control group, which can approximate the rigor and causal inference achieved with randomization.

Unit of analysis. In the view of many TEP participants, evaluations of EELM should focus on the level of the practice rather than on the patient or the provider; by extension, randomization should occur at the level of the practice. This was expressed as an ideal because of the conceptual focus of EELM on improving care at the practice level—although this was by no means expressed as the only option. Part of the reason is that patients might see more than one provider, providers might see each other's patients, and providers within the same practice might confer among themselves about how to treat certain types of patients, leading to concerns about contamination under provider-level evaluations. EELM are often discussed as force multipliers, with the expectation that new provider knowledge could affect colleagues as well. As discussed in the review of the evidence for EELM, the degree to which this actually occurs is still an open question. For that reason, analysis at the practice level was considered best for evaluations, particularly ones with intervention and control groups, such as the stepped-wedge model.

A summary of potential study designs brought up by the TEP members for evaluating EELM, with associated advantages and disadvantages, is shown in Table 6.3.

Table 6.3. Potential Study Designs for Evaluating EELM

Potential Study Design	Advantages	Disadvantages
Randomized		
RCT, placebo-controlled	• When done at the practice level, can provide high-quality evidence about the impacts of EELM on population health • The gold standard for addressing unmeasured confounders that might otherwise bias the results	• Can be expensive • Sites might be hesitant to sign up for a study in which they could be randomized to the control group • Possibly lesser engagement among practices in the control group, which could lead to incomplete data collection • If randomizing at the practice level, can be difficult to recruit a sufficient sample size of practices
RCT, non–placebo-controlled (e.g., all arms receive an intervention)	• Addresses a major implementation weakness of other designs in that controls are also adopters of EELM (of another focus topic) • Factors contributing to adoption do not differ between sites • This approach might help address reluctance to be randomized to a control group because it does not require randomization to a nontreatment group	• Patients might have both conditions being addressed by EELM, which will need to be accounted for in the analysis • Expensive (Despite some savings compared with a classic RCT because two programs can be evaluated for a similar cost to one program, this option remains high in cost)
Stepped-wedge	• All patients can eventually get the intervention, but staggered and delayed roll-out facilitates causal inference • Works like a randomized trial, with those not yet receiving the intervention serving as controls, leveraging the fact that there are logistical constraints associated with rolling out the study everywhere at once • Responsive to ethical concerns about withholding an intervention from a group of people	• Can be expensive • Cluster randomization is required • Logistics of staggering the roll-out of the intervention can be complex and require specialized analytical expertise • Takes longer than starting everyone at once • If an additional control group is included, can add to costs
Nonrandomized		
Pre-post design with a control group	• Frequently used in health services research to evaluate health care delivery interventions where there is not a profit motive to fund a more expensive randomized trial • Most studies thus far have used pre-post design; the addition of a control group only requires additional data collection from the comparison group and greatly improves study design strength • Does not require randomization • Can use strategies, such as propensity score matching, to create an appropriate control group when analyzing secondary data sources, such as claims	• A weaker design than others because sites that choose to implement EELM might be different from sites that do not, for reasons that cannot be observed/measured in the data (limiting the ability to find an appropriately matched control group) • Requires twice as much data collection • Sometimes difficult to collect data on non-intervention group • Can be difficult to find an appropriately matched control group • Requires implementers to anticipate the need for evaluation • Cannot easily be added after the fact

Key Theme 7: Enthusiasm for EELM

Potential Strategy 7a: Generate Evidence for the Expressed Aspirations of the Model

There is a growing, albeit incomplete, understanding of why EELM are viewed with promise, and what needs the models are meeting. Indeed, evaluating the extent to which EELM achieve their intended purpose or purposes is among the four highest-priority research questions identified by the TEP (see Key Theme 4). The panel noted that mixed-methods and qualitative research could be useful in ascertaining the sources of enthusiasm among current participants of EELM. Also, such methods would be useful to better understand what factors lead to successful implementation, such as the role of dynamic, charismatic individuals (i.e., session leaders, hub leaders, and specialists); the importance of high-functioning hub teams; and the quality of the specialist's expertise and usefulness of his or her recommendations. Qualitative studies could include both interviews and a direct observation component (i.e., observation of sessions).

Potential Strategies by Time Frame of Options

There was broad agreement among TEP members that, given the sheer number of unanswered questions about the impacts of EELM on various outcomes (primarily health outcomes but also provider capacity and other metrics; see Table 6.2), building the evidence base for EELM will take time and cannot be accomplished all at once. As noted in Key Theme 4, TEP members identified a list of general, high-level research questions they thought were critical to answer in evaluating EELM. But underlying each of those questions are a series of more focused research questions around specific conditions and objectives.

Therefore, it is important to articulate what steps could be taken in the very near term to address those questions and what steps could be taken in the intermediate or longer term. The strategies vary in terms of how resource-intensive they might be to implement, and thus, over what time horizon they could likely be achieved.

The approaches that could begin to be implemented in the next few months to years include the following:

- coming to consensus around the various intended purposes of EELM; i.e., defining the goal or goals of the different ways it is implemented and what variations work best under what circumstances
- capacity-building through the development of a ready-to-use (but customizable) "evaluation kit" for sites to use
- carrying out qualitative evaluations that use existing programs as the "laboratory," that is, unit of study, to answer questions such as "What makes a hub successful?"
- conducting pre-post studies with a control group, with specific attention to choosing comparators and patient outcomes that are clinically meaningful rather than examining only process outcomes
- building an evaluation component into grant funding, both public and private.

Goals that might require more time to achieve (e.g., three to five years or more) include the following:

- building capacity related to evaluation of EELM through annual seminars/conferences or the creation of a resource center
- conducting studies of the persistence of the effects of EELM on providers and on care outcomes
- performing stepped-wedge trials with rolling implementation of the intervention over time
- developing policies to support more-consistent funding opportunities for evaluation of EELM.

Summary

Based on the thorough evidence review and the expertise of the TEP, we identified gaps in the literature and potential strategies to address those gaps. Further implications of the TEP findings are discussed in the final chapter of this report, Chapter 8.

7. Example Evaluation Study Designs

One of the key findings from the TEP was that future evaluations of EELM have an opportunity to increase methodological rigor. We were asked to give three examples of different EELM evaluation designs, ranging from relatively straightforward to more-complex designs. Here, we present three possible scenarios for evaluation designs, informed in part by a review of the literature to identify evaluations of other health services interventions (i.e., not EELM) of similar scope and complexity, and based in part on panelists' comments.

The three evaluation scenarios that we present cover a spectrum of study design options that vary in terms of health conditions addressed, complexity of study design, type of evidence generated, and likely cost. They respond to the priority research areas, research questions, and research methodologies identified by TEP members. The PICOTSS framework, which is often used for the identification and evaluation of research questions, was used to guide discussions of the TEP and to describe elements of the scenarios: populations, interventions, comparators, outcomes, timing, settings, and study design.

Scenario #1: Lower-Complexity Evaluation Design

Research Question(s): Are EELM more effective than alternative technology-based platforms for improving provider and patient outcomes?

Rationale: No studies to date have assessed whether the framework of EELM outperforms other approaches to technology-enabled distance learning. Alternative didactic approaches are potentially less expensive—insofar as they necessitate less provider time by experts (for example, whether trainings are prerecorded and therefore can be replicated without their continued involvement)—and are also potentially more flexible, insofar as sessions could be administered whenever participants are available. By comparison, the approach of EELM is hands-on, case-based, and occurs in real-time, offering a set of distinct advantages but also different costs.

***Scenario Vignette**. A university-based hub wants to implement a new program on complex presentations of pediatric asthma. To test whether the program is more effective than a traditional web-based didactic training series, the hub also creates a series of online training videos, quizzes, and resources over a four-month period. The research team recruits 16 providers, who have an average caseload of four pediatric patients with complex asthma (64 patients total). Eight providers are assigned to the program, and eight providers are assigned to the training videos. Both interventions comprise eight training sessions, conducted biweekly in 60-minute increments, over four months. Researchers evaluate provider participation frequency, retention in trainings, satisfaction, test-based knowledge, and confidence at baseline and post-intervention. They also compare patient-level outcomes: frequency of emergency department visits, sick visits for asthma exacerbations, and oral steroid use among patients at baseline and six months after training—within the patient panels of participating providers. Inclusive of developing materials, implementation, and analysis, the full trial funding period lasts 12 months. Writing and publication of results occurs after completion of the funding period. See Table 7.1.*

Table 7.1. Overview of Scenario #1 Study Components

Population	Intervention(s)	Comparison	Outcomes	Time Frame	Study Design	Setting
One hub **Six practices** **16 providers** **64 patients**	EELM-based training on pediatric asthma Web-based didactic sessions	EELM-based sessions vs. didactic sessions	Provider metrics Patient metrics	Four-month implementation period 12-month trial period	Prospective, nonrandomized pre-post comparison with control	University and clinics Regional

Scenario #2: Moderate-Complexity Evaluation Design

Research Question: Are EELM effective in improving practice-level outcomes in the specific content areas of training? Are these effects sustained over time?

Rationale. No studies to date have examined the comparative effectiveness of two unrelated EELM in terms of content-specific training (e.g., diabetes care vs. OUD treatment) on content-specific patient benefits (e.g., improved HbA1c levels). Additionally, few studies have examined whether training effects of EELM are distributed throughout a practice in a multi-provider practice versus only within a provider's own panel, and whether training effects are sustained after conclusion of participation in EELM. The approach outlined here and the extended time line of data collection would allow researchers to explore all such elements. One limitation is that practice-level evaluations imply a multilevel approach to analysis in which observations are nested, leading to a reduction in statistical power to detect a significant effect of the intervention.

Scenario Vignette. *A hub at a university-affiliated teaching hospital wants to examine whether there are positive practice-level benefits of two programs they are implementing—one on type 2 diabetes and another on MAT for OUD. They recruit 20 practices to participate in both programs and randomize ten practices (*n *= 24 providers) to receive the program on diabetes, and the other ten practices (*n *= 26 providers) to receive the MAT program. Both are implemented biweekly for 12 sessions over a six-month period and then followed for a subsequent 18 months to assess the durability of the effects. At baseline, six months, 12 months, and 18 months, all practices report on a set of patient-level metrics for the entire practice-level patient panel, with a focus on outcomes relevant to diabetes and OUD: HbA1c levels among diabetics, hospital admissions, opioid prescribing rates, and patient functioning. Outcomes are analyzed among those operationally defined as "retained in care"—i.e., those who attend all scheduled medical appointments. Outcome are also analyzed using an intent-to-treat framework in which all patients are included in analysis, regardless of retention. Inclusive of developing materials, recruitment, implementation, and analysis, the full trial funding period lasts 24 months. See Table 7.2.*

Table 7.2. Overview of Scenario #2 Study Components

Population	Intervention(s)	Comparison	Outcomes	Time Frame	Study Design	Setting
One hub **20 practices** **50 providers** **300 patients**	EELM-based training on diabetic care EELM-based training on MAT	Program 1 vs. program 2	Patient metrics at practice level	Six-month implementation period 24-month trial period	Practice-level randomization to the diabetes or the MAT program	University hospital and clinics State level

Scenario #3: Higher-Complexity Evaluation Design

Research Question(s): Are EELM effective in improving health-related quality of life among patients? Are effects observed consistently across hubs and spokes? Are effects sustained?

Rationale: No studies of EELM to date have used a stepped-wedge design, which includes an element of randomization and approximates an experimental trial. This approach would provide significantly improved internal validity regarding the effects of EELM, and the larger scale of implementation would allow for both greater statistical power to detect an effect and the ability to examine generalizability of EELM across different geographies. Improved quality of life is also an ultimate objective of clinical care and has yet to be studied in detail in the context of EELM.

***Scenario Vignette**. Five hubs in different states agree to randomize the timing for rollout of a program on dementia care for elderly individuals in nursing homes. The hubs all participate in designing the curriculum and cofacilitating sessions, and each works with an average of three spoke practices. The EELM-based training consists of ten sessions, 60 minutes per session, over a 4-month period. A total of ten providers per hub participate, with an average caseload of* n *= 4 elderly patients with dementia. Over a 20-month period, the hubs sequentially roll out the program, collecting information in four-month increments on provider knowledge and confidence providing care and on patient-reported health-related quality of life using dementia care mapping. Following implementation, a series of key informant interviews are held with ten providers and ten patients regarding perceived quality of care, care satisfaction, and benefits and challenges associated with EELM. Inclusive of developing materials, recruitment, implementation, interviews, and analysis, the full trial funding period lasts 48 months. See Table 7.3.*

Table 7.3. Overview of Scenario #3 Study Components

Population	Intervention(s)	Comparison	Outcomes	Time Frame	Study Design	Setting
Five hubs **15 practices** **50 providers** **200 patients**	EELM-based training on dementia care	Hubs that have received EELM-based training vs. those that have not yet	Provider metrics Patient health-related quality of life	20-month implementation period 48-month trial period	Stepped-wedge cluster randomized trial	Nursing homes Multistate

Summary

Each of the proposed scenarios described sets the stage for what is possible from a research perspective, given a finite budget and necessary trade-offs, and based on the recommendations of TEP members. We find that key research questions pertaining to EELM, identified by TEP members, have the potential to be investigated with a range of more- and less-complex study

designs. These different designs are likely to provide information of differing definitiveness and emphasis, but all have the potential to add to what is currently known.

8. Implications and Conclusions

We conducted a series of analyses on behalf of ASPE regarding the evidence base for the effectiveness of EELM and developed steps that can be taken to advance that evidence base. Among the results presented already, the results of the evidence review and of the evaluation report (based on feedback from the TEP) warrant further discussion and contextualization here. This chapter discusses these findings, followed by a brief summative section.

Implications of Evidence Review Findings

We conducted a review of the evidence of the effectiveness of EELM (see Chapter 5) regarding both provider-relevant and patient-relevant outcomes. As mentioned previously, we found that the empirical evidence for the effects of EELM on patient and provider outcomes remains modest, though consistently showing positive effects in the areas that researchers have measured.

One of the main findings of this evidence review was that the quality of evidence for the effectiveness of EELM is generally rated as "low" or "very low" based on the GRADE system. However, it is important to note that this is by no means limited to EELM; many models of care delivery are supported only by low-quality evidence. It is a broader issue in the field of health services research that implementation complexities and constraints are liable to affect choice of study design. Nevertheless, it is appropriate to continue to strive for higher-quality evidence, which could be difficult (but not impossible) to produce in a health services context. In particular, our evidence review pointed to a need for more and better evidence regarding impact on improving processes of care, outcomes of care, and provider-relevant outcomes (such as improved retention, especially in underserved areas).

Our findings indicate a need for targeted funding to evaluate EELM. The intention of EELM—to educate and empower health providers, particularly those in locales with limited access to specialist care, such as rural and remote areas—is both principled and strategic. However, relative to the scope and scale at which programs have proliferated over the past decade, the evidence base has yet to keep pace. Some of the options for evaluation designs could include experimental and quasi-experimental trials that permit stronger causal inference regarding the effects of EELM than was possible with many previous studies. It would be even more ideal to conduct randomized controlled trials that compare EELM with alternative modes of CME that can also be remotely accessed, although conducting randomized trials in a health services context is admittedly challenging. Given the capacity-building orientation of EELM, it would also behoove study designers to provide longer periods of follow-up that would allow researchers to assess not only the initial effects of EELM but also the sustainability of those effects over time. Lastly, only a small number of studies to date have included measurements of

cost, such as the cost of implementing EELM and the costs of patient care delivered under these programs and under comparison conditions. Such information would be especially useful to funders as they consider potential expansions of EELM.

Implications of TEP Findings

We conducted a TEP meeting to examine the state of the evidence for EELM and options for what could be done to advance that evidence base. The panel identified several opportunities to strengthen the evidence base on the impacts of EELM. Of the numerous potential approaches to build the evidence base, four broad points should be re-emphasized.

First, it is critical to develop a **clear understanding of EELM**: the diversity of what it is intended to accomplish and the critical components of the model. Building the evidence base requires a recognition that different EELM are implemented in unique ways with various adaptations to the original Project ECHO, and evaluations should account for this diversity.

Second, an **expanded focus on rigorous reporting of program characteristics of EELM** is important to encourage those who implement EELM to carefully document implementation details so that evaluators can assess how the model is put into practice and what "ingredients" might lead to better outcomes and are worth replicating.

Building capacity to evaluate EELM is a third critical opportunity and is two-pronged. Capacity-building could help implementers design EELM to facilitate improved evaluations and also help researchers to more effectively choose populations, outcomes, comparators, and study designs.

Fourth, it will be important for implementers and evaluators of EELM to continue to **engage with policymakers, funders, and others** to explore mutually beneficial mechanisms for supporting rigorous evaluation. Ideally, such mechanisms would address care delivery imperatives in the near term and enable more-rigorous evaluations that expand the evidence base to support long-term investments in EELM.

The panel took care to emphasize that the relatively weak evidence base in the academic literature does not imply that EELM are ineffective. Rather, to date, only limited data are available to objectively assess its effectiveness. There was a high level of agreement among TEP members that more data are needed to assess the impacts of EELM. The panel noted the complexities of studying this model of care delivery and, even while articulating those significant challenges, showed enthusiasm for the potential for more-rigorous evaluation.

Summary and Next Steps: Advancing the Evidence Base for EELM

Since Project ECHO began in 2003, EELM have expanded to encompass hundreds of hub sites and thousands of spoke sites, with multiple participating clinicians at many sites. EELM now address conditions that extend far beyond the initial application of the concept to HCV treatment in primary care. Many thousands of patients have been discussed in case presentations, and possibly millions of patients have been treated by clinicians who are participants or alumni

of EELM. Many participants express enthusiasm for the model, stating that it provides a learning community, enhances their practice, and increases their professional satisfaction.

Although EELM have expanded rapidly, important challenges remain, as described in this report. The success at rapidly scaling up EELM has not yet been matched with rigorous evaluation and evidence of impact on patient outcomes (i.e., processes or outcomes of care), or even provider outcomes (such as retention). In this report, and with the help of the TEP, we identified many of the barriers to expanding the evidence base for the effectiveness of EELM and proposed several potential strategies to facilitate higher-quality evaluation and higher-quality evidence.

Policy solutions should be informed by facts and evidence. Policymakers, researchers, and clinicians all share a goal of bringing high-quality health care to patients who have trouble accessing care for such reasons as living in a rural location or a health care shortage area. More research is needed to determine the extent to which EELM provide a solution to these problems and how EELM compare with other options that could be used. This report can inform efforts to advance the evidence base for EELM and ultimately help answer those questions. In turn, the answers will help guide choices of when and where to implement EELM—and how best to do so—to make the greatest strides possible in improving access to high-quality care, regardless of location.

Appendix A. Search Technique for Inventory

Search Terms

Search term I:

- State or territory name

Search term II:

- Government agency name, medical school name, large hospital name, or top hospital name

Search term III:

- "Project ECHO"
- "Extension of Community Healthcare Outcomes"
- "Extension of Community Health Care Outcomes"
- "Telementor"
- "Telementoring"
- "Technology-enabled collaborative learning"
- "Technology-enabled learning collaborative"
- "Technology-enabled capacity building"

Search Approach

Search term I/State territory name AND search term II (running through list) AND Search terms III (linked by OR)

For example, for Alabama, searches included:

- ("ALABAMA" Department of Public Health) AND ("Project ECHO" OR "Extension of Community Healthcare Outcomes" OR "Extension of Community Health Care Outcomes" OR "Telementor" OR "Telementoring" OR "Technology-enabled collaborative learning" OR "Technology-enabled learning collaborative" OR "Technology-enabled capacity building")
- ("ALABAMA" Brookwood Medical Center) AND ("Project ECHO" OR "Extension of Community Healthcare Outcomes" OR "Extension of Community Health Care Outcomes" OR "Telementor" OR "Telementoring" OR "Technology-enabled collaborative learning" OR "Technology-enabled learning collaborative" OR "Technology-enabled capacity building")
- ("ALABAMA" Flowers Hospital) AND ("Project ECHO" OR "Extension of Community Healthcare Outcomes" OR "Extension of Community Health Care Outcomes" OR "Telementor" OR "Telementoring" OR "Technology-enabled collaborative learning" OR

"Technology-enabled learning collaborative" OR "Technology-enabled capacity building")

In addition, the category III search terms (about EELM) were searched within the websites of each of the following government agencies:

Government agencies:

- HHS
- HHS—Administration of Children and Families
- HHS—Administration for Community Living
- HHS—AHRQ
- HHS—Office of the Assistant Secretary for Preparedness and Response
- HHS—CDC
- HHS—CMS
- HHS—HRSA
- HHS—IHS
- HHS—National Institute on Drug Abuse (NIDA)
- HHS—NIH
- HHS—SAMHSA
- DoD
- DoD—Army
- DoD—Navy
- DoD—Air Force
- VA—SCAN-ECHO

The full inventory can be found in Appendix F.

Appendix B. Search Technique for Evidence Review

PubMed

2007–2018; English

(Telementoring[title/abstract] OR tele-mentoring[title/abstract] OR tele-mentor[title/abstract] OR videoteleconferencing[title/abstract] OR video-teleconferencing[title/abstract] OR videoconferencing[title/abstract] OR video-conferencing[title/abstract] OR tele-training[title/abstract] OR teletraining[title/abstract] OR tele-conference[title/abstract] OR teleconference[title/abstract] OR tele-education[title/abstract] OR teleeducation[title/abstract] OR tele education[title/abstract] OR teleECHO[title/abstract] OR tele-ECHO[title/abstract] OR boot camp*[title/abstract] OR bootcamp*[title/abstract] OR mini-residenc*[title/abstract] OR learning collaborative[title/abstract] OR collaborative learning[title/abstract] OR crash course[title/abstract])
AND
(psycholog*[title/abstract] OR psychiatr*[title/abstract] OR "mental health"[title/abstract] OR "behavioral health"[title/abstract]OR counselor*[title/abstract])

Embase

2007–2018; English

(Telementoring OR tele-mentoring OR tele-mentor OR videoteleconferencing OR video-teleconferencing OR videoconferencing OR video-conferencing OR tele-training OR teletraining OR tele-conference OR teleconference OR tele-education OR teleeducation OR "tele education" OR teleECHO OR tele-ECHO OR "boot camp*" OR bootcamp* OR mini-residenc* OR "learning collaborative" OR "collaborative learning" OR "crash course"):ab,ti
AND
(psychology* OR psychiatr* OR "mental health" OR "behavioral health" OR counselor*):ab,ti

PsycInfo

2007–2018; English

TI ((Telementoring OR tele-mentoring OR tele-mentor OR videoteleconferencing OR video-teleconferencing OR videoconferencing OR video-conferencing OR tele-training OR teletraining OR tele-conference OR teleconference OR tele-education OR teleeducation OR "tele education" OR teleECHO OR tele-ECHO OR "boot camp*" OR bootcamp* OR mini-residenc* OR "learning collaborative" OR "collaborative learning" OR "crash course")) OR AB

((Telementoring OR tele-mentoring OR tele-mentor OR videoteleconferencing OR video-teleconferencing OR videoconferencing OR video-conferencing OR tele-training OR teletraining OR tele-conference OR teleconference OR tele-education OR teleeducation OR “tele education” OR teleECHO OR tele-ECHO OR “boot camp*” OR bootcamp* OR mini-residenc* OR “learning collaborative” OR “collaborative learning” OR “crash course”))
AND
TI (psychology* OR psychiatr* OR “mental health” OR “behavioral health” OR counselor*) OR AB (psychology* OR psychiatr* OR “mental health” OR “behavioral health” OR counselor*)

Appendix C. Studies Used in Evidence Review

In Tables C.1–C.3, we include the studies identified in the evidence review, organized by first author. Relevant features of each implementation of EELM are listed, where known, including health content area, number of sessions, session frequency, and number of patients or providers studied.

Table C.1. Reviewed Studies—Overview (*n* = 52 studies)

Citation	Health Content Area	Hub Name and Location	Spokes	Trainees Evaluated	Evaluation Implementation Period	Training Sessions	Frequency of Training Sessions	Duration of Training Sessions	Patients in Evaluation
Anderson et al., 2017	Pain management	Integrative Pain Center of Arizona, Tucson, Arizona	16	12 in the intervention group; 11 in the control group	2013	8	Weekly	120 minutes	Exposure group: 1,586 at baseline; 1,485 at follow-up Control group: 2,020 at baseline; 1,695 at follow-up
Arora et al., 2010	Hepatitis C	UNM Health Sciences Center, Albuquerque, New Mexico	Unknown	Varied by year: 17–52 providers	2006–2008	Unknown	Weekly	120 minutes	NA
Arora, Thornton, et al., 2011	Hepatitis C	UNM, Albuquerque, New Mexico	21	Unknown	2004–2008	Unknown	Weekly	Unknown	261 patients in exposure group; 146 patients in control group
Ball et al., 2018	Pain management	Louis Stokes Cleveland Veterans Affairs Medical Center, Cleveland, Ohio	3	25 (surveys); 14 (focus group discussions)	2011–2014	Unknown	Weekly	Unknown	NA
Beste et al., 2017	Hepatitis C	VA, Washington, D.C. (National Program)	152	376	2011–2015	Unknown	1–2 weeks	60–90 minutes	6,431 patients in exposure group; 32,322 patients in control group

Citation	Health Content Area	Hub Name and Location	Spokes	Trainees Evaluated	Evaluation Implementation Period	Training Sessions	Frequency of Training Sessions	Duration of Training Sessions	Patients in Evaluation
Beste et al., 2016	Infectious diseases; hepatitis C; pulmonology; nephrology	Veterans Affairs Puget Sound Health Care System, Seattle, Washington	Unknown	78	2014	Unknown	Weekly	60–90 minutes	NA
Carey et al., 2016	Pain management	VA, Washington, D.C. (National Program)	Unknown	Unknown	2010–2013	Unknown	Unknown	Unknown	371,646
Carlin et al., 2018	Chronic pain management	University of Toronto, Toronto, Canada	3	37	2014–2015	Unknown	Weekly	120 minutes	NA
Catic et al., 2014	Dementia	Beth Israel Deaconess Medical Center, Boston, Massachusetts	11	Unknown	2012–2013	Unknown	Bimonthly	90 minutes	47
Chaple et al., 2018	Substance use disorder	National Development & Research Institutes, New York, New York	Unknown	20	2016–2017	12	Biweekly	60 minutes	NA
Cofta-Woerpel et al., 2018	Tobacco cessation	University of Texas M. D. Anderson Cancer Center, Houston, Texas	Unknown	23	2015	16	Weekly to biweekly	60 minutes	NA

Citation	Health Content Area	Hub Name and Location	Spokes	Trainees Evaluated	Evaluation Implementation Period	Training Sessions	Frequency of Training Sessions	Duration of Training Sessions	Patients in Evaluation
Cordasco et al., 2015	Women's health	Veterans Affairs Healthcare Systems of Los Angeles, San Diego and Oklahoma City	Unknown	Varied by type of survey: 18–53	2012–2013	14	Monthly	60 minutes	NA
Covell et al., 2015	Co-occuring mental and substance use disorders	Center for Practice Innovations, Columbia University and New York State Psychiatric Institute; New York, New York	11	8 (provider-level); 11 (program-level)	2012–2013	Unknown	Monthly	90 minutes	NA
Eaton et al., 2018	Chronic pain management	University of Washington, Seattle, Washington	29	41	2012–2016	13	Weekly	90 minutes	NA
Farris et al., 2017	Dementia	Beth Israel Deaconess Medical Center, Boston, Massachusetts	8	12	2013–2015	Unknown	Weekly	Unknown	NA
Fisher et al., 2017	Dementia	University of Rochester Medical Center, Rochester, New York	35	154 (cohort); 26 (qualitative interviews)	2014–2016	33	Unknown	Unknown	> 70,000

Citation	Health Content Area	Hub Name and Location	Spokes	Trainees Evaluated	Evaluation Implementation Period	Training Sessions	Frequency of Training Sessions	Duration of Training Sessions	Patients in Evaluation
Frank et al., 2015	Chronic pain	Seven regional Veterans Affairs Healthcare Systems	195	159	2011–2013	Unknown	Every 1–2 weeks	Unknown	22,454 patients in exposure group; 299,981 in non-exposure group
Glass et al., 2017	Chronic liver disease	VA Ann Arbor Healthcare System Liver Clinic, Ann Arbor, Michigan	23	106	2011–2015	157	Weekly	60–90 minutes	582 in exposure group; 1,395 in comparison group
Gordon et al., 2016	Dementia	Beth Israel Deaconess Medical Center, Boston, Massachusetts	11	Unknown	2012–2013	Unknown	Biweekly	120 minutes	Unknown
Haozous et al., 2012	Cancer-related pain management	UW, Seattle, Washington	11 (education sessions); 16 (case sessions)	24 (education sessions); 32 (case conference sessions)	Unknown	4 education sessions; 9 case conference sessions	Monthly	60 minutes	NA
Jansen et al., 2018	Pain management in end-stage dementia	Queen's University, Belfast, Northern Ireland	Unknown	18	2016	5	Weekly	75 minutes	NA
Johnson et al., 2017	Multiple sclerosis	UW, Seattle, Washington	13	15 trainees participated in evaluation; 24 trainees total	Unknown	12	Weekly	60–90 minutes	NA

Citation	Health Content Area	Hub Name and Location	Spokes	Trainees Evaluated	Evaluation Implementation Period	Training Sessions	Frequency of Training Sessions	Duration of Training Sessions	Patients in Evaluation
Katzman et al., 2014	Chronic pain	UNM, Albuquerque, New Mexico	191	763 (surveys); 9 (focus group discussants)	2010–2013	136	Weekly	60 minutes	NA
Katzman et al., 2018	Chronic pain management	Seven military medical treatment facilities in the United States and Germany	80 spoke locations; 99 clinics	Unknown	2013–2016	Unknown	Weekly	120 minutes	52,431 in exposure group; 1,187,945 in comparison group
Kauth et al., 2015	Transgender health	VA, Washington, D.C. (National Program)	5	13	2014–2015	14	Biweekly	60 minutes	NA
Komaromy, Bartlett, et al., 2017	Integrated addictions and psychiatry	ECHO Institute, UNM Health Sciences Center, Albuquerque, New Mexico	Unknown	41	2015–2016	Unknown	Weekly	120 minutes	NA
Komaromy, Ceballos, et al., 2018	Community health worker training: obesity prevention and addiction recovery	ECHO Institute, UNM Health Sciences Center, Albuquerque, New Mexico	Unknown	16 (obesity prevention); 46 (addiction recovery)	2010–2015	16 (obesity); 20 (addiction)	Weekly	120 minutes	NA
Lewiecki et al., 2017	Osteoporosis	New Mexico Clinical Research and Osteoporosis Center, Albuquerque, New Mexico	Unknown	16	2015–2017	Unknown	Weekly	75 minutes	NA

Citation	Health Content Area	Hub Name and Location	Spokes	Trainees Evaluated	Evaluation Implementation Period	Training Sessions	Frequency of Training Sessions	Duration of Training Sessions	Patients in Evaluation
Marciano et al., 2017	Hepatitis C	Hospital Italiano de Buenos Aires, Buenos Aires, Argentina	12	14	2015	12	Biweekly	90 minutes	NA
Masi et al., 2012	Hypertension	University of Chicago, Chicago, Illinois	6	9 in the intervention group; 3 in the control group	2010–2011	12	Biweekly	Unknown	NA
Mazurek et al., 2017	Autism spectrum disorders	University of Missouri, Columbia, Missouri	9	14	Unknown	12	Biweekly	120 minutes	NA
Mehrotra et al., 2018	Mental health	National Institute of Mental Health and Neurosciences, Bangalore, India	11	12	2017–2018	12	Biweekly	Unknown	NA
Meins et al., 2015	Chronic pain management	UW Center for Pain, Seattle, Washington	Unknown	58	Unknown	Unknown	Weekly	Unknown	NA
Mohsen et al., 2018	Hepatitis C	Liverpool Hospital, Sydney, Australia	Unknown	42	2017–2018	Unknown	Weekly	60–120 minutes	100 in exposure group; 100 in comparison group

Citation	Health Content Area	Hub Name and Location	Spokes	Trainees Evaluated	Evaluation Implementation Period	Training Sessions	Frequency of Training Sessions	Duration of Training Sessions	Patients in Evaluation
Moore et al., 2017	Geriatric care	Beth Israel Deaconess Medical Center, Boston, Massachusetts	6 intervention sites; 41 comparison sites	Unknown	2014	52	Weekly	90 minutes	Exposure group: 213 at baseline, 148 at end; comparison group: 220 at baseline, 214 at end
Ní Cheallaigh et al., 2017	Hepatitis C	St James Hospital, Dublin, Ireland	4	6	2015	10	Biweekly	120–180 minutes	Unknown
Oliveira, Branquinho, and Goncalves, 2012	Varies: e.g. dermatology, neurology, and gastroenterology	Regional Health Administration of Alentejo	52	848	2009–2010	Unknown	Unknown	Unknown	NA
Parsons et al., 2017	Sleep medicine	VA Puget Sound Health Care System, Seattle, Washington	25	39	2015	20	Weekly	60 minutes	NA
Qaddoumi et al., 2007	Pediatric neuro-oncology	Division of Neurosurgery, The Hospital for Sick Children, Toronto, Canada	1	Unknown	2004–2006	20	Monthly	60 minutes	NA
Rahman et al., 2012	Geriatric nutrition	Davis School of Gerontology, University of Southern California, Los Angeles, California	9	Unknown	Unknown	8	Monthly	60–90 minutes	NA

Citation	Health Content Area	Hub Name and Location	Spokes	Trainees Evaluated	Evaluation Implementation Period	Training Sessions	Frequency of Training Sessions	Duration of Training Sessions	Patients in Evaluation
Ray, Fried, and Lindsay, 2014	Palliative care	Centre for Health System Strengthening, James Cook University, Townsville, Australia	Unknown	101	Unknown	16	Monthly	60 minutes	NA
Salgia et al., 2014	Hepatitis C	VA Ann Arbor Healthcare System, Ann Arbor, Michigan	Unknown	24	2011–2012	Unknown	Biweekly	Unknown	NA
Shipherd et al., 2016	Transgender care	LGBT Program, VA, Washington, D.C.	16	111	2014–2015	14	Biweekly	60 minutes	NA
Sockalingam et al., 2017	Mental health	Centre for Addictions and Mental Health and University of Toronto, Toronto, Canada	Unknown	Varied by type of survey: 22–27	2015	32	Weekly	120 minutes	NA
Su et al., 2018	Chronic liver disease	VA Ann Arbor Healthcare System Liver Clinic, Ann Arbor, Michigan	11	Unknown	2011–2015	Unknown	Unknown	Unknown	513 in VA SCAN-ECHO group; 62,237 in comparison group
Swigert et al., 2014	Diabetes	U.S. Air Force Diabetes Center of Excellence, San Antonio, Texas	Unknown	Unknown	2012	20	Biweekly	Unknown	NA

Citation	Health Content Area	Hub Name and Location	Spokes	Trainees Evaluated	Evaluation Implementation Period	Training Sessions	Frequency of Training Sessions	Duration of Training Sessions	Patients in Evaluation
Van Ast and Larson, 2007	Disability care	Western Australian Country Health Service Midwest, Geraldton, Western Australia, Australia	12	8	2004–2005	21	Unknown	120 minutes	NA
Volpe, Boydell, and Pignatiello, 2014	Psychiatric services	The Hospital for Sick Children, Toronto, Ontario, Canada	14	Unknown	2010–2011	12	Biweekly	90 minutes	NA
Watts et al., 2016	Diabetes	Louis Stokes Cleveland Veterans Affairs Medical Center, Cleveland, Ohio	2 intervention sites; 2 comparison sites	2	2012–2014	Unknown	Biweekly	60 minutes	39
White et al., 2015	Palliative care	Northern Ireland Hospice, Belfast, Northern Ireland	9	28	2014	24	Weekly	120 minutes	NA
Wood et al., 2018	HIV/AIDS (PrEP)	University of Washington, Seattle, Washington	Unknown	45	2015–2017	88	Monthly	Unknown	NA
Wood et al., 2016	HIV/AIDS	University of Washington, Seattle, Washington	21	45	2012–2015	172	Weekly	60 minutes	NA

Table C.2. Reviewed Studies Reporting Provider Measures (*n* = 43 studies)

Citation	Health Content Area	Number of Trainees Evaluated	Evaluation Design	Main Provider Outcome Measures	Main Provider Outcomes Reported
Anderson et al., 2017	Pain management	12 in the intervention group; 11 in the control group	Pre-post study design with comparison group	Pain-related knowledge and self-reported self-efficacy; frequency of formal assessment tool utilization; frequency of opioid agreements developed; patient concern about addiction to opioids	Increased pain knowledge in the intervention group ($p < 0.001$), not observed in the control group ($p = 0.11$); nonsignificant group difference in frequency of opioid agreement usage ($p = 0.05$); lower concern about patient addiction to opioids in the intervention group ($p = 0.006$)
Arora et al., 2011	Hepatitis C	Varied by year: 17–52 providers	Pre-post study design without comparison group	Self-reported satisfaction with ECHO training; self-reported self-efficacy before versus after ECHO training; self-reported perceived benefits of ECHO training	Satisfaction with ECHO training ranged from 4.3 to 4.9 on 1–5 ordinal scale (2006); self-efficacy increased significantly across all categories ($p < 0.001$) (2006–2007); moderate-major benefits self-reported across eight categories 82–98 percent of time (2008)
Ball et al., 2018	Pain management	25 (surveys); 14 (focus group discussions)	Pre-post study design without comparison group; focus group discussions	Self-reported confidence and knowledge treating patients with chronic pain before versus after ECHO training; barriers and facilitators to participation in ECHO	Increased provider confidence ($p < 0.01$) and increased provider knowledge ($p < 0.05$) on chronic pain; focus group discussions indicated increased provider self-efficacy and knowledge, as well as increased workload associated with participation
Beste et al., 2017	Hepatitis C	376	Retrospective cohort study with comparison group	Rate of PCPs who initiate Hepatitis C treatment with antiviral treatment	Providers who received at least one SCAN-ECHO training were more likely to initiate antiviral treatment ($p < 0.01$), compared with those with no SCAN-ECHO training. This was attributable to more frequent initiation among those presented as cases during trainings.

Citation	Health Content Area	Number of Trainees Evaluated	Evaluation Design	Main Provider Outcome Measures	Main Provider Outcomes Reported
Beste et al., 2016	Infectious diseases; hepatitis C; pulmonology; nephrology	78	Participant survey	Self-reported benefits of ECHO participation, such as perceived impact on providers and perceived impact on care delivery; association between duration of participation and perceived benefits	Strong agreement with trainings' impact on providers ranged from 34.2 to 46.8 percent across questions; strong agreement with trainings' impact on care delivery ranged from 28.6 to 38.4 percent across questions; participation for more than one year was associated with greater perceived impact, particularly perceived patient access to specialty care ($p = 0.005$)
Carlin et al., 2018	Chronic pain management	37	Focus group discussions (6)	Qualitative feedback on barriers and facilitators to ECHO, as well as perceived benefits and drawbacks	Respondents reported insights defined under such themes as challenges of managing chronic pain; ECHO participation and improvement in patient-provider interaction and participant knowledge; ECHO participation generating a sense of community; and disadvantages associated with participating in ECHO
Catic et al., 2014	Dementia	Unknown	Prospective cohort study without comparison group	Self-reported adherence to recommendations of the ECHO-AGE expert team	Self-reported adherence to expert recommendations in 39 of 44 cases (89 percent) presented
Chaple et al., 2018	Substance use disorder	20	Participant survey	Participant satisfaction in quality of training; self-reported enhancement in clinical skills	General participant satisfaction was 4.69 of 5; self-reported enhancement of clinical skills as a result of training was 4.45 of 5
Cofta-Woerpel et al., 2018	Tobacco cessation	23	Participant survey	Self-reported confidence treating tobacco use; satisfaction with participation; tobacco-related knowledge survey	All respondents (22) reported moderate-to-high confidence to address tobacco use; a majority of knowledge questions yielded 69–85 percent correct answers; 77 percent agreed the program was satisfactory

Citation	Health Content Area	Number of Trainees Evaluated	Evaluation Design	Main Provider Outcome Measures	Main Provider Outcomes Reported
Cordasco et al., 2015	Women's health	Varied by type of survey: 18–53	Participant surveys; participant semistructured interviews	Self-reported impact of training on care; self-reported satisfaction with participation	47 of 53 survey respondents (89 percent) reported that SCAN-ECHO information would influence their patient care; 18 of 18 interviewees (100 percent) reported SCAN-ECHO was useful for building and maintaining knowledge
Covell et al., 2015	Co-occurring mental and substance use disorder	8 (provider-level); 11 (program-level)	Participant survey (provider level); prospective cohort study without comparison (program level)	Provider-level: self-reported satisfaction. Program-level: increased knowledge about integrated treatment; percent of charts with stage of treatment recorded.	All providers reported that the online learning collaborative was helpful, the implementation model was helpful, and strategies supporting implementation were helpful. At program-level, sites showed significant increase in dual disorder treatment knowledge survey ($p < 0.05$); sites showed increase in chart documentation ($p < 0.05$)
Eaton et al., 2018	Chronic pain management	41	Cluster randomized controlled trial (clinic participation in TelePain sessions)	Pain management knowledge measured by KnowPain-12; self-reported knowledge and attitudes regarding pain; self-reported perceived competence	No significant change in knowledge scores or self-perceived competence when compared between intervention and control group PCPs ($p > 0.05$)
Farris et al., 2017	Dementia	12	Participant survey	Self-reported benefits of ECHO participation, including on patient treatment plans	Satisfaction on features of ECHO ranged from 3.25 to 3.58 on scale of 1 (strongly disagree) to 5 (strongly agree); providers demonstrated an average score of 3.64 on agreement that they incorporated training advice into treatment plans
Fisher et al., 2017	Dementia	154 (cohort); 26 (qualitative interviews)	Semistructured interviews; retrospective cohort study with comparison group	Semistructured interviews explored participant perceptions and experiences in the program	Interviewees reported the program led to improvements in clinician geriatric mental health care knowledge and treatment practices

Citation	Health Content Area	Number of Trainees Evaluated	Evaluation Design	Main Provider Outcome Measures	Main Provider Outcomes Reported
Glass et al., 2017	Chronic liver disease	106	Retrospective cohort study with control comparison	Association between complexity of trainee cases presented and number of cases presented	Providers who presented more than ten SCAN-ECHO cases were more likely to present complex cases about a specific treatment or a procedure, compared with those presenting ten or fewer cases ($p < 0.001$)
Haozous et al., 2012	Cancer-related pain management	24 (education sessions); 32 (case conference sessions)	Retrospective cohort study with and without control comparison	Self-reported satisfaction survey on pain management educational sessions; self-reported perceived competence proceeding case conference calls	Providers who attended pain management sessions reported mean item-level satisfaction scores ranging from 2.75 to 3.47 on a 0–4 ordinal scale; providers who attended case conference calls reported significantly higher competence on pain management than a control comparison group ($p < 0.01$)
Jansen et al., 2018	Pain management in end-stage dementia	18	Mixed-methods prospective cohort study	Participant self-efficacy and knowledge, based on KnowPain-50 and KnowPain-12 questionnaires; two focus group discussion interviews	Overall knowledge and self-efficacy scores were significantly higher post-ECHO than pre-ECHO for physicians ($p = 0.01$) and nurses ($p = 0.04$). Key themes that emerged were knowledge and skills development and dissemination, protected time, areas for improvement, and the future of ECHO.
Johnson et al., 2017	Multiple sclerosis	15 trainees participated in evaluation; 24 trainees total	Participant surveys	Self-reported confidence treating multiple sclerosis; self-reported satisfaction with program; self-reported feedback on program format	Mean self-reported confidence treating multiple sclerosis after training was 4.53 out of 5; 9 of 15 participants indicated the program met their expectations; 15 of 15 participants indicated that sessions expressed good value
Katzman et al., 2014	Chronic pain	763 (surveys); 9 (focus group discussants)	Participant survey; focus group discussions	Percentage of providers who reported that trainings were “excellent” on five dimensions; exploratory feedback on utility of presentations and impact of participation	From 2010 to 2012, the percentage of providers reporting “excellent” increased significantly across categories ($p < 0.01$); provider feedback on utility of ECHO trainings and impact of participation were generally positive

Citation	Health Content Area	Number of Trainees Evaluated	Evaluation Design	Main Provider Outcome Measures	Main Provider Outcomes Reported
Kauth et al., 2015	Transgender health	13	Participant survey; pre-post study design with comparison group	Post-intervention self-reported satisfaction on training; pre- and post-intervention self-reported confidence providing care	92.3 percent of providers described the didactics as somewhat or very helpful. The majority (76.9 percent) reported that receiving consultation was somewhat or very helpful, and nearly everyone (92.3 percent) felt that they benefited from listening to other cases being discussed; 39.7 percent of providers increased in self-reported confidence to treat transgender veterans after SCAN-ECHO ($p = 0.007$)
Komaromy, Bartlett, et al., 2017	Integrated addictions and psychiatry	41	Participant survey	Percentage of participants who reported changing their patient care plan as a result of presenting a case; percentage who rated the value of expert input received as 5 on a scale of 1–5; percentage who reported training as useful in caring for their own patients	77 percent of case presenters reported that the case discussion changed their patient care plan; 86 percent reported the value of the input they received as a 5 out of 5; 93 percent reported training as useful in caring for their own patients
Komaromy, Ceballos, et al., 2018	Community health worker training: obesity prevention and addiction recovery	16 (obesity prevention); 46 (addiction recovery)	Pre-post study design without comparison group; trainer-rated pre-post survey	Self-reported change in obesity prevention knowledge and abilities; trainer-reported change in motivational interviewing skills for addiction recovery	Self-reported obesity prevention knowledge and abilities increased on 12 of 13 dimensions ($p < 0.05$); trainer-reported provider performance on motivational interviewing improved ($p < 0.001$)
Lewiecki et al., 2017	Osteoporosis	16	Pre-post study design without comparison group	Pre-post intervention change in self-reported self-efficacy, based on self-efficacy questionnaire	Overall increase in reported self-efficacy among participants who completed the survey ($p = 0.005$). It uses a pre-post framework.
Marciano et al., 2017	Hepatitis C	14	Pre-post study design without comparison group	Self-assessed provider knowledge on HCV	Increase in self-assessed knowledge on all ten aspects of HCV care from pre- to post-intervention ($p < 0.05$)

Citation	Health Content Area	Number of Trainees Evaluated	Evaluation Design	Main Provider Outcome Measures	Main Provider Outcomes Reported
Masi et al., 2012	Hypertension	9 in the intervention group; 3 in the control group	Pre-post study design with comparison group	Knowledge surveys administered at baseline and endline; self-reported knowledge reported at baseline and endline	Tested knowledge of how to treat hypertension increased among intervention providers ($p < 0.01$) but not among controls. Self-assessed knowledge increased among intervention providers ($p < 0.01$) but not among controls
Mazurek et al., 2017	Autism spectrum disorders	14	Pre-post study design without comparison group	Self-reported self-efficacy; self-reported use of M-CHAT or another screening tool; self-reported adherence to American Academy of Pediatrics autism spectrum disorder screening guidelines; self-reported use of 15 possible resources for autism; satisfaction with program	Self-efficacy improved significantly ($p = 0.002$); use of resources increased from 0.29 out of 15 to 4.07 out of 15, on average ($p = 0.003$); high satisfaction with ECHO trainings was reported
Mehrotra et al., 2018	Mental health	12	Pre-post study design without comparison group; participant survey	Self-reported responses to satisfaction survey; pre- and post-intervention knowledge test and pre- and post-intervention self-reported self-efficacy	Mean participant satisfaction was 4.5 or higher on a scale of 1–5 for five survey questions. Topical knowledge increased significantly ($p < 0.01$), as did self-reported self-efficacy ($p < 0.05$).
Meins et al., 2015	Chronic pain management	58	Participant survey; participant observation	Self-reported belief that participation enhanced knowledge of pain management; self-report that participant intends to use new knowledge gained	On scale of 1–4, mean score for statement that participation enhanced knowledge was 3.94; mean score for statement that participant intended to use new knowledge gained was 3.77
Ní Cheallaigh et al., 2017	Hepatitis C	6	Participant semistructured interviews	Self-reported care management skills following ECHO training	Respondents generally reported that ECHO participation increased their ability to manage HCV infection
Oliveira, Branquinho, and Goncalves, 2012	Varied: e.g. dermatology, neurology, and gastroenterology	848	Participant survey	Overall participant satisfaction	Overall satisfaction was reported as medium, high, or very high (range: very low, low, medium, high, very high) by 90 percent of respondents in 2009 and 94 percent in 2010

Citation	Health Content Area	Number of Trainees Evaluated	Evaluation Design	Main Provider Outcome Measures	Main Provider Outcomes Reported
Parsons et al., 2017	Sleep medicine	39	Participant surveys	Self-reported comfort treating sleep disorders; self-reported clinical practice change	Increased provider comfort reported by 77 percent of respondents; a majority (85 percent) of respondents reported "some" or significant" practice change across practice domains
Qaddoumi et al., 2007	Pediatric neuro-oncology	Unknown	Prospective cohort study without comparison group	Percentage of patients for whom expert recommendations differed from original care plan; percentage of patients for whom there was a significant change in the original care plan, conditional on recommendations	In 23 patients (36 percent), major changes from original plan were recommended on different aspects of the care; in 21 patients (91 percent), those recommendations were followed
Rahman et al., 2012	Geriatric nutrition	Unknown	Participant survey; prospective cohort study without comparison group	Post-intervention participant satisfaction; pre-post intervention change in knowledge	89 percent of participants reported that they would participate in a similar project and recommend the course; knowledge scores on trainer-administered quiz improved significantly ($p < 0.05$)
Ray, Fried, and Lindsay, 2014	Palliative care	101	Pre-post study design without comparison group	Increased confidence to provide palliative care pre- versus post-intervention; post-intervention rating of content usefulness	Provider confidence increased significantly ($p < 0.05$); average rating of content usefulness was 3.50 on scale of 1–4
Salgia et al., 2014	Hepatitis C	24	Participant survey	Self-reported change of care provision following the intervention	The majority of participants (20, 83 percent) reported having encountered a case similar to the one presented in SCAN-ECHO; of these participants, 18 (90 percent) reported improvements in their perceived diagnostic approach, 16 (80 percent) reported having developed a better treatment plan, and 16 (80 percent) reported perceived improvements in follow-up plan development

Citation	Health Content Area	Number of Trainees Evaluated	Evaluation Design	Main Provider Outcome Measures	Main Provider Outcomes Reported
Shipherd et al., 2016	Transgender care	111	Participant surveys	Post-session knowledge test score; post-session self-reported satisfaction survey scores; post-intervention feedback survey; self-perceived confidence treating transgender veterans before versus after participation	Session participation ranged from 11 to 57, with 93 percent receiving a post-session knowledge survey score greater than 80 percent; average session satisfaction was 4.28 on 0–5 scale; participants rated all aspects of the intervention to be useful; 92 percent of participants increased in treatment confidence (p-value unreported); 63 percent of participants expected to care for more transgender patients in the future
Sockalingam et al., 2017	Mental health	Varied by type of survey: 22–27	Pre-post study design without comparison group	Self-reported knowledge and self-efficacy	Increased mental health and addictions knowledge ($p < 0.001$); increased provider self-efficacy approaching statistical significance ($p = 0.06$)
Swigert et al., 2014	Diabetes	Unknown	Pre-post study design without comparison group	Self-reported knowledge and confidence levels (including retrospective report of baseline knowledge and confidence); self-reported intention to change current clinical care practices	Self-reported increase in diabetes knowledge ($p < 0.001$) and increased confidence ($p < 0.001$) after individual ECHO sessions; a majority of participants (95 percent) reported an intention to change clinical practice after ECHO sessions
Van Ast and Larson, 2007	Disability care	8	Semistructured interviews	Perceived acceptability of technology; perceived benefits of participation	Participants generally reported favorable feedback about the technology platform; participants reported positive behavioral changes in caregiving
Volpe, Boydell, and Pignatiello, 2014	Psychiatric services	Unknown	Focus group discussion; key informant interviews	Overall participant satisfaction; acceptability of televideo technology	Focus group discussants and interviewees reported overall satisfaction; televideo technology was regarded as an effective tool for learning

Citation	Health Content Area	Number of Trainees Evaluated	Evaluation Design	Main Provider Outcome Measures	Main Provider Outcomes Reported
White et al., 2015	Palliative care	28	Mixed-methods prospective cohort study	Provider knowledge score; self-reported self-efficacy scores, provider self-reported satisfaction with program	Mean knowledge score improved significantly (71.3 percent to 82.7 percent, $p < 0.001$); self-efficacy significantly improved ($p = 0.063$); 96 percent reported gains in learning; 90 percent felt ECHO had improved the care they provide; 83 percent would recommend ECHO to other health care providers; 70 percent said ECHO's technology gave them access to education they would have had difficulty accessing
Wood et al., 2018	HIV/AIDS (PrEP)	45	Participant survey	Self-reported knowledge of PrEP, comfort level discussing PrEP, and prescribing practices	93.3 percent of survey respondents reported that the intervention helped them stay up to date on PrEP guidelines "extremely" or "moderately" well; 91.1 percent reported an "extremely" or "moderately" increased likelihood to prescribe PrEP; 40.0 percent reported that, without the intervention, they would have referred patients seeking PrEP to another provider
Wood et al., 2016	HIV/AIDS	45	Prospective cohort study without comparison group	Self-assessed confidence to perform essential components of HIV care; self-reported feeling part of a community of practice; self-reported overall HIV care knowledge	Self-assessed confidence improved over time in several clinical skill areas on 14 of 18 dimensions of care provision ($p < 0.05$); feelings of professional isolation decreased while degree to which participants felt part of an HIV community of practice increased ($p < 0.05$); self-reported HIV care knowledge increased ($p = 0.004$)

Table C.3. Reviewed Studies Reporting Patient Measures (*n* = 15 studies)

Citation	Health Content Area	Patients in Evaluation	Evaluation Design	Main Patient Outcome Measures	Main Patient Outcomes Reported
Anderson et al., 2017	Pain management	Exposure group: 1,586 at baseline; 1,485 at follow-up Control group: 2,020 at baseline; 1,695 at follow-up	Pre-post study design with comparison group	Percentage of patients with chronic pain treated with an opioid medication; average number of opioid prescriptions written per patient with pain; frequency of referrals for behavioral health and physical therapy	Greater reduction in the intervention group for percentage of patients with chronic pain treated with an opioid medication ($p = 0.002$); smaller increase in the intervention group for number of opioid prescriptions written per patient with pain ($p = 0.001$); frequency of referrals to behavioral health and physical therapy ($p < 0.001$)
Arora, Thornton, et al., 2011	HCV	261 patients in exposure group 146 patients in control group	Prospective cohort study with comparison group	Percentage of patients with sustained viral response; percentage of patients among whom a serious adverse event occurred	No difference in percentage of patients with sustained viral response ($p = 0.89$); greater prevalence of serious adverse events reported in the control group ($p = 0.02$)
Beste et al., 2017	HCV	6,431 patients in exposure group 32,322 patients in control group	Retrospective cohort study with comparison group	Rate of patients with sustained virologic response	No significant difference in rates of sustained virologic response between providers with versus without SCAN-ECHO training ($p = 0.32$)
Carey et al., 2016	Pain management	371,646	Spatial reach analysis	Association between distance to specialty pain care and being seen in person at a specialty clinic; association between distance to specialty pain care and access to a Pain SCAN-ECHO participating PCP	Patient distance from home to specialty pain care associated with 22 percent lower odds of being seen in person at a specialty care clinic ($p < 0.001$); distance from home to specialty pain care associated with 2 percent lower odds of access to a Pain SCAN-ECHO participating PCP ($p = 0.01$)
Catic et al., 2014	Dementia	47	Prospective cohort study without comparison group	Association between provider self-reported adherence to expert recommendations and provider self-reported (1) clinical improvement and (2) hospitalization of their patients	Clinical improvement among patients was self-reported as greater among those who adhered to expert recommendations ($p < 0.05$); hospitalization among patients was self-reported as lower among those who adhered to expert recommendations (p-value unreported)

Citation	Health Content Area	Patients in Evaluation	Evaluation Design	Main Patient Outcome Measures	Main Patient Outcomes Reported
Fisher et al., 2017	Dementia	More than 70,000	Semistructured interviews; retrospective cohort study with comparison group	Patient health care utilization and costs at participant practices, before and after enrollment in study	Reduction in emergency department costs ($406 to $311; $p < 0.05$) among those with mental disorder; increase in outpatient care utilization and costs among those without a mental disorder ($p < 0.05$)
Frank et al., 2015	Chronic pain	22,454 patients in exposure group 299,981 in non-exposure group	Prospective cohort study with comparison group	Association between case presentations and (1) delivery of outpatient care (physical medicine, mental health, SUD, and pain medicine), and (2) medication initiation (antidepressants, anticonvulsants, and opioid analgesics)	Patients whose case was presented during training sessions had greater likelihood of utilizing physical therapy ($p < 0.05$), but not care for mental health, SUD, or specialty pain medicine ($p > 0.05$), compared with patients whose cases were not discussed. Patients with presented cases also had greater likelihood of initiation on antidepressants and anticonvulsants ($p < 0.05$), but not an opioid analgesic ($p > 0.05$)
Glass et al., 2017	Chronic liver disease	582 in exposure group 1,395 in comparison group	Retrospective cohort study with control comparison	Patient time to liver consultation; patient distance traveled to care	SCAN-ECHO liver consults were completed an average of 9.6 days sooner than in the Liver Clinic (*p*-value unreported); average patient distance traveled to the Liver Clinic was 250 miles round-trip (*p*-value unreported)
Gordon et al., 2016	Dementia	Unknown	2:1 matched cohort study	Percentage of patients receiving antipsychotic medications; percentage of patients physically restrained; nine other secondary outcomes	Patients at participant facilities were marginally less likely to be physically restrained than patients at nonparticipant facilities ($p = 0.05$), and less likely to be prescribed antipsychotic medication ($p = 0.07$). Patients at participant facilities were less likely to experience a urinary tract infection

Citation	Health Content Area	Patients in Evaluation	Evaluation Design	Main Patient Outcome Measures	Main Patient Outcomes Reported
Katzman et al., 2018	Chronic pain management	Unknown	Prospective cohort study with comparison group	Prescription rates of opioid analgesics and coprescribing of opioids and benzodiazepines	Clinics participating in the intervention (ECHO Pain) showed greater declines in opioid prescriptions than did comparison facilities (–23 percent versus –9 percent, $p < 0.001$); days of coprescribed opioids and benzodiazepines also declined more ($p < 0.001$)
Mohsen et al., 2018	Hepatitis C	100 in exposure group 100 in comparison group	Retrospective cohort study with a comparison group	Percentage of patients with direct acting antiviral therapy initiated; percentage of patients who complete their regimen; percentage of patients with sustained virological response	Treatment was initiated among 78 percent of intervention patients versus 81 percent of those in a TLC; 89 percent of intervention participants completed treatment—of those, 87 percent had sustained virological response compared with 86 percent and 96 percent, respectively, in the TLC group. Statistical significance not reported
Moore et al., 2017	Geriatric care	Exposure group: 213 at baseline, 148 at endline Comparison group: 220 at baseline, 214 at endline	Prospective cohort study with comparison group	30-day readmission rates; 30-day total cost of care; average length of stay at the skilled nursing facility; 30-day mortality rate	Readmission was lower in the intervention group ($p = 0.04$); adjusted 30-day cost was lower in intervention group ($p < 0.001$); average length of stay at skilled nursing facility was shorter in intervention group ($p < 0.001$); 30-day mortality rate was not significantly different between groups ($p = 0.11$)
Ní Cheallaigh et al., 2017	Hepatitis C	Unknown	Participant semistructured interviews	Provider-reported benefits to patients	Respondents reported that patients attending their practice benefited from ECHO training
Su et al., 2018	Chronic liver disease	513 in VA SCAN-ECHO group; 62,237 in comparison group	Retrospective cohort study with comparison group	All-cause mortality among patients who received a SCAN-ECHO visit, propensity score matched to patients who received no visits	Propensity-adjusted mortality rates showed that a SCAN-ECHO visit was associated with a hazard ratio of 0.54 ($p = 0.003$) compared with no visit

Citation	Health Content Area	Patients in Evaluation	Evaluation Design	Main Patient Outcome Measures	Main Patient Outcomes Reported
Watts et al., 2016	Diabetes	39	Pre-post study design without comparison group	Mean glycated HbA1c value (glycemic control) at intervention sites before and after intervention; comparative levels of HbA1c > 9.0 percent at intervention and comparison sites at baseline and endline	Mean HbA1c improved from 10.2+/–1.4 percent to 8.4+/–1.8 percent ($p < 0.001$) over the average follow-up period of five months, not explained by systemwide changes or improvements; comparative increase in HbA1c scores at comparison sites ($p < 0.05$)

Appendix D. Studies Considered as Examples of EELM Evaluations

The studies in this appendix were considered when developing examples of potential evaluations of EELM with differing levels of methodological rigor and complexity. These studies were all program evaluations, although none evaluated an EELM program.

Table D.1. Example Program Evaluations (*n* = 41 studies)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Digital Tools for Coping with Chronic Pain *Study Record:* USNLM, 2018i	Chronic pain	200 adult and older adult patients with opioid prescriptions for chronic pain at sites in different geographic regions of the United States	• Intervention: 2017–2019 • Study funding: Unknown	My Strength, Inc.	Unknown	Double-arm RCT with wait list control and 1:1 randomization	Baseline + 6 months	Improved function; outlook on pain; perception of prescription	Krista Schladweiler, PhD (kschladweiler@mystrength.com); Abigail Hirsch, PhD (ahirsch@mystrength.com)
Extension Connection Evaluation *Study Record:* USNLM, 2017as *Project Description:* USNLM, 2018n	Dementia	60,000 older adult patients, 2 cohorts: (1) Medicare beneficiaries with dementia; (2) Medicare beneficiaries residing in nursing homes (with or without dementia) in Iowa	• Intervention: Unknown • Study funding: 2013–2018	Patient-Centered Outcomes Research Institute (PCORI)	Total: $1,626,680	Retrospective observational analysis of county-level controlled intervention	Baseline + up to 4 years	Antipsychotic use; anticholinergic use	Ryan Carnahan, PharmD, MS (ryan-carnahan@uiowa.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Northern-Manhattan Hispanic Caregiver Intervention Effectiveness Study *Study Record:* USNLM, 2016c *Project Description:* USNLM, 2018o	Dementia	221 adult and older adult Hispanic family member caregivers of patients with dementia in New York, New Jersey, and Connecticut	• Intervention: 2014–unknown • Study funding: 2013–2018	NIH	2013: $533,205 2014: $542,090 2015: $754,811 2016: $594,828 2017: $520,583	Double-arm RCT with active comparator and 1:1 caregiver-level randomization	Baseline + 6 months	Caregiver depressive symptoms; caregiver burden	José A. Luchsinger, MD, MPH (jal94@columbia.edu)
Translation of COPE for Publicly Funded Home Care Clients and Their Families *Study Record:* USNLM, 2018g *Project Description:* USNLM, 2018r	Dementia	582 older adult patients in a public home care programs in Connecticut with dementia or Alzheimer's	• Intervention: Unknown • Study funding: 2014–2019	NIH	Total: $671,600	Double-arm RCT with usual-care comparator and 1:1 patient-level randomization	Baseline + 4 months	Functional dependence	Richard H. Fortinsky, PhD (fortinsky@uchc.edu)
Optimizing Care for Patients with Dementia *Study Record:* USNLM, 2018h *Project Description:* USNLM, 2018p	Dementia	80 nursing home practices that serve older adult patients with dementia or Alzheimer's residing in LTC facilities in 10 geographic regions of the United States	• Intervention: Unknown • Study funding: 2018–2023	PCORI	Total: $4,722,108	Double-arm RCT with active comparator and practice-level randomization	Baseline + 18 months	Receipt of off-label psychotropic medications	Natalie E. Leland, PhD (NEL24@pitt.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Care Ecosystem: Navigating Patients and Families Through Stages of Care *Study Record:* USNLM, 2017ak *Project Description:* USNLM, 2017e	Dementia	780 adult and older adult patients with dementia who are insured by Medicaid or Medicare and their primary caregivers in California, Nebraska, and Iowa	• Intervention: Unknown • Study funding: 2017–2022	NIH/ National Institute on Aging (NIA)	2017: $1,168,825	Double-arm, RCT with a no-intervention arm and patient-level randomization	Baseline + 12 months	Quality of life	Bruce L. Miller, MD (Bruce.Miller@ucsf.edu)
A Family-Centered Intervention for Acutely Ill Persons with Dementia *Study Record:* USNLM, 2017av *Project Description:* USNLM, 2017ad	Dementia	438 older adult patients who are hospitalized with very mild to moderate dementia; and their caregivers, at 3 hospitals in Pennsylvania	• Intervention: 2017–2021 • Study funding: 2017–2022	NIH/NIA	2017: $612,352	Double-arm RCT with a no-intervention arm and cluster patient-level (dyad-level) randomization within hospital site	Hospital admission, hospital discharge + 6 months post-discharge	Physical function; functional performance; physical activity; delirium (occurrence and severity); neuropsychiatric symptoms; depression	Marie Boltz, PhD, RN (mpb40@psu.edu)
EPIC: An Intervention for Early-Stage AD [Alzheimer's Disease] Dyads *Study Record:* USNLM, 2018c *Project Description:* USNLM, 2017g	Dementia	160 adults and older adult patients with early-stage dementia who live at home; and their family member caregivers in Arizona and Nevada	• Intervention: 2017–2021 • Study funding: 2016–2021	NIH/NIA	2016: $772,914	Double-arm RCT with a wait list active comparator arm and patient-level (dyad-level) randomization	Baseline + 12 months	Emotional well-being of patient and caregiver; patient quality of life	David W. Coon, PhD (David.w.coon@asu.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Aggression Prevention Training for Caregivers of Persons with Dementia *Study Record:* USNLM, 2018e *Project Description:* USNLM, 2017a	Dementia	228 adult patients with dementia and pain or depression; and their caregivers in Texas	• Intervention: 2015–2018 • Study funding: 2014–2019	NIH/ National Institute of Nursing Research	Total: $1,184,306 2015: $507,781	Double-arm RCT with an enhanced usual-care comparator arm and patient-level (dyad-level) randomization	Baseline + 12 months	Aggressive behaviors	Mark Kunik, MD, MPH (mkunik@bcm.edu)
Aligning Patient Preferences: A Role Offering Alzheimer's Patients, Caregivers, and Healthcare Providers Education and Support *Study Record:* USNLM, 2017ar *Project Description:* USNLM, 2017u	Dementia	206 urban and rural nursing home practices in 14 states (22,650 adult and older adult patients)	• Intervention: 2019–2022 • Study funding: 2017–2019	NIH/NIA	2017: $371,281	Double-arm cluster RCT with a usual-care comparator arm and cluster randomization	Baseline + 12 months	Hospital transfers (admissions and emergency department visits)	Susan E. Hickman, PhD (hickman@Iu.edu); Kathleen Unroe, MD (kunroe@iu.edu)
Educational Video to Improve Nursing Home Care in End-stage Dementia *Study Record:* USNLM, 2017ao *Project Description:* USNLM, 2017ac	Dementia	360 older adult adults with advanced dementia currently residing in 20 nursing homes in Massachusetts	• Intervention: 2013–2017 • Study funding: 2012–2018	NIH/NIA	2012: $674,113 2013: $636,622 2014: $664,047 2015: $634,183 2016: $551,506	Double-arm cluster RCT with an active comparator and 1:1 practice-level cluster randomization	Baseline + 12 months	Decisions to forgo hospitalization	Susan Mitchell, MD, MPH (smitchell@hsl.harvard.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Team-Based Safe Opioid Prescribing *Project Description:* USNLM, 2017ae	Chronic pain	14 remote, rural primary care clinics in Washington and Idaho	• Intervention: Unknown • Study funding: 2015–2018	AHRQ	2015: $497,386	Unknown	Baseline + 12 months	Proportion of patients with data in registry; change in monthly average daily morphine equivalent dose; proportion of clinics that revise policies; change in staff self-assessed use of best practices	Michael Parchman, MD, MPH (parchman.m@ghc.org)
Evaluation of the Extension for Community Healthcare and Outcomes (ECHO) Model for Pain and Opioid Stewardship in Ontario *Study Record:* Canadian Research Information System, 2012 *Project Description:* USNLM, 2017i	Chronic pain	Unknown number of PCPs from urban and rural clinics in Ontario, Canada at ~19 spoke clinics in Ontario	• Intervention: Unknown • Study funding: 2014–2017	Canadian Institutes of Health Research	2014–2015: $105,544 2015–2016: $126,594 2016–2017: $143,243 2017–2018: $24,429 Total: $399,810	Unknown	Unknown	Clinician knowledge about chronic pain; clinician self-efficacy, attitudes, and behaviors	Andrea Furlan, PhD (afurlan@iwh.on.ca)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Medical Strategies for the Management of Pain in the Addicted Patient *Project Description:* USNLM, 2017r	Chronic pain/MAT	66 adult patients with co-occurring chronic pain (spinal surgical procedure) and OUD at 6 community practices in Buffalo, New York	• Intervention: Unknown • Study funding: 2011–2013	NIH/NIDA	Unknown	Double-arm RCT with an active comparator arm and patient-level randomization	Baseline + 9 months	Self-reported patient pain levels	Richard Blondell, MD (blondell@buffalo.edu)
Virtual Environment Training in the Proper Use of Prescription Pain Medications *Project Description:* USNLM, 2017aj	Chronic pain	Unknown number of health care providers who prescribe opioid pain medications	• Intervention: Unknown • Study funding: 2013–2019	NIH/NIDA	2013: $288,784 2015: $493,559 2016: $499,721 2017: $385,867	Double-arm RCT with an active control arm and provider-level randomization	Unknown	Provider competence, communication skills, and opioid treatment behavior	Bradley Tanner, MD (bradtanner@gmail.com)
Toward Safer Opioid Prescribing for Chronic Pain in High-Risk Populations: Implementing the CDC Guideline in the Primary Care HIV Clinic *Project Description:* USNLM, 2017ah	Chronic pain	10 HIV PCPs who have patients with HIV and chronic pain for whom they prescribe opioids; and their patients (~5 per provider) in New York	• Intervention: Unknown • Study funding: 2017–2020	AHRQ	2017: $496,708	Double-arm RCT with a usual-care comparator arm and provider-level randomization	Baseline + 6 months	Opioid misuse; pain control; antiretroviral therapy treatment adherence; patient relationship with provider	Jessica Robinson-Papp, MD, MS (jessica.robinson@mssm.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Facilitating Lower Opioid Amounts Through Tapering *Project Description:* USNLM, 2017k	Chronic pain	Unknown	• Intervention: Unknown • Study funding: 2017–2020	NIH/NIDA	2017: $381,922	Mixed-method study (detail unknown)	Unknown	Unknown	David H. Smith, RPh, PhD (David.H.Smith@kpchr.org)
Targeting Effective Analgesia in Clinics for HIV-Intervention (TEACH) *Study Record:* USNLM, 2018b *Project Description:* USNLM, 2017o	Chronic pain	41 providers who are the main provider for 1+ adult and older adult patients on chronic opioid therapy who are living with HIV in Boston, Massachusetts, or Atlanta, Georgia	• Intervention: Unknown • Study funding: 2014–2019	NIH/NIDA	2014: $1,105,595 2015: $1,106,535	Double-arm RCT with a standard of care control arm and collaborative care team-level (i.e., provider-level) randomization	Baseline + 12 months	Patient receipt of urine drug testing; percentage of patients with early refills; provider satisfaction	Jeffrey Samet, MD, MA, MPH (Jsamet@bu.edu); Carlos del Rio, MD (cdelrio@emory.edu)
Patient Activation to Address Chronic Pain and Opioid Management in Primary Care *Study Record:* USNLM, 2017ap *Project Description:* USNLM, 2017aa	Chronic pain	377 adult and older adult patients with chronic pain receiving treatment at two large primary care clinics in California	• Intervention: Unknown • Study funding: 2014–2018	PCORI	Total: $1,928,560	Double-arm RCT with a usual care control arm and collaborative care team-level (i.e., provider-level) randomization	Baseline + 12 months	Patient activation (with regard to chronic pain treatment)	Cynthia I. Campbell, PhD, MPH (cynthia.i.campbell@kp.org)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
PRescribing INterventions for Chronic pain via the Electronic health record (PRINCE) *Project Description:* USNLM, 2017z	Chronic pain	40 primary care clinics in Minnesota	• Intervention: Unknown • Study funding: 2017–2019	NIH/NIDA	2017: $210,673	RCT with practice-level randomization	Baseline + 12 months	Provider behavior (detail unknown)	Ezra Golberstein, PhD (egolber@umn.edu)
A Method to Increase Buprenorphine Treatment Capacity and Effectiveness *Project Description:* USNLM, 2017s	MAT	Unknown number of patients with OUD at an unknown number of buprenorphine-certified primary care settings	• Intervention: Unknown • Study funding: 2016–2017	NIH/NIDA	2016: $293,694	Double-arm RCT with a maintenance treatment-controlled arm	Unknown	Increased treatment retention; reduction in illegal drug use	Julia Shi, MD (julia.shi@yale.edu); Rosalyn Liss
Intervention to Expand Opioid Use Disorder Treatment Pharmacotherapy Prescribers *Study Record:* USNLM, 2017at *Project Description:* USNLM, 2017ag	MAT	70 addiction treatment organizations in Wisconsin	• Intervention: 2016–2020 • Study funding: 2016–2020	NIH/NIDA	2016: $631,016	Double-arm RCT with a control arm and cluster practice-level 1:1 randomization	Baseline + 50 months	Buprenorphine prescribing capacity; extended-release naltrexone capacity	Todd Molfenter (todd.molfenter@chess.wisc.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Extended-Release Naltrexone Opioid Treatment at Jail Re-Entry *Study Record:* USNLM, 2018m *Project Description:* USNLM, 2017j	MAT	255 adults and older adults with OUD leaving New York's Rikers Island jail	• Intervention: 2014–2021 • Study funding: 2013–2018	NIH/NIDA	2013: $628,726 2014: $678,642 2015: $672,308 2016: $677,777	(1) Double-arm RCT with an enhanced treatment-as-usual control arm and individual patient-level randomization; (2) quasi-experimental, nonrandomized methadone treatment program observational arm recruited in parallel	Baseline + 24 weeks	Time to relapse to OUD	Joshua D. Lee, MD, MS (Joshua.Lee@nyumc.org)
Pilot Test of Patient Decision Aid for Opioid Use Disorder *Study Record:* USNLM, 2018a *Project Description:* USNLM, 2017w	MAT	60 adult and older adult patients with OUD at an unknown number of sites in California	• Intervention: Unknown • Study funding: 2017–2018	NIH/NIDA	2017: $223,217	Stepped-wedge, cluster RCT with randomization stratified by rural vs. nonrural area	Baseline + 3 months	MAT treatment retention	Yih-Ing Hser, PhD (yhser@ucla.edu); Larissa J. Mooney, MD (lmooney@mednet.ucla.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Evaluating the Implementation and Impact of a Novel Medication-Assisted Treatment Program in a Unified Jail and Prison System *Project Description:* USNLM, 2017h	MAT	Unknown, at jails and prisons in Rhode Island	• Intervention: Unknown • Study funding: 2017–2019	NIH/NIDA	2017: $215,157	Mixed-method assessment (detail unknown)	Unknown	Rates of fatal opioid overdose	Josiah Rich, MD, MPH (jrich@lifespan.org)
Onsite Buprenorphine Treatment at Syringe Exchange Programs *Study Record:* USNLM, 2018l *Project Description:* USNLM, 2017d	MAT	250 adult and older adult patients with OUD who are not receiving treatment and who use needle exchange programs in New York City	• Intervention: Unknown • Study funding: 2017–2022	NIH/NIDA	2017: $721,387	Double-arm RCT with an active enhanced-referral comparator arm and patient-level 1:1 randomization	Baseline + 30 days	Buprenorphine engagement (patients having an active buprenorphine prescription)	Aaron Fox, MD (adfox@montefiore.org)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Long-Acting Naltrexone for Pre-Release Prisoners *Study Record:* USNLM, 2018d *Project Description:* USNLM, 2017q	MAT	240 adult and older adult patients with a history of OUD who are not currently using opioids, who are incarcerated at one of four prisons in Baltimore City and Baltimore County, Maryland, and who are eligible for release	• Intervention: 2017–2020 • Study funding: 2016–2021	NIH/NIDA	2016: $644,996	Double-arm RCT with an active comparator arm and two-group block patient-level randomization within gender	Baseline + 12 months	Treatment adherence; illicit opioid use; re-arrest; re-incarceration; criminal activity (self-reported); injection drug use; HIV sexual risk factors	Michael S. Gordon, DPA (mgordon@friendsresearch.org)
Models of Screening, Brief Intervention with a Facilitated Referral to Treatment (SBIRT) for Opioid Patients in the Emergency Department *Study Record:* USNLM, 2016b *Project Description:* USNLM, 2017t	MAT	329 adult and older adult patients with OUD who present at the emergency department in New Haven, Connecticut	• Intervention: 2008–2013 • Study funding: 2008–2013	NIH/NIDA	Total: $4,818,496 2012: $650,599	Three-arm RCT with a usual care comparator arm (and 2 experimental arms), with patient-level randomization	Baseline + 30 days	Engagement in SUD treatment (self-reported)	Gail D'Onofrio, MD, MS (gail.donofrio@yale.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Linking Hospitalized Injection Drug Users to Buprenorphine *Study Record:* USNLM, 2015b *Project Description:* USNLM, 2017p	MAT	147 adult medically hospitalized patients with OUD who inject opioids and are completing inpatient detoxification in Providence, Rhode Island, and Boston, Massachusetts	• Intervention: 2009–2014 • Study funding: 2012–2017	NIH/NIDA	2012: $498,068 2013: $461,306 2014: $480,526 2015: $477,241 2016: $475,128	Double-arm RCT with a treatment-as-usual control arm and patient-level randomization	Baseline + 6 months	Opioid use; HIV risk behavior	Michael Stein, MD, (Michael_Stein@brown.edu)
Buprenorphine and Substance Abuse Services for Prescription Opioid Dependence *Study Record:* USNLM, 2017au *Project Description:* USNLM, 2017c	MAT	300 adults with OUD receiving large outpatient SUD treatment program in Sacramento, California	• Intervention: 2015–2019 • Study funding: 2014–2018	NIH/NIDA	2014: $543,878 2015: $571,363	Double-arm RCT with a usual-care comparator arm and patient-level randomization	Baseline + 12 months	MAT adherence; substance use abstinence; SUD treatment utilization costs; MAT drug testing adherence	Cynthia Campbell, PhD, MPH (cynthia.i.campbell@kp.org); Monique Does, MPH (monique.does@kp.org)
Peer-Administered Asthma Self-Management Intervention in Urban Middle Schools *Study Record:* USNLM, 2018f *Project Description:* USNLM, 2017y	Asthma	432 Latino pediatric patients with current persistent asthma at middle schools in Providence, Rhode Island, and San Juan, Puerto Rico	• Intervention: 2018–2023 • Study funding: 2013–2015	NIH/ National Institute of Child Health and Human Develop-ment	2013: $212,708 2014: $229,520	Three-arm RCT with an active comparator arm and no-treatment control arm, and with patient-level randomization within site	Baseline + 12 months	Asthma control; number of symptom-free days; asthma-related school absence ratio; lung function	Daphne Koinis-Mitchell, PhD (Daphne_Koinis-Mitchell@brown.edu); Glorisa Canino, PhD (glorisa.canino@upr.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Promoting Asthma Guidelines and Management Through Technology-Based Intervention and Care Coordination (PRAGMATIC) *Study Record:* USNLM, 2017al *Project Description:* USNLM, 2017ab	Asthma	512 pediatric patients with persistent or uncontrolled asthma at 20 practices in the Bronx, New York	• Intervention: 2017–2021 • Study funding: 2016–2021	NIH/ National Heart, Lung, and Blood Institute (NHLBI)	2016: $848,392 2017: $832,065	Double-arm RCT with an enhanced usual-care comparator arm and cluster randomization	Baseline + ~5 years	Adherence to clinical guidelines	Marina Reznik, MD, MS (mreznik@montefiore.org); Guadalupe Salazar (guadalupe.salazar@einstein.yu.edu)
Patient Empowered Strategy to Reduce Asthma Morbidity in Highly Impacted Populations; PeRson EmPowered Asthma RElief (PREPARE) *Study Record:* USNLM, 2018k *Project Description:* USNLM, 2017x	Asthma	1,200 African American and Hispanic/Latino adult and older adult patients with asthma who are receiving daily maintenance therapy; in ten states and Puerto Rico	• Intervention: 2017–2020 • Study funding: 2016–2022	PCORI	Total: $13,857,788	Double-arm RCT with an enhanced usual-care comparator arm	Baseline + ~15 months	Rate of asthma exacerbations per year (related to number of emergency department visits or hospitalizations requiring corticosteroids per patient year)	Elliot Israel, MD (eisrael@partners.org); Nancy Maher, MPH (nmaher@bwh.harvard.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
The Breathewell Program to Improve Asthma Outcomes *Project Description:* USNLM, 2017b	Asthma	10,400 asthma patients at 26 primary care clinics in Colorado	• Intervention: Unknown • Study funding: 2015–2020	NIH/ NHLBI	2015: $831,168	Double-arm RCT with a usual-care comparator arm	Unknown	Asthma exacerbations; quality of life; cost	Bruce Bender, PhD (bruce.bender@ucdenver.edu)
Guidelines to Practice: Reducing Asthma Health Disparities Through Guideline Implementation (G2P) *Study Record:* USNLM, 2015a *Project Description:* USNLM, 2017l	Asthma	550 African American, Hispanic/Latino, and low-income adult and older adult patients with uncontrolled asthma at 40 primary care clinics in Minnesota	• Intervention: 2014–2016 • Study funding: 2014–2018	PCORI	Total: $3,397,813	Four-arm factorial RCT with a usual care comparator arm	Baseline + 12 months	Symptom-free days; asthma control (self-reported and spirometry assessment); asthma-related quality of life	James Stout, MD (jstout@uw.edu)
Coordinated Healthcare Interventions for Childhood Asthma Gaps in Outcomes (CHICAGO) *Study Record:* USNLM, 2015c *Project Description:* USNLM, 2017f	Asthma	640 English and Spanish-speaking pediatric patients with uncontrolled asthma who present to the emergency department; and their caregivers, at clinical centers in Chicago	• Intervention: 2015–2017 • Study funding: 2014–2018	PCORI	Total: $3,999,821	Three-arm RCT with a usual care comparator arm and patient-level randomization stratified by race (black vs. not black) and clinical center	Baseline + 6 months	Asthma impact; caregiver satisfaction	Jerry Krishnan, MD, PhD (jakris@uic.edu); Helene A. Gussin, PhD (hgussin@uic.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Using IT to Improve Access, Communication and Asthma in African American and Hispanic/Latino Adults *Study Record:* USNLM, 2017am *Project Description:* USNLM, 2017ai	Asthma	300 African American, Hispanic/Latino, and low-income adults with asthma in Philadelphia	• Intervention: 2014–2017 • Study funding: 2014–2019	PCORI	Total: $1,968,004	Double-arm RCT with an active comparator arm and patient-level randomization	Baseline + 12 months	Asthma symptom control	Andrea J. Apter, MD, MSc, MA (apter@mail.med.upenn.edu)
A Patient Advocate to Improve Real-World Asthma Management for Inner City Adults (HAP2) *Study Record:* USNLM, 2018j *Project Description:* USNLM, 2017v	Asthma	312 adult and older adult patients (primarily African American, Hispanic/Latino, and low-income) with moderate to severe persistent asthma and evidence of reversible airflow obstruction in Philadelphia	• Intervention: 2013–2019 • Study funding: 2013–2018	NIH/ NHLBI	2013: $693,595 2014: $741,378 2015: $726,347 2016: $720,146	Double-arm RCT with a usual-care comparator arm and patient-level randomization	Baseline + 6 months	Asthma symptom control	Andrea J. Apter, MD, MSc, MA (apter@mail.med.upenn.edu)

Study Title	Content Area	Population and Setting	Time Line	Funder	Award Amount	Study Design	Outcome Measurement Period	Primary Outcome(s)	Contact
Telemedicine Enhanced Asthma Management Through the Emergency Department *Study Record:* USNLM, 2017aq *Project Description:* USNLM, 2017af	Asthma	430 pediatric patients with persistent and poorly controlled asthma who present to the emergency department with acute asthma exacerbation in Rochester, New York	• Intervention: 2016–2021 • Study funding: 2008–2021	NIH/ NHLBI	2009: $774,857 2010: $755,575 2011: $747,418 2012: $743,678 2013: $702,271 2016: $764,084 2017: $748,322	Double-arm RCT with an enhanced usual care active comparator arm and patient-level randomization	Baseline + 12 months	Number of asthma symptom-free days	Jill Halterman, MD, MPH (Jill_Halterman@urmc.rochester.edu) Maria Fagnano, MPH (maria_fagnano@urmc.rochester.edu)
Breathe with Ease: A Unique Approach to Managing Stress (BEAMS) *Study Record:* USNLM, 2017an *Project Description:* USNLM, 2017n	Asthma	250 African American and Hispanic pediatric patients with uncontrolled asthma; and their parents in Washington, D.C.	• Intervention: Unknown • Study funding: 2014–2018	PCORI	Total: $2,245,126	Double-arm, single-blind RCT with a usual care active comparator arm and patient-level (parent-child dyad-level) randomization	Baseline + 12 months	Number of asthma symptom-free days	Stephen Teach, MD, MPH (steach@childrensnational.org)
Transforming Opioid Prescribing in Primary Care (TOPCARE) *Study Record:* USNLM, 2016a *Project Description:* USNLM, 2017m	Chronic pain	53 PCPs who treat patients with opioid medication; and their patients (~500 total) in Boston	• Intervention: 2014–2016 • Study funding: 2012–2017	NIH/NIDA	2012: $547,501 2013: $527,794 2014: $542,116 2015: $519,474 2016: $16,994	Double-arm cluster RCT with an active control care comparator arm and provider-level randomization	Baseline + 12 months	Provider adherence to chronic opioid treatment guidelines	Karen Lasser, MD, MPH (Karen.Lasser@bmc.org); Jane Liebschutz, MD, MPH (jane.liebschutz@bmc.org)

NOTE: DPA = doctorate of public administration; MA = master of medicine; MD = doctorate of medicine; MPH = master of public health; MS = master of surgery; MSc = master in science; PharmD = doctorate of pharmacy; PhD = doctorate of philosophy; RN = registered nurse; RPh = registered pharmacist.

Appendix E. Case Studies: Technology-Based Health Care Collaborative Learning & Capacity-Building Models

With input from the ASPE, we selected EELM that are noteworthy in terms of program scope, organization, funding, ability to meet local needs, and potential for lessons learned. We list these cases here as an appendix because many readers of this report might not be very familiar with EELM. The case studies can serve as a useful complement to the other parts of the report, enabling readers to gain a more intuitive understanding of what these programs are and how they might function in practice. In addition, the case studies illustrate the broad variety of EELM that exist.

There were no formal inclusion or exclusion criteria for a program to be the subject of a case study. Our main goals were to ensure that each case would embody a unique aspect of EELM. One case (the Vermont Hub-and-Spoke Program) was included because we had been under the impression that it was an ECHO-like model, but we later found out that their program did not quite meet our definition. This illustrates the fact that, in some cases, it can take some additional research to determine whether a program belongs in this category.

The case studies draw on such information sources as the program's website and semistructured discussions with key informants or leaders from each program. We spoke with at least one leader from each program, usually its founding leader or current director. In many cases, we had additional semistructured discussions with the program manager or other key informants, and followed up with additional clarifying questions. In all cases, key informants reviewed our case study summaries to ensure that there were no factual errors. We also conducted a purposive review of program websites to fill in gaps in our summaries and to ensure that we had a full understanding of the programs about which we would be writing.

To facilitate comparisons across cases, each case study follows a similar structure:

- introduction and brief history of the program
- unique aspects of the program
- challenges faced and how they were addressed
- lessons learned.

In addition, some case studies contain maps or other materials to further illustrate EELM.

Table E.1 provides an overview of the case studies and our rationale for their inclusion.

Table E.1. Programs Featured as Case Studies

Program	Year Founded	Unique Features/Rationale for Inclusion
Project ECHO UW	2008	First replication of ECHO outside New Mexico; serves a large, multi-state area
ECHO-Chicago	2010	Focus on underserved urban communities and the issues impacting them
University of Rochester	2014	Strong integration of sophisticated evaluation, state evaluation funding, private payer engagement through data-sharing, and incorporating EELM into new and existing delivery system reform initiatives
VA SCAN-ECHO	2013	Adaptation of the ECHO model by a federal agency, VA
Vermont Hub-and-Spoke	2013	Statewide learning collaborative as an alternative strategy to address a demonstrated need; a closely related but not identical model to EELM
Oregon ECHO	2017[a]	ECHO with an independent oversight board that includes local health care payers (Oregon is one of only a few states with a waiver to use Medicaid funds to support the ECHO model.)
Show-Me ECHO	2015	An example of EELM founded with proactive (and ongoing) involvement by state-level officials
ECHO Colorado	2016	Program that uses EELM as one of several telehealth delivery strategies to serve the needs of a state
Weitzman Institute	2012	ECHO program run by, and run for, clinicians practicing in FQHCs across the nation

[a] A pilot program began in 2013; the Oregon ECHO in its current form launched in 2017.

Main Findings from Case Studies

The case studies in this appendix describe the experiences of different organizations with implementation of EELM, both in response to a range of challenges with health care delivery in their local contexts and to address the needs of providers in other regions. The programs attempt to overcome such challenges as physical barriers to accessing specialty care, lack of access to expertise in a subject area, and lack of resources and support to manage certain health conditions. Each program has pursued its own mix of support from university advocates, state funding, federal grants, and private sources. What many of these programs share are (1) a general enthusiasm on the part of specialist mentors to help their primary care colleagues who are practicing in remote and underserved areas, and (2) an eagerness on the part of generalist mentees to learn about subject areas and conditions relevant to their practices with the ultimate goal of expanding capacity and improving care.

One of the key themes we found was that many EELM exist alongside other mechanisms of telehealth, including direct-care telehealth and e-consults. Some programs, such as the Show-Me ECHO, explicitly exist within a broader telehealth initiative and are run by the same entity. Other programs, such as the Rochester ECHO, emphasized the fluid nature of different telehealth strategies and frequently refer patients from one telehealth strategy to the other, in the manner of choosing an appropriate level of care to suit the complexity of the case. EELM, therefore, should

not be thought of in isolation, but as part of a suite of strategies for telehealth delivery—and frequently used alongside the other strategies.

We found that EELM are actively involved in learning from each other, adopting best practices, and soliciting advice across entities. However, EELM must be tailored to their unique environments, and no one solution can work across all situations. Accordingly, each program offers its own lessons in how to creatively address barriers, maximize resources, and innovate. Most sites had one or more strong champions of the program whose dedication and tenacity seem key to their success.

Another theme we encountered was the importance of human connections in making EELM "work" for generalist mentees. Investing in understanding the needs of generalist mentees and engaging in outreach to them are key to sustaining interest in EELM on the part of spokes, and in securing leadership support for continued participation (as was seen with UW). Key informants frequently commented on how different subject areas require different designs, different implementations, perhaps different frequencies and durations of sessions, and even different approaches to evaluation. The ability to tailor EELM to local needs and to link them with other interventions is a tremendous strength, conceptually, but measuring their impact can be difficult when they run concurrently with other service delivery and quality improvement efforts. In addition, most funding to date has been focused on implementation rather than evaluation.

One of the important sources of variation seen across these case studies is in the role of a defined geographic area. Programs used EELM as a way to recruit effective specialist mentors from far away (e.g., Weitzman), to deliver content across state lines (e.g., Washington), or, in contrast, to bound their offerings tightly to a particular state because of funding (e.g., Missouri, Oregon, Colorado, New York) and consequently to the needs of that state. Some ECHO programs actually focus only on one part of a state; Rochester initially took this approach, though it shows signs of becoming a statewide program for all of New York. One program explicitly mentioned the importance of local knowledge by ECHO specialist mentors as being important for generalist mentees to absorb not only how to practice medicine (or related disciplines) but also how best to access locally available resources and feel part of a practice community.

Many programs noted both the advantages and disadvantages of organizing at a state level. Key advantages include staying close to the needs of the generalist mentees, especially with an understanding of local issues, such as obtaining needed resources (e.g., food assistance, medication affordability programs). Key disadvantages of staying within one state include limiting the possible supply of specialist mentors or possibly forgoing particularly dynamic and effective hubs located out of state.

Although these case studies represent a snapshot of the diversity of EELM that are in operation around the United States, they provide important insights into the origins of EELM in different settings, the features that are unique and common across programs, the challenges that different programs face and the approaches that they have taken to overcome these challenges, and the ways they are approaching the evaluation of their work.

University of Washington

ECHO Across the Pacific Northwest

> "Taking the time to do a site visit to a potential spoke before the program begins goes a long way toward obtaining support."
>
> *—Brian Wood, medical director of the Mountain West AIDS Education and Training Center ECHO telehealth project (interview, 2018)*

Introduction

The UW School of Medicine is the only academic medical center serving the five-state area of Washington, Wyoming, Alaska, Montana, and Idaho. This area accounts for 27 percent of the land mass of the United States but less than 5 percent of the population (Scott et al., 2012; UW, undated). One in four Pacific Northwest residents lives in a rural community, which presents challenges with access to specialty care. Rural residents are more likely to lack health insurance or to be part of the American Indian, Alaska Native, or Hispanic minority groups, two factors associated with difficulty in accessing care.

Brief History of the Program

To address the challenges of geographic access, a team at the UW School of Medicine established the first ECHO program outside the founding UNM. In 2008, UW launched an HCV treatment program to connect generalists and specialists across the Pacific Northwest; the program received funding from RWJF in 2009 (Johnson et al., 2017; Wood interview, 2018; Wood et al., 2016). In subsequent years, modules were added for other conditions, such as HIV/AIDS in 2012, tuberculosis in 2015, and antibiotic stewardship in 2017 (Table E.2). There are currently ten ECHO programs under way at UW, with the aim of serving rural populations without requiring patients to travel significant distances to be seen in person (Wood interview, 2018).

Recruitment of generalists into the program varies by condition and subject area. For instance, the HIV program initially focused on recruiting primary care doctors with fewer than 25 HIV patients on their panels. The rationale was that these providers would have less experience and fewer resources to manage these patients. Over time, the program has expanded to include any provider who can demonstrate a lack of such resources as clinical support, colleagues for consultation, or resources for continuing medical education.

UW has developed a method of engaging PCPs by developing personal relationships through in-person visits to providers to encourage them to join the program, assess technology needs, begin the mentoring process, and meet with site administrators to encourage buy-in and support. For example, when starting the HIV program, the UW team spent six months recruiting generalists, visiting potential sites, meeting administrators, and providing information about the benefits and functions of the program. They credit this approach to successful recruitment and retention of sites.

Table E.2. Project ECHO UW Participating Sites and Clinicians

Service	Launch Date	Participating Clinicians	Participating Sites
Hepatitis C	2008	163	57
HIV/AIDS	2012	157	46
Technical Cooperation Group: Leadership, Surveillance, and Field Services[a]	2014	169	31
Tuberculosis	2015	175	62
Geriatrics	2015	200	18
Heart Failure	2015	67	27
Psychiatry and Addictions	2016	223	24
Psychosis and Dialectical Behavior Therapy	2017	15	7
Antibiotic Stewardship	2017	71	28

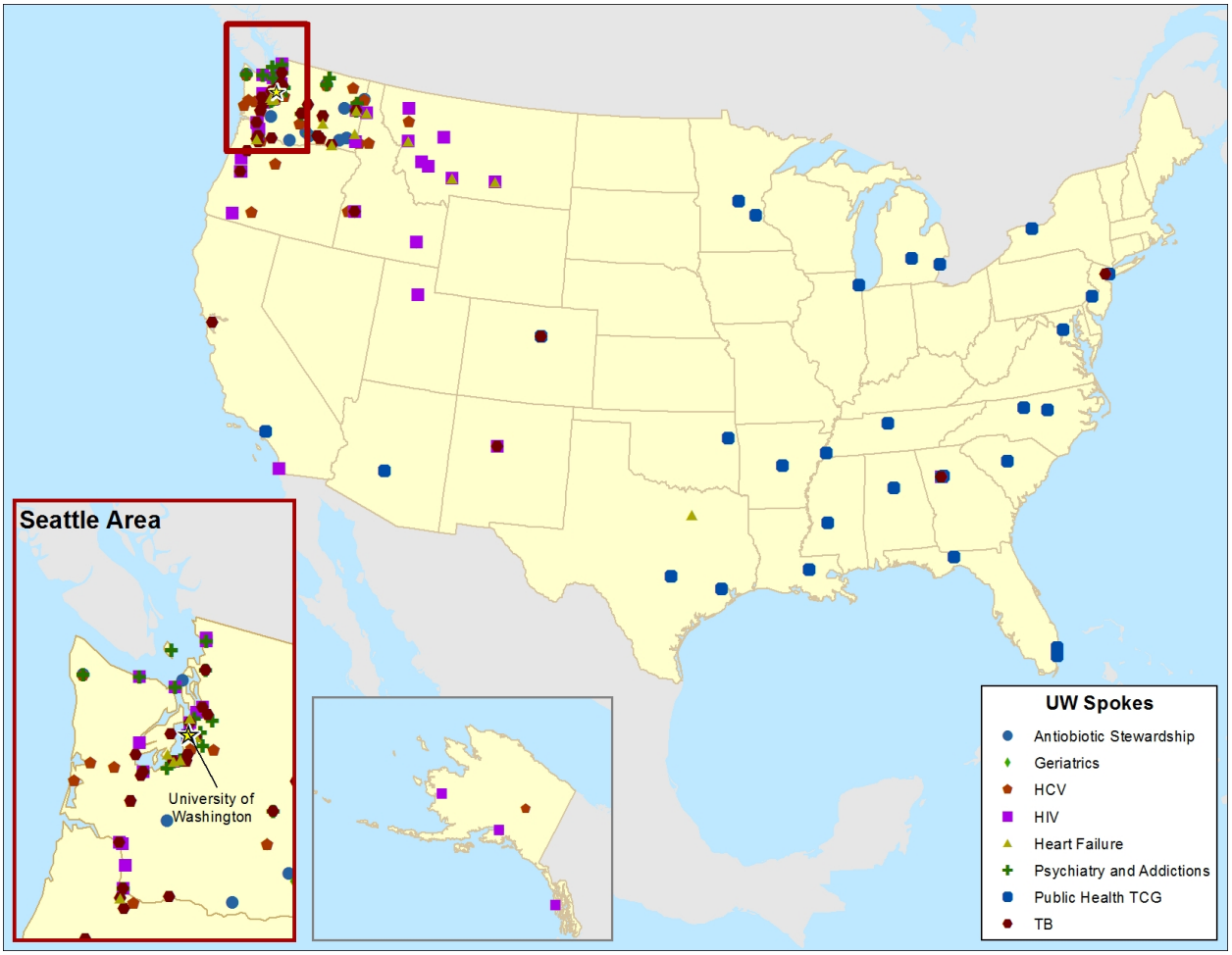
SOURCE: Wood, 2018.
[a] The Technical Cooperation Group is not a traditional ECHO program. It was formed as a "pragmatic think tank'" to allow discussions around best practices and innovation for HIV prevention and care. More details can be found at the HIV Technical Cooperation Group website (undated).

Unique Features of the Program

In addition to being the first replication site outside New Mexico, UW's ECHO program is unique among EELM in various ways. It has expanded to cover several subjects that other EELM have not addressed, such as antimicrobial stewardship, which focuses on appropriate use of antibiotics. The geographic reach of the program is extensive, with program sites for their HIV ECHO, for example, located beyond Washington in seven different states (Figure E.1).

The UW program focuses on evaluating the end-user experience across the range of subjects. Examples of studies that UW has undertaken include an early study that reported the number of ECHO conferences and generalist mentees participating (Scott et al., 2012; Scott interview, 2018): 23 different videoconference clinics for HCV, with 263 participating providers at spoke sites, caring for a total of 399 patients. Of these patients, 167 had started antiviral therapy for HCV, including 50 who started protease inhibitors, which at the time were newly approved by the U.S. Food and Drug Administration. Since this 2012 study, participation has increased: As of early 2018, the program has had more than 2,500 cases presented. Another study, this one on HIV, focused on provider self-efficacy assessments, reporting a significant increase in participants' self-reported confidence to provide various essential elements of HIV care (Wood et al., 2016). They also found an increase in reports of feeling part of an HIV community of practice and decreased feelings of professional isolation.

Figure E.1. Map of UW ECHO Spokes



SOURCE: Map based on data from Wood, 2018.
NOTE: TCG = technical cooperation group.

Although UW was the first site to replicate the ECHO model, the UW program has also added several customizations and innovations. For example, UW has an informatics specialist who is tasked with optimizing provider engagement, thinking about details such as camera angles for the videoconferences and ensuring it is clear who is speaking (Scott et al., 2012; Scott interview, 2018). Another innovation is the use of interactive polling during ECHO sessions. Mentees answer questions in real time using their cell phones, which helps keep them engaged when there are a large number of generalist mentees participating in a session. This strategy has received excellent feedback from the mentees. Anecdotally, retention of spoke providers in the UW HIV ECHO program is quite high, with only five providers leaving the program; of these, two retired and one moved away, leaving only two who actually stopped attending.

Program Challenges and How They Were Addressed

Three main challenges were identified by UW: funding, recruitment and retention of spoke sites, and running a program across multiple states.

Securing consistent funding to operate the program has been an ongoing challenge. In addition to the initial funder (RWJF), UW's ECHO program has received funding from the Washington State Department of Health, the CDC, and HRSA, as well as internal funding from the UW School of Medicine (Scott interview, 2018). Intense effort has been devoted to writing grants, soliciting contracts, working with policymakers, and thinking about creative ways to pay for the program. Most of the funding now goes to cover salaries of people involved (most significantly the specialist mentors) and, as technology to execute the program has become inexpensive, to cover the administrative time required to organize sessions. Funding is critical for sustainability, but grants are often time-limited and typically do not include resources for evaluation.

A second challenge relates to the rolling enrollment and its impact on cultivating relationships with and between sites. New providers join those who have participated in an ECHO program for years, so each of the spoke sites has different experience levels and baseline knowledge of the subject. UW has handled this challenge by calling upon more-experienced participants to act as experts or answer questions for less-experienced participants—mainly to engage the former more fully despite their growing expertise.

The UW hub reaches to sites far outside of Washington state, which presents other challenges. Although ECHO's design allows for spoke sites to be located at a distance, the geographical dispersion across multiple states and time zones can make recruitment and site visits more laborious. UW has also faced challenges of local and state differences in medical practice, including local reporting guidelines and differing reimbursement, making it sometimes hard to offer practical or logistical guidance about topics associated with accessing medical care through a broad program. The approach of using experienced generalists as experts, along with the relationship-building emphasized by this hub, has helped with some of these challenges.

Lessons Learned

- Efforts to obtain buy-in (such as in-person visits to recruit generalists) and to maximize retention through careful attention to the structure of each session (including technology use, such as live polling) have yielded high retention rates in certain programs.
- Although EELM can benefit patients in many ways, such as decreased wait times or improved quality of care, these models are ultimately a provider-focused intervention, and recruitment efforts need to focus on those providers who require the most support.
- Grants to support EELM thus far have supported implementation more than evaluation.
- It is feasible to have spokes spread across several states, with some challenges.

University of Chicago

Building Capacity Across the Greater South Side with ECHO-Chicago

> "ECHO fits perfectly with what I'm trying to do, which is to build capacity."
>
> —*Daniel Johnson, director of ECHO-Chicago (interview, 2018*)

Introduction

Improving primary care workforce capacity and ameliorating racial and ethnic disparities in access to quality care are two primary objectives of ECHO-type programming at ECHO-Chicago. The average wait time to see a pediatric psychiatrist for a child receiving primary care through an FQHC in South Side Chicago has been as many as 93 days (Patrick et al., 2011)—an issue that ECHO-Chicago has been helping to address with its work on pediatric ADHD. At free and charitable clinics or safety-net health care organizations that do not receive federal funding, there are similar challenges in securing specialty referrals for low-income and Medicaid-insured patients. Barriers in access to specialty care for residents of South Side Chicago, the population of which is at least 93 percent black, are especially troubling given increasing black-white disparities in health and disproportionate mortality among blacks because of preventable conditions (Hunt and Whitman, 2015).

Brief History of the Program

ECHO-Chicago was the second replication of Project ECHO outside of UNM, and it was the first to apply the ECHO model to an urban area (Johnson interview, 2018). Its program features collaborations with the Illinois Association of Free and Charitable Clinics, the South Side Healthcare Collaborative, American Academy of Pediatrics, Americares, the University of Chicago's Urban Health Initiative, and an extensive list of FQHCs and area health departments, among others (University of Chicago, undated-a).

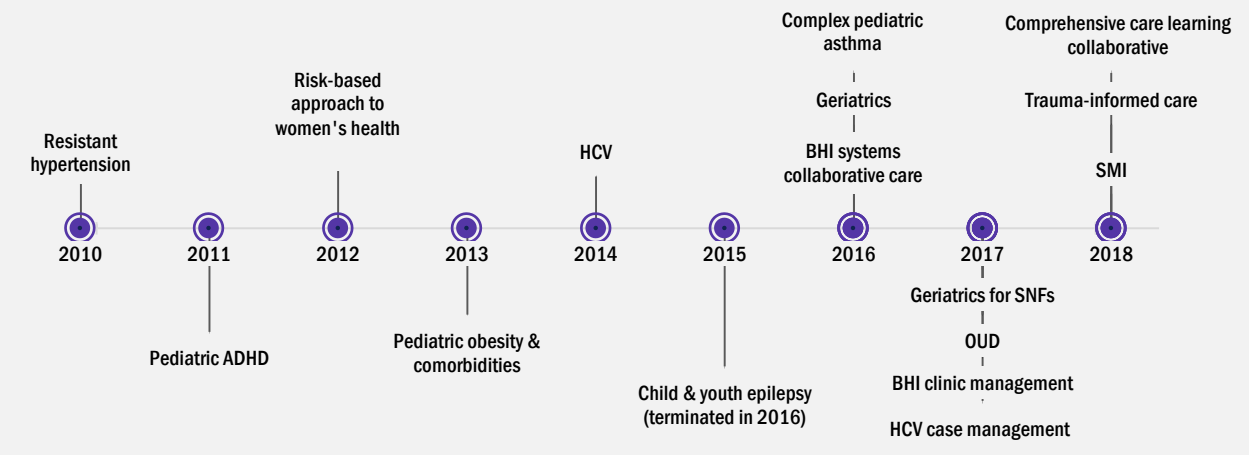
The founding leadership of ECHO-Chicago first learned about the Project ECHO model in 2009. Later that year, members of leadership at several Chicago FQHCs accompanied ECHO-Chicago leadership on a trip to UNM to learn more about ECHO. Seeing the value of the model for existing efforts to build workforce capacity, the Chicago team selected resistant hypertension, one of the most prominent health problems in its FQHC communities at the time, as its first subject area (Johnson interview, 2018).

It took approximately a year for the ECHO-Chicago team to prepare, identify a funding stream for the program, and build relationships with six interested FQHC community partners. In November 2010, ECHO-Chicago launched its first ECHO project, delivering two complete series of the curriculum in the first year of operation. The program was well received by the six FQHC partners, who heartily expressed interest in establishing additional ECHO-Chicago programs. Program organizers received feedback from FQHC spoke sites that their clinicians were "happy" and "seemed to be learning more" (Johnson interview, 2018).

Before selecting another subject area, the ECHO-Chicago team approached its FQHC partners to ask where the need and interest was greatest. The suggestion by the providers at the time was to establish a pediatric ADHD program. Although the prevalence of diagnosed ADHD was approximately 1 percent among the pediatric populations of the FQHC partners, epidemiological data suggested an actual prevalence of ADHD closer to 7–9 percent. In accounting for the disparity, providers explained that they were electing not to diagnose ADHD or even screen for it in many cases, given that wait times were more than a year for referrals to specialists. In other words, the inability to adequately treat or refer for ADHD in these settings had been affecting the rate of diagnosis. Three years into the ECHO-Chicago Pediatric ADHD program, data showed that 4–6 percent of pediatric populations in the spoke clinics were being diagnosed with ADHD, which is closer to the estimated prevalence (Johnson interview, 2018).

Building on the success of these early programs, ECHO-Chicago continued to expand into new subject areas (Figure E.2).

Figure E.2. Time Line of ECHO-Chicago Series Launch Events



SOURCE: Johnson interview, 2018; Migliaccio et al., 2017.
NOTE: BHI = behavioral health integration; SMI = serious mental illness; SNF = skilled nursing facility

Although HCV was a signature condition treated by Project ECHO, providers at ECHO-Chicago spoke sites did not initially think that the condition was much of an issue in the patient populations served by their clinics (Johnson interview, 2018). The CDC estimates that 45–85 percent of the 3.5 million Americans living with HCV are unaware of their infection (Smith et al., 2012), and many of the providers in ECHO-Chicago spoke sites not commonly treating HCV in their clinics were not testing for HCV infection (Johnson interview, 2018). In response, the ECHO-Chicago Hepatitis C Community Alliance to Test and Treat (HepCCATT) collaboration was launched, establishing a network of public health departments, advocacy and community groups, academic medical centers, and corporate partners to raise HCV awareness, improve the quality of care in safety net primary care settings, and support the development of an HCV surveillance and monitoring system for the city of Chicago (University of Chicago, undated-b).

The HepCCATT programs are funded by the CDC, and approximately 15 percent of HepCCATT programming and activities are ECHO-related (Johnson interview, 2018).

In 2015, ECHO-Chicago launched its sixth subject area: Child and Youth Epilepsy. This curriculum was not very popular with generalist mentees: In its second year, the only interested generalist mentees were school nurses who said that they were witnessing seizures in classrooms and wanted training on how to handle those situations and manage the follow-up for children and youth with epilepsy. A combination of different factors could have played a role in determining provider interest, including epilepsy not affecting a sizable percentage of patients in their practices and providers feeling uncomfortable with the initial management and follow-on treatment of the condition. Many providers also did not seem to view pediatric epilepsy as a significant threat to public health, and it is possible that this perception also influenced the lack of interest in this series (Johnson interview, 2018).

Chicago's ECHO program is now a superhub, meaning it can train other ECHO hub sites.

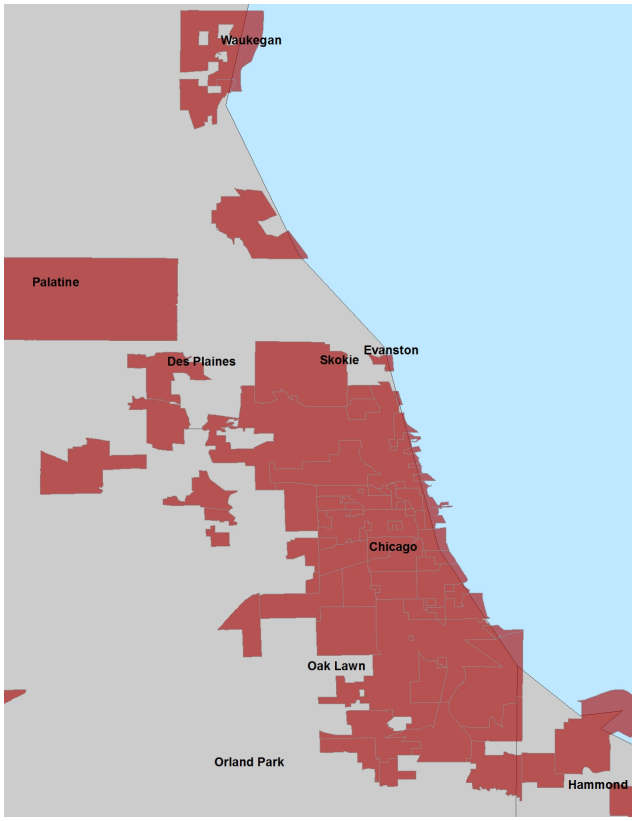
Unique Features of the Program

FQHCs and Free and Charitable Clinics

A strength of the ECHO-Chicago program is its relationships with FQHCs and free and charitable clinic partners. Improving health care access and health outcomes for medically underserved populations (MUPs) and in medically underserved areas (MUAs) is one of the stated goals of EELM (Public Law 114-270), and the FQHCs and free and charitable health clinics that make up the primary care safety net are the chief providers of care to the medically underserved.[9] MUPs and MUAs in the Greater Chicago area are shaded in Figure E.3.

[9] HRSA defines MUAs as geographic areas (census tracts in metropolitan areas or counties in nonmetropolitan areas) with a shortage of primary care health services according to the population to provider ratio, the percentage of population living below the federal poverty level, the percentage of the population over age 65, and the infant mortality rate (Kleinsorge, 2016). Population MUPs are defined as populations living within an MUA, such as homeless, low-income, Medicaid-eligible, Native American people, or migrant farmworkers (HRSA, 2016).

Figure E.3. Chicago MUAs/MUPs



SOURCE: Data from HRSA, undated.

Urban Focus

As previously mentioned, ECHO-Chicago was the first to use the concept of EELM to apply the solutions that address barriers to continuing education in rural settings to the workforce capacity challenges in urban safety net settings. PCPs at clinics that do not have an affiliation with a hospital or academic medical center, in particular, might find it difficult to keep up with best practices and evolving treatment recommendations. Patients using these clinics might be challenged by economic and social distance and by the difficulties arising from the cost and time required to travel from one location to another within a city.

Focus on Black Populations

ECHO-Chicago's focus on blacks is a significant aspect of its program. Disparities in health and associated mortality between black and white populations are prominent across many different disease areas and conditions (e.g., HIV, heart disease, diabetes, cancer) (U.S. Department of Health and Human Services, Office of Minority Health, 2017). Perceived discrimination is among the factors thought to contribute to racial disparities in health in the United States (Bacon et al., 2017; Bailey et al., 2017; Cozier et al., 2014; Lukachko, Hatzenbuehler, and Keyes, 2014). By increasing the quality of culturally competent care

provided to black patients by PCPs within their communities, ECHO-Chicago seeks to ameliorate racial disparities in health.

Program Challenges and How They Were Addressed

Product Branding

Success of each program, in terms of participation and interest, depends on whether potential generalist mentees think that a subject is of value to them. Provider interest in a given curriculum might be determined by perceptions about the prevalence of a condition among the patients in their practices or the extent to which generalists think an intervention has the potential to make them competent in a particular clinical area. In the case of ECHO-Chicago, the way that projects were named and marketed had a great deal to do with the degree of provider interest. In designing a program to address racial disparities in women's health and breast cancer outcomes, for example, the team discovered that an ECHO called "Cancer Survivorship" generated very little interest among potential generalist mentees while an ECHO with a very similar curriculum named "Risk-Based Approaches to Women's Health" was broadly appealing. Potential generalist mentees, reacting to the way the program was being promoted, told organizers that "cancer is a scary word," and the project leadership concluded that the way programs are publicized is important (Johnson interview, 2018).

Funding

Securing and sustaining program funding is another challenge. ECHO-Chicago has not received any state or city funding. It is seeking funding through Section 1115 of the Social Security Act (Johnson interview, 2018), which provides for funding of pilot and demonstration projects that serve Medicaid populations (Centers for Medicare and Medicaid Services, undated). The primary source of ECHO-Chicago funding has been from private foundations, and the program has had success in seeking federal money for projects that combine ECHO into other programs. The HepCCATT program, for example, was primarily designed for testing and treatment, but 15 percent of the total funding is allocated to be spent on ECHO curriculum for HCV. Despite securing federal funding for some ECHO programing, the long-term sustainability of the model at ECHO-Chicago remains challenging (Johnson interview, 2018).

Evaluation

Another challenge has been the difficulty of gathering data for evaluation. The program has a standard set of procedures built into every curriculum in which generalist mentees complete pre-post surveys focused on self-efficacy and an additional post-survey asking about the quality of the program and any self-reported behavior changes that have resulted from completing the ECHO curriculum. Determining individual patient outcomes via chart reviews is costly and requires the program to bring in an evaluation team or to work with students at the University of Chicago. As another strategy, in the past, the ECHO-Chicago team has obtained state Medicaid data to look at prescribing patterns. The process of requesting and obtaining the data from the

state took a year and a half, in addition to considerable staff time to fill out paperwork and follow up on various stages of the application. The Medicaid data set was also large enough that the program needed to hire an outside evaluator to complete the analysis.

The need to demonstrate program impact and return on investment makes evaluation of the ECHO-Chicago curricula an important program objective. To address the challenge of cost and time required for systematic data collection and analysis, the program has built a partnership with Alliance-Chicago, a nonprofit committed to providing health information technology support to community health agencies that treat underserved populations. Through its collaboration with Alliance-Chicago, ECHO-Chicago spoke sites at nine FQHCs have obtained access to an electronic medical record platform and corresponding data warehouse that are designed specifically for FQHC treatment settings, and which could help support future analyses (Johnson interview, 2018).

Lessons Learned

- EELM might have utility in cities and in rural areas, especially in underserved neighborhoods and communities of color, by increasing access to specialty care. An estimated 54 percent of people worldwide resided in urban areas in 2014, and projections suggest that 70 percent of the global population will be living in urban locales by the year 2050 (United Nations, Department of Economic and Social Affairs, Population Division, 2015).
- Diagnosis rates might be suppressed when there is inadequate access to specialists.
- How a program is framed and publicized matters: Programming with the title "Cancer Survivorship" was intimidating to providers whereas similar programming titled "Risk-Based Approach to Women's Healthcare" attracted more interest (Johnson interview, 2018).
- Providers' perceptions of the extent to which a health condition is a public health issue, or is a condition they commonly manage, could shape provider willingness to participate.

University of Rochester

EELM Supported by State Funding

> "We wanted to do a good evaluation and speak to sustainability beyond the grant."
>
> *—Michael Hasselberg, Rochester ECHO program director (interview, 2018)*

Introduction

In 2013, the University of Rochester Department of Psychiatry was having trouble keeping up with the demand for geriatric psychiatry consults, and there were long waits to see a provider. The private New York State Health Foundation was specifically interested in funding an effort that relied on the ECHO model. To take advantage of this funding opportunity, providers and researchers from the University of Rochester teamed up with a large commercial insurer in the local market (Excellus), and sent several attendees from the University of Rochester and Excellus to visit Project ECHO in New Mexico to learn how to run an ECHO model (Hasselberg interview, 2018).

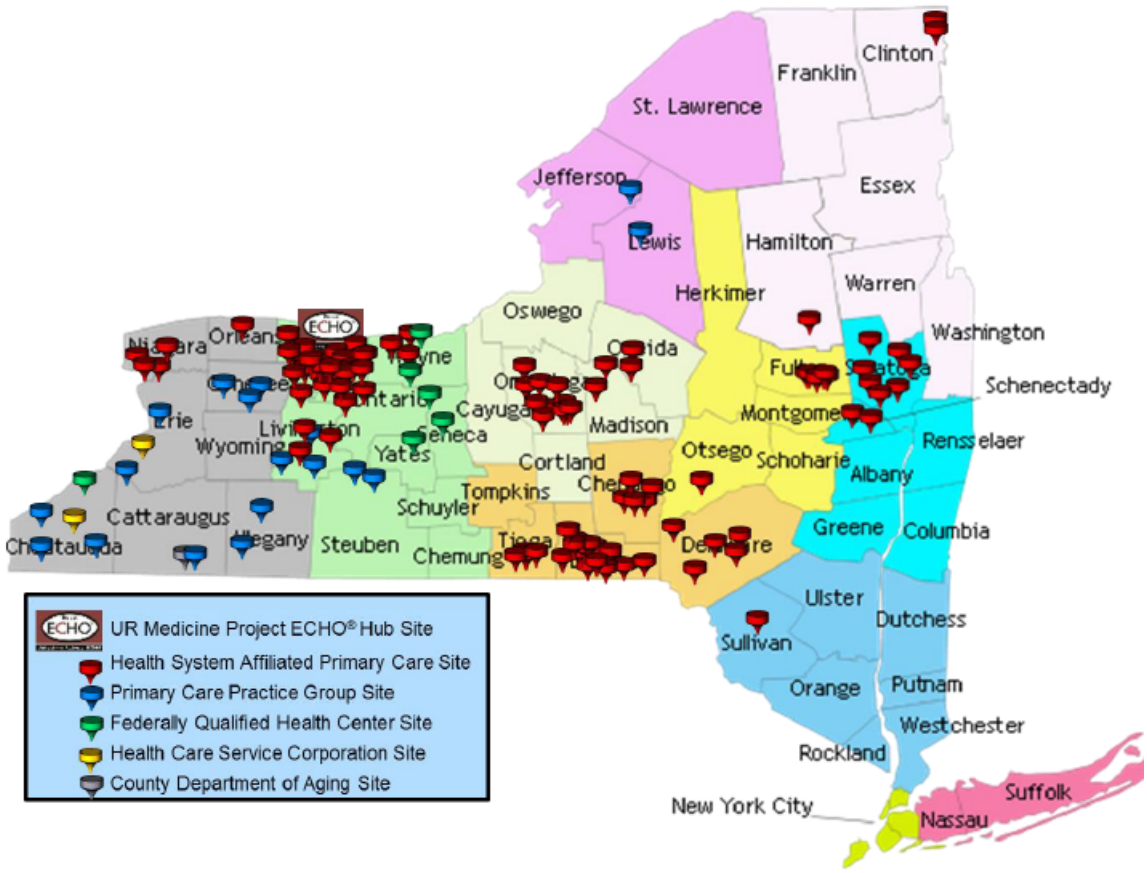
Brief History of the Program

With widespread interest from PCPs, Rochester launched the first ECHO-based program in New York State in September 2014, on the subject of geriatric mental health (see Figure E.4 for a map of participating sites). Generalist mentees indicated that only a small subset of their patients fit into this category, however. Therefore, they requested a program focusing on mental health conditions across the lifespan, which was founded in January 2017. To date, Rochester has expanded into 13 content areas, including LTC, palliative care, and hospital medicine.

Each rollout of a new subject was planned to enable a rigorous evaluation, such as by ensuring the availability of patient-level data and by building in a control group. Some evaluations used mixed methods; others used special project design considerations. For example, one project limited provider eligibility to the ACO to which the University of Rochester belongs, both to allow better access to data and to help ensure that the program benefits the ACO's bottom line. Numerous entities have contributed to evaluations in other ways, including Excellus (which shared data) and the New York Academy of Medicine (which shared data and ran analyses).

The Rochester ECHO model was proactive about soliciting and incorporating end user feedback. Generalist mentees stated that weekly sessions lasting 90 minutes were too frequent and too long. The sessions were quickly reduced to 60 minutes every other week for most conditions.

Figure E.4. Project ECHO Geriatric Mental Health for Primary Care



SOURCE: Hasselberg, 2018.

Unique Features of the Program

Rochester's ECHO model has secured funding from different sources, such as private foundations, HRSA, the New York State Department of Health, and the New York State Office of Mental Health. At times, the Rochester model benefited from fortuitous circumstances. For example, as members were preparing to start an ECHO in LTC, there was a Medicaid reform effort in New York State funded by a Delivery System Reform Incentive Payment (DSRIP) waiver project entitled "Behavioral Interventions Paradigm in Nursing Homes." With the incentives provided by this DSRIP program, many LTC facilities in the Rochester region elected to be part of a project to improve behavioral health in LTC. This encouraged many LTC facilities to sign up as spoke sites for Rochester ECHO's related offering. Later, through its adult behavioral health offering, Rochester ECHO helped respond to a second DSRIP in New York State, entitled "Behavioral Health Community Crisis Stabilization Services."

This diversified funding has enabled rapid program growth and a statewide reach. The Rochester ECHO now essentially leads all efforts at EELM on behalf of the state government, which is becoming increasingly enthusiastic about supporting such efforts. Recently, the New

York State Office of Mental Health issued a contract with Rochester to replicate its LTC model throughout the state.

Program Challenges and How They Were Addressed

One key challenge has been a lack of sufficient interest around certain conditions, which has led to ending sessions in some subject areas. Despite having strong content leadership, some ECHO programs are too subspecialized in disease focus to be successful because many clinicians have only a few such patients in their panel. These programs might have had constrained enrollment and limited sustainability that necessitated ongoing financial support.

A second key challenge has been balancing different subject areas. The Rochester ECHO staff have learned that it is important not to offer too many programs in the same region—even if they are on different subjects—because the potential generalist mentees can become "saturated." For example, an established ECHO in geriatric mental health had a noticeable decline in participation after a new ECHO program focusing on palliative care was offered within the same region of the state. Several PCPs have said that blocking out time in their schedule to attend one ECHO program is difficult and that blocking out time to attend multiple ECHOs is almost impossible. Thus, the Rochester ECHO has had to be strategic in choosing what to offer, balancing the goals of maximizing participation, meeting the needs of the communities that the spoke sites serve, and being mindful of the demands on PCPs' time.

Lessons Learned

- When possible, it is important to plan for evaluation from the very beginning of a program because this can help make a case with decisionmakers and funders to continue supporting the program.
- Sometimes it can be difficult to attract enough generalist mentees to sustain a program on a less-common clinical condition.
- Partnering with a state Department of Health can help increase funding—as well as program reach and impact—but creates an imperative to justify one's impact on an ongoing basis. The Rochester ECHO has met this imperative in part by incorporating sophisticated evaluations of many of its offerings.
- There is a limit to the number of offerings from EELM that a market can bear before generalist mentees' capacity to engage becomes saturated.
- Anticipating priorities for state-level or other funders can ease implementation of a new program, as with Rochester's foray into LTC. Relatedly, positioning EELM to concord with new and existing delivery system reform initiatives can help secure funding and support.

VA SCAN-ECHO

Adapting EELM to a unique system of care

> "We had a need to demonstrate the impact of our program to justify continued support. . . . I had to engage site-level program leaders to work on measures that would demonstrate value, such as return on investment, to enable continued funding and resource support."
>
> *—Susan Kirsh, former acting director, VA Office of Specialty Care Transformation (interview, 2018)*

Introduction

VA has historically placed high value on access to care. Although VA has made sure that the great majority of veterans live within 30 miles of a VA health care facility, sometimes these facilities are community-based outpatient clinics, which are similar in capability to a small primary care practice. Patients visiting these clinics who need referrals to specialty care might need to travel to the parent VA Medical Center (VAMC), which could be located tens or even hundreds of miles away. Many VA patients are reimbursed for such travel, meaning that both patients and the VA system bear this cost. Therefore, there is a clear imperative to find ways to obviate the need for such travel whenever possible while maintaining high-quality care. In addition, VA received negative attention in 2014 as a result of complaints about wait times for care, which added urgency to efforts to increase access.

Brief History of the Program

In 2013, the Office of Specialty Care Transformation (OSCT) in the VA Office of Specialty Care was embarking on a new effort to institute a range of different options for delivering specialty care to distant patients. This featured a mix of strategies, such as e-consults,[10] mini-residencies,[11] and direct provision of care via telemedicine. After a meeting with UNM's Arora, key OSCT staff selected the ECHO model as part of this multimodal approach alongside other telehealth strategies (Kirsh interview, 2018). OSCT developed a request for proposals, inviting VAMCs to apply for grants that would support setting up an ECHO program called SCAN-ECHO. Participating VAMCs submitted proposals for programs to address a variety of medical conditions and subject areas, including women's health, pain management, HCV, diabetes, and many others. Twelve VAMCs from across the country were ultimately selected to be part of this national program and to set up a local franchise of SCAN-ECHO. Each received a $1 million grant in year 1, followed by progressively smaller grants in subsequent years ($500,000 in year 2; $250,000 in year 3; and then no funds).

[10] An e-consult allows a specialist to consult on a patient through chart review and by answering a specific question from the generalist, without the patient traveling or being seen by the specialist, either in person or otherwise.

[11] A mini-residency is a series of webinars or in-person sessions that attempts to increase the ability of a generalist clinician to handle a specific problem. The format is usually primarily didactic. While there might be case presentations, the cases are usually developed by the instructor.

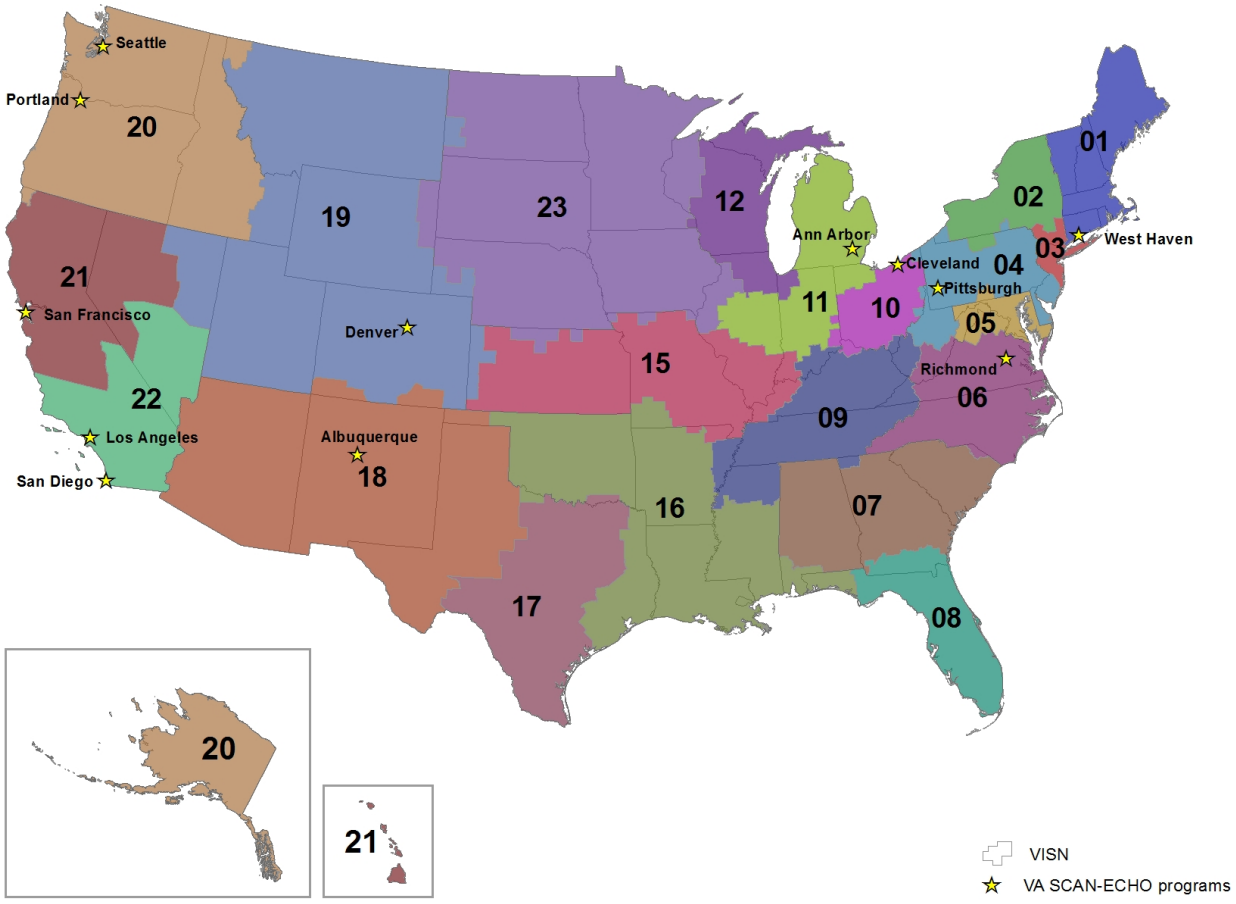
Many of the local SCAN-ECHO programs performed their own evaluations, either out of academic interest or a need to justify the continued existence of the program. Soon after SCAN-ECHO began, OSCT also requested proposals for a national evaluation of all the SCAN-ECHO programs, together with an evaluation of other telehealth strategies (especially e-consults).

A mixed-methods evaluation, co-led by two VA Health Services Research and Development Centers, began soon after SCAN-ECHO's inception; an interim report was released in 2015, and the evaluation continues. Briefly, the interim report found that many PCPs were highly enthusiastic about the program but that many had difficulty obtaining release time to attend the sessions. Thus, attendance was sometimes limited, despite a high degree of enthusiasm. Support from site-level and Veterans Integrated Service Networks (VISN)-level leaders was mentioned as a key facilitator to effective implementation of SCAN-ECHO—and a key barrier when not present.

Unique Features of the Program

Several features of SCAN-ECHO align with the structure of VA. Most of the SCAN-ECHO networks were set up within VISNs, the then-21 geographic units that are used to organize VA care delivery (see Figure E.5). Because patient care dollars, referral networks, and even video links are specific to individual VISN units, there are few incentives to expand SCAN-ECHO programs beyond a single VISN—and there are considerable hurdles to doing so. As a result, efforts to address a particular condition with a SCAN-ECHO program might occur in parallel in two or more VISNs, with the leaders of such programs being aware of the other programs and sharing ideas, but in most cases maintaining separate programs.

Figure E.5. Map of VA's VISNs and SCAN-ECHO Hub Sites



Initial funding was intended to support such activities as program administration, outreach to potential spoke sites, and coverage for the cost of the expert telementors (i.e., the specialists but not the generalist mentees). In such a system of care as VA, clinicians are salaried, but they are still subject to productivity targets; therefore, supervisors must grant what is called "release time" for any time they spend in activities other than patient care—even worthy activities. SCAN-ECHO programs typically contained specific funds to cover the cost of release time for specialists who develop and deliver content but not for generalist attendees.

Grant funding was intentionally reduced after the first few years because the program was expected to be self-supporting after year 3; i.e., funds to support buy-in from leaders at the VISN and the VAMC level would no longer be needed. In anticipation of the funding drop-off, many of the SCAN-ECHO programs used some of their grant funding to engage in evaluations to quantify their contribution to care delivery at the VAMC and/or the VISN level. The results of these evaluations were then used to help justify requests for continued funding from local VAMC or VISN leaders. Other programs obtained matching funds from other VA entities, such as VISN- or national-level offices of rural health.

SCAN-ECHO is also noteworthy for being inspired by the original ECHO model but not necessarily bound to each detail of it. SCAN-ECHO has been adapted to fit the needs of the VA context, with variation in the number and frequency of mentoring sessions, the content of the case-based learning, and even the use of video technology rather than conference calls. Where these details have been changed, the adjustments represent tailoring of the model to meet local circumstances.

Program Challenges and How They Were Addressed

One of the key challenges facing SCAN-ECHO, as for many EELM, is the issue of obtaining release time for generalist mentees. Generalist mentees would need to secure support from supervisors for release time, during which it is understood that the provider would not be seeing patients. Supervisors must be cognizant of facility-level productivity targets, and therefore might not be able to honor all generalists' requests. The system's use of release time leaves supervisors to choose which programs are worthy of release time, with SCAN-ECHO programs being only one "good cause" to which the limited resources of release time might be devoted.

SCAN-ECHO programs have addressed this challenge in various ways. Clinicians could attend programs during their lunch hour, if they are highly motivated and if clinical care demands allow. Requests for release time have also been incorporated into appeals to VA- or VISN-level leaders to support the SCAN-ECHO program itself, along with justification in the form of evaluation results. Nonetheless, the lack of available release time has been a barrier in some cases that ultimately ended the SCAN-ECHO program in question.

A second key challenge is that, although SCAN-ECHO had some degree of central funding and coordination in its early years, the funding might end in the near future. There is no national clinical lead for the SCAN-ECHO program; some local programs have become self-supporting, relying on local VISN or VA-level funding, but two have ceased to exist. Although ten of the original 12 programs continue to exist and do coordinate activities to some degree, they do so without the benefit of significant national-level direction or guidance.

Lessons Learned

- Developing EELM as part of a multipronged approach to increase access to specialist care can generate enthusiasm for implementation but also make it harder to isolate the effects of the program from those of other interventions being implemented simultaneously.
- Balancing fidelity to the ECHO model and the need to tailor to local circumstances is a key tension in our evaluation of EELM. Here, VA SCAN-ECHO epitomizes a program that chose to emphasize tailoring to local circumstances, possibly at the expense of fidelity in some cases.
- A lack of compensation for PCP time spent attending sessions is a crucial barrier to implementation—both in the VA setting, where compensation is measured in internal funds, and in settings where providers directly reduce their own profit by spending

time in activities other than patient care. Incorporating a model of compensation for both specialists' and generalists' time might be crucial to participation in programs—and, therefore, their sustainability.

- Programs that are developed in a highly decentralized environment with limited seed funding (a common situation for new EELM) will need to rely on a high degree of entrepreneurship to continue.
- It is important for programs to evaluate their own impacts to effectively make the case to funders and stakeholders for the value they add—and, thus, for their continued existence.

Vermont Hub-and-Spoke

One State's Response to the Opioid Crisis

> "We didn't hear about Project ECHO until we'd already been doing our thing for several years. So it's home grown."
>
> —*John Brooklyn, one of several informal leaders of the Vermont Hub-and-Spoke model (interview, 2018)*

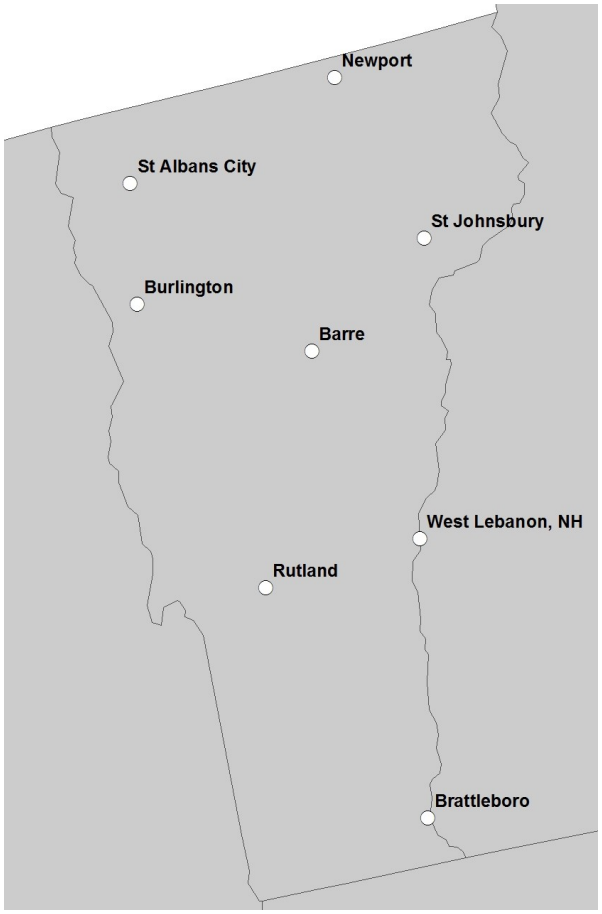
Introduction

When Dr. John Brooklyn, a family medicine doctor practicing in Vermont, first got the idea for a "hub-and-spoke" treatment model for OUD in 2011, the escalating opioid crisis was just beginning to attract widespread public attention nationwide (Brooklyn interview, 2018). Rates of unintentional deaths in the United States due to prescription opioid overdose had quadrupled between 1999 and 2011 (Chen, Hedegaard, and Warner, 2014), and the number of Vermonters seeking treatment for OUD was increasing rapidly (Simpatico, 2015). As of 2002, there was no MAT for OUD available in the state of Vermont, and residents were forced to travel to other states to receive care. Although MAT programs began to form after 2002, wait lists for care were long and the nearest methadone or buprenorphine clinics were often many miles away. At the same time, many trained buprenorphine prescribers were not providing any OUD care in their practices. Brooklyn and others were determined to lower the barriers to quality OUD care, and the Vermont Hub-and-Spoke was their proposed solution (Brooklyn interview, 2018).

Brief History of the Program

The Vermont Hub-and-Spoke program was established in 2013 with the support of the Governor, Vermont Medicaid, the Vermont Department of Health, commercial insurers, and the Vermont Blueprint for Health. It was designed to increase access to MAT for OUD by increasing the number of trained buprenorphine prescribers with the expertise and the confidence to take on new patients throughout the state. This program established a referral and treatment network of hubs and affiliated spoke sites throughout the state. As the program grew, more hubs were added throughout the state (see Figure E.6).

Figure E.6. Map of Vermont Program Hub Locations



SOURCE: Rawson, 2017; Vermont Department of Health, undated.

All of the three most-common medications used to treat OUD—methadone, buprenorphine, and naltrexone—are used in the Hub-and-Spoke model. Methadone is a full opioid agonist that must be administered under observation in licensed, accredited Opioid Treatment Programs (OTPs) on a daily basis, according to federal regulations (42 C.F.R., Part 8). Naltrexone can be given as an oral medication, or more often as a long-acting injection. Buprenorphine is a partial opioid agonist that was approved for use in the United States in 2002; it can be administered in office-based settings by certified providers who have Drug Addiction Treatment Act of 2000 (DATA 2000) waivers, or special approval to prescribe buprenorphine under the Drug Addiction Treatment Act of 2000 (SAMHSA, 2016). The Vermont MAT program focused almost exclusively on methadone and buprenorphine (rather than naltrexone). Each of the hubs was an accredited OTP that had authority to administer both methadone and buprenorphine, and each of the spoke sites were established buprenorphine prescribers in office-based opioid treatment (OBOT) settings.

The hub-and-spoke model was built on the belief that better triage of patients according to OUD illness severity was key to improving access to treatment for all Vermonters with OUD. In

this model, individuals with severe or unstable OUD are directed toward more-structured treatment with methadone or buprenorphine in the hubs (i.e., the fully resourced, centrally located OBOT clinics). Conversely, individuals with less severe OUD are retained for treatment in local OBOT clinics at the spokes (Brooklyn interview, 2018). As individuals receiving OUD treatment cycle through the various stages of recovery, including periods of relapse and sobriety, they can be triaged between treatment programs. The reasoning is that during periods of relapse or instability, the more-structured treatment setting in the hubs might be better for patient care. People who are more established in recovery might require less structure and therefore be better suited to receiving buprenorphine in OBOT settings.

Health Home teams, composed of one registered nurse and one master's-level behavioral health clinician, were created early in the Vermont Hub-and-Spoke program through funding from the Affordable Care Act. Specifically, funding came from the Act's Section 2703, which allows a monthly rate, subsidized by Medicaid or a state grant, to pay for the creation of such teams, provided that they deliver one standard clinical service and one medical service per month. The teams were deployed at no charge to the OBOT prescribers and formed the basis of the spoke team. Separate specific trainings for hub-and-spoke prescribers and for the MAT teams were created, with spoke training focused on the use of buprenorphine in OBOT settings. Spoke physicians who completed MAT training also received continuing support from the addiction specialists at the hub sites as questions arose related to patient care (Brooklyn and Sigmon, 2017). Buprenorphine training and prescriber support is an ongoing characteristic of the Hub-and-Spoke program.

Whether patients present at a spoke or a hub, they can enter a system that includes an assessment of both OUD severity and any psychiatric comorbidity at the hub, where a determination about triage can be made. Those who screen positive for needing methadone are required to go to a hub to receive the medication. However, patients screened to receive buprenorphine could receive that medication at either spoke sites or the hub site. Hospitals, emergency rooms, residential programs, community mental health clinics, and Department of Corrections facilities also act as entry points into the Hub-and-Spoke system by referring a person with OUD to one of the hubs or spokes for entry into treatment (Brooklyn and Sigmon, 2017).

Unique Features of the Program

We were not certain that this program was an ECHO-like model at the outset, and we eventually learned that it does not meet the formal definition. This program's differences from other EELM lie mainly in its use of in-person training, multidisciplinary teams, and referral pathways. However, the model attempts to solve many of the same issues and uses many of the same tools. We therefore felt it was worth including here, despite the key differences from other EELM.

In-Person Training

Vermont conceptualizes its Hub-and-Spoke program differently from other EELM, which have operationalized *hub and spoke* to mean a network of spoke generalist clinicians who are connected by technology-enabling mechanisms to specialist providers at hubs (UNM, undated-f). In Vermont, however, the training is mainly conducted in person. Spokes are regional clinics with generalist providers who administer buprenorphine treatment; hubs are centralized clinics that have OTPs for methadone treatment and specialists who have expertise on both methadone and buprenorphine. Most EELM are also designed so that the majority of patients can stay in their spoke clinics with their local primary care clinicians to receive treatment. Vermont Hub-and-Spoke requires patients to leave their local clinics and travel to the hub site if the severity of the OUD illness warrants supervised daily dosing with buprenorphine or conversion to methadone.

Vermont Hub-and-Spoke uses a learning collaborative that includes in-person meetings and occasional webinars to achieve its aim of increasing clinician and health system knowledge. Similar to typical EELM, the in-person training of Vermont Hub-and-Spoke is provided by specialists at the hub sites to generalists at the spoke sites. Unlike EELM, however, technology such as videoconferencing is used only when needed, not as the primary enabling mechanism for training sessions (Brooklyn interview, 2018).

Additional spoke MAT team clinician and nurse education takes place during monthly in-person meetings of regional learning collaboratives, conducted in groups of approximately 20 spoke providers to share lessons learned and best practices (Rudolph et al., 2014). Vermont Hub-and-Spoke thus builds networks among local communities of spoke providers for peer collaboration, as well as consultation networks between spoke buprenorphine prescribers and hub addiction specialists.

Comprehensive State Program

Also unlike typical EELM, the Vermont Hub-and-Spoke features a system of statewide supports and services that are specific to treatment of OUD. A key feature of the Vermont Hub-and-Spoke model is that it is focused at increasing capacity to treat OUD, but it also emphasizes making improvements at the level of the health system rather than expanding the capacity of individual generalist clinicians to treat OUD. A statewide set of evidence-based practices in MAT were developed and established for the purposes of the program, and all providers generally adhere to the same treatment recommendations and standards. The model also provides each spoke clinic with a MAT team made up of one registered nurse and one behavioral health clinician per 100 Medicaid patients receiving buprenorphine treatment. The MAT team handles patient drug tests, buprenorphine prescription refill and insurance authorizations, oversight of the Vermont Prescription Monitoring System, and the provision of brief counseling and case management services to spoke patients. A centralized quality monitoring program of all sites—hubs and spokes alike—is provided by the Vermont Blueprint for Health (Brooklyn and Sigmon, 2017). The program uses economies of scale to provide standardized services to Vermonters

across the state. Both the hubs and spokes can provide six different health home services that enhance the integration of care for the individual and also provide associated systems to ensure payment whether the service is provided in the hub (using an enhanced payment system) or in the spoke (nonbillable). These six services are comprehensive case management, care coordination, health promotion, transition of care, individual or family support, and referral to community services. This model allows for robust collaboration with community agencies and the medical community to create linkages to all types of services.

Referral Pathways

The bidirectional flow of patient referrals according to illness severity distinguishes the Vermont Hub-and-Spoke from other EELM. In an attempt to optimize the match between provider and OUD patient, the Hub-and-Spoke triage process determines which patients are best suited to treatment by hub sites and which patients can receive adequate treatment at spoke locations. Although spoke providers receive buprenorphine training and ongoing support, the goal is not to bring their competence to a level that allows them to deliver treatment to more-complex cases that are treated at the hubs—a similar feature to other EELM. Instead, the goal is to provide spoke physicians with training in a limited area within OUD treatment and to increase the rate of referral of complex cases from the spokes to the hub sites.

Multidisciplinary Care Teams

Individuals with OUD frequently experience co-occurring substance use and mental health conditions which can complicate treatment. These individuals typically require more support from their primary care teams and might also have increased social needs. They might need help with housing, or they could be experiencing food insecurity precipitated by periods of unemployment, or they might have weakened supportive social networks resulting from opioid use. This dimension of OUD is addressed in the Hub-and-Spoke model by using a multidisciplinary team-based approach to care that treats OUD as a chronic condition (Jaffrey, 2018). It is a model that encourages triage according to illness severity, ensuring that the higher-need patients receive care in the treatment settings that are best equipped to provide comprehensive care. By leaning on specialist providers at the hubs for teleconsultation as required, the model also frees up provider time to focus on patients who are deemed the most appropriate for OBOT in spoke settings.

Program Challenges and How They Were Addressed

An early challenge faced by the Vermont Hub-and-Spoke was the nature of its sparsely populated geography. By the U.S. Census definition of rurality—in which any territory that is not otherwise included in an urban area, or areas of fewer than 2,500 people, are considered rural (U.S. Census Bureau, undated)—Vermont is the state with the second largest percentage of its residents living in rural areas. Such a context made it difficult for the designers and implementers of Vermont Hub-and-Spoke to provide both structured and less-structured treatment settings in

all parts of the state to Vermont residents with OUD. Low population density can make it more difficult to deliver appropriate health care services, particularly when such services require treatment from specialized clinicians and in specialized settings. Program implementers had to think strategically about the geographic distribution of need in determining where to locate the more highly structured hub treatment sites. The development of new methadone treatment facilities is also expensive, and Vermont Hub-and-Spoke implementers had to justify the need for such programs in sparsely populated parts of the state. By creating a statewide program, Vermont Hub-and-Spoke established regional centers that could provide access to specialist providers and specialized methadone clinics to residents all over the state. It also committed itself to being responsive to residents in all parts of the state regardless of population density.

When the program first started, there were wait lists at the hub sites, and patients were required to schedule appointments for new patient assessments in advance. Since September 2017, all hub sites have featured open access treatment in which any prospective patient can show up at a hub to be assessed for and receive treatment. Also since September 2017, there have been no wait lists at any of the hub treatment sites (Brooklyn interview, 2018). One critical change to the model was to create new hub sites to address the volume of patient demand. What started out as five hub sites and corresponding treatment regions has since been expanded to eight (Brooklyn and Sigmon, 2017). The system is more integrated now than it was at its inception: All spoke physicians have access to MAT teams for care coordination, case management, and health promotion services. These teams also create a connection between hubs and spoke providers because they are based at the hub site and spend one day per week at each of the spoke offices to manage care coordination activities. There are an equal number of people (approximately 4,000 patients) in each treatment region, which ensures that there is adequate treatment capacity at each of the hub sites throughout the state (Brooklyn interview, 2018).

Another ongoing challenge to the Hub-and-Spoke model is the need for appropriate and timely triage of patients at hubs and spoke sites throughout the course of treatment. Despite established procedures and a statewide assessment protocol for making such determinations, ensuring that patients are receiving the most appropriate level of care can be difficult. OUD is a cyclical and chronic disease for many people, often characterized by periods of relapse and recovery that require differing levels of treatment and structure. There have been some reports of patients in the Vermont Hub-and-Spoke program who are kept at the hub level for OUD treatment longer than is clinically necessary. Other patients have reported that, rather than referring them to the hub for more-structured treatment after they relapsed to opioid use, their spoke doctors discontinued care (Lopez, 2017). The challenge of coordinating referrals and treatment for patients with OUD throughout Vermont is ongoing, and generally such difficulties are being addressed through the continued education and support of program physicians, MAT nurses and behavioral health clinicians, and other program staff.

These efforts have resulted in meaningful improvements in the quality of care for OUD, as documented by in a 2016 manuscript. Specifically, the investigators tracked seven process-of-care measures, such as documentation of an OUD in the record, the percentage of patients seen

weekly, and the percentage of patients whose state prescription monitoring system record was checked at least quarterly. Performance at participating sites improved on six out of seven measures; for four, the difference was statistically significant.

Lessons Learned

- Programs that are coordinated at the state level might be well-positioned to address the challenges associated with delivering treatment in sparsely populated areas.
- Various options exist to meet the same demands that can be met by EELM. Here, a program was developed around the concept of a learning collaborative, an approach that shares many features with EELM (ongoing mentorship, creating community, capacity-building) but also has important differences (run democratically without experts; meetings are less frequent, face-to-face, and run all day; most work takes place in between meetings). In the case of the Vermont Hub-and-Spoke system, the program appears to be meeting the local needs. This implies that EELM are not the only effective approach to addressing unmet needs for specialty care, even in rural areas.
- As is true with many EELM, this program works well because clinicians feel a clear need to increase their capacity to address OUD in Vermont—as opposed to a model driven primarily by an expert who wants to share his or her expertise.

Oregon ECHO

Organizing as a Core Utility to Serve the Needs of a State

> "Our goal was to develop a statewide infrastructure for ECHO in Oregon."
>
> *—Ronald Stock, director, Oregon ECHO (interview, 2018)*

Brief Program History

Oregon's foray into the ECHO model began with the confluence of several entities and funding sources. The state's Medicaid program, known for pursuing innovations in care delivery, received funding from the CMS Center for Medicare and Medicaid Innovation's (Innovation Center) State Innovation Models Initiative Model Test Awards Round One to establish a Transformation Center in 2013. As part of this initiative to transform care delivery, Oregon formed several large Medicaid Coordinated Care Organizations (CCOs) that manage care for the majority of the state's Medicaid recipients (CMS, 2018).

As these CCOs looked for ways to deliver better care and to control costs, the ECHO model was one of the top considerations, especially given the success of VA SCAN-ECHO within the state. In 2013, a large CCO began a three-year pilot ECHO program using state money from the Innovation Center's award grant on the subject of adult psychiatric medication management.[12] The success of this pilot and a favorable return on investment led to great demand by other CCOs to develop a similar program. Oregon then set out to develop a statewide ECHO program, with Oregon Health and Science University (OHSU) as a partner and with the CCOs, the State Health Agency, and others as stakeholders.

In July 2016, the Oregon Rural Practice-based Research Network (ORPRN), a division within OHSU, began a nine-month needs assessment, exploring the requirements for a statewide ECHO program. In April 2017, ORPRN reported to the state on what would be needed to build and sustain an ECHO network. Later that year, a new group containing representatives from ORPRN, several CCOs, and the Transformation Center was chartered as the Oregon ECHO Network (OEN). The Oregon ECHO has added multiple subject areas, and OEN is planning for its second year of operations with an advisory council that meets on a quarterly basis for planning and steering meetings.

Unique Features of the Program

Oregon ECHO has four ongoing ECHO programs in 2018 with four more in development for 2018–2019. Each is funded separately, with infrastructure provided by the OEN. Sometimes the specialist mentors are drawn from OHSU, but not always. Current offerings are SUD, liver disease, behavioral health, and mental health in LTC settings. The LTC offering was initiated at the urging of the Oregon Health Authority, which had learned about a similar program at the

[12] Claims regarding favorable return on investment are based on information shared during the discussion; these have not been published.

Rochester ECHO and wished to replicate it in Oregon. This LTC model was based heavily on the program run by the Rochester ECHO.

As an ECHO program that began relatively recently, Oregon ECHO has sought ideas and best practices from other ECHO programs. In addition to consultations with Project ECHO of UNM, the architects of Oregon ECHO estimate that they have had ongoing conversations with approximately eight other hubs.

The Oregon ECHO has an internal evaluation group as part of the core services it provides. All sessions are evaluated on user satisfaction and changes in self-efficacy. Currently, evaluation results are used for internal quality control to improve program delivery (rather than for adding to the evidence base for ECHO through peer-reviewed publications). Some subject areas have begun to generate opportunities to do more-rigorous evaluations, such as their receipt of Minimum Data Set (MDS) data from the state. MDS data are used to evaluate care in LTC facilities; thus, they could be used to help evaluate the impact of the Oregon LTC ECHO. Oregon ECHO staff have begun to consider applying for funding from such entities as NIH, but they have not yet done so because it would require a more research-oriented focus than they have had to date.

Program Challenges and How They Were Addressed

As with other ECHO programs, a key challenge has been how to ensure financial sustainability. The OEN currently relies on three primary sources of funding:

1. grants, including money from the 21st Century Cures Act and from CMS
2. stakeholder fees (paid by CCOs as part of joining the OEN) and subscription fees (usually by the parent institutions of ECHO generalist mentees rather than the mentees themselves)
3. contract fees from entities that wish to start up an ECHO program and enlist the services of the OEN (dubbed the "private pay" model—as an example, a CCO recently enlisted OEN's assistance in organizing an ECHO program aimed at community health workers).

The OEN steering committee continually considers the ideal balance of these three funding sources. The current proportion funded by grants is 60 percent, a number the committee hopes to reduce over time. The committee also expects the number of subscribing organizations to increase over time because several organizations that "sat out" from participating in the first OEN advisory council have expressed an interest in being included soon, given the continuing success of the program. Some CCOs are also trying to find ways to build the cost of ECHO subscription into their fee structure.

Another challenge facing many ECHO hubs is how to remain focused on clear and achievable goals. To this end, the Oregon ECHO has a clear set of priorities that help guide its decisions. OEN aims to be:

- an efficient and sustainable "utility," or a center providing services to all qualified users within the state, under a single centralized destination for ECHO services in Oregon
- a user-centric program rather than an academic-centered one, driven by the needs of ECHO mentees, as opposed to the desire of content experts to deliver content
- dedication to collecting and addressing participant feedback for internal quality improvement purposes.

Given these priorities, leaders select subject areas for their programs with input from generalist mentees and the OEN advisory council, being careful not to saturate the community with too many offerings. Subjects tend to be on clinical conditions with a clear need (HCV, HIV, frail elderly, SUD, management of psychiatric medications) or serving groups of clinicians who might feel especially in need of support (clinicians in LTC settings, nurse practitioners). Oregon ECHO plans to add more programs oriented toward facilitating quality improvement rather than a specific clinical discipline or disease. This requires a different perspective than other ECHO programs because patients are not discussed one at a time as part of the practice of quality improvement. Rather, when discussing a case about quality improvement, mentees refer to it as a "practice situation."

Lessons Learned

- The Oregon ECHO has made several conscious choices in terms of how it is organized and what it chooses to emphasize. These choices can be considered as possible options by other EELM looking to similarly organize.
- The Oregon ECHO program can be considered a sustainable "utility" on behalf of a state, with participation from an academic center, but not ownership by them or any other entity.
- A needs assessment, conducted prior to launching the program, helped ensure alignment of topics covered with local needs and priorities.
- Governance of EELM can be set among multiple entities if a clear statement of priorities is developed to guide programming choices and a plan for financial sustainability is articulated.
- Diversified sources of funding can help ensure uninterrupted program funding.
- Similar to many ECHO programs formed more recently, Oregon ECHO elected to limit the amount of time, typically to one year, that cohorts of generalist mentees spend in each ECHO program. These limits help the program secure a strong level of commitment from generalist mentees during that period and also facilitate pre- and post-program evaluations. The program has not yet formally compared the effect of different program durations on participation.

- Close participation and financial support from large Medicaid CCOs in the state can help support both EELM and alignment with transformation initiatives within the state's Medicaid program.
- Oregon ECHO maintains close contact with other large and successful EELM and shows evidence of actively borrowing some of their most successful ideas.
- To date, Oregon ECHO has focused on strong implementation rather than the generation of academic evidence, peer-reviewed publications, or research grants.

University of Missouri

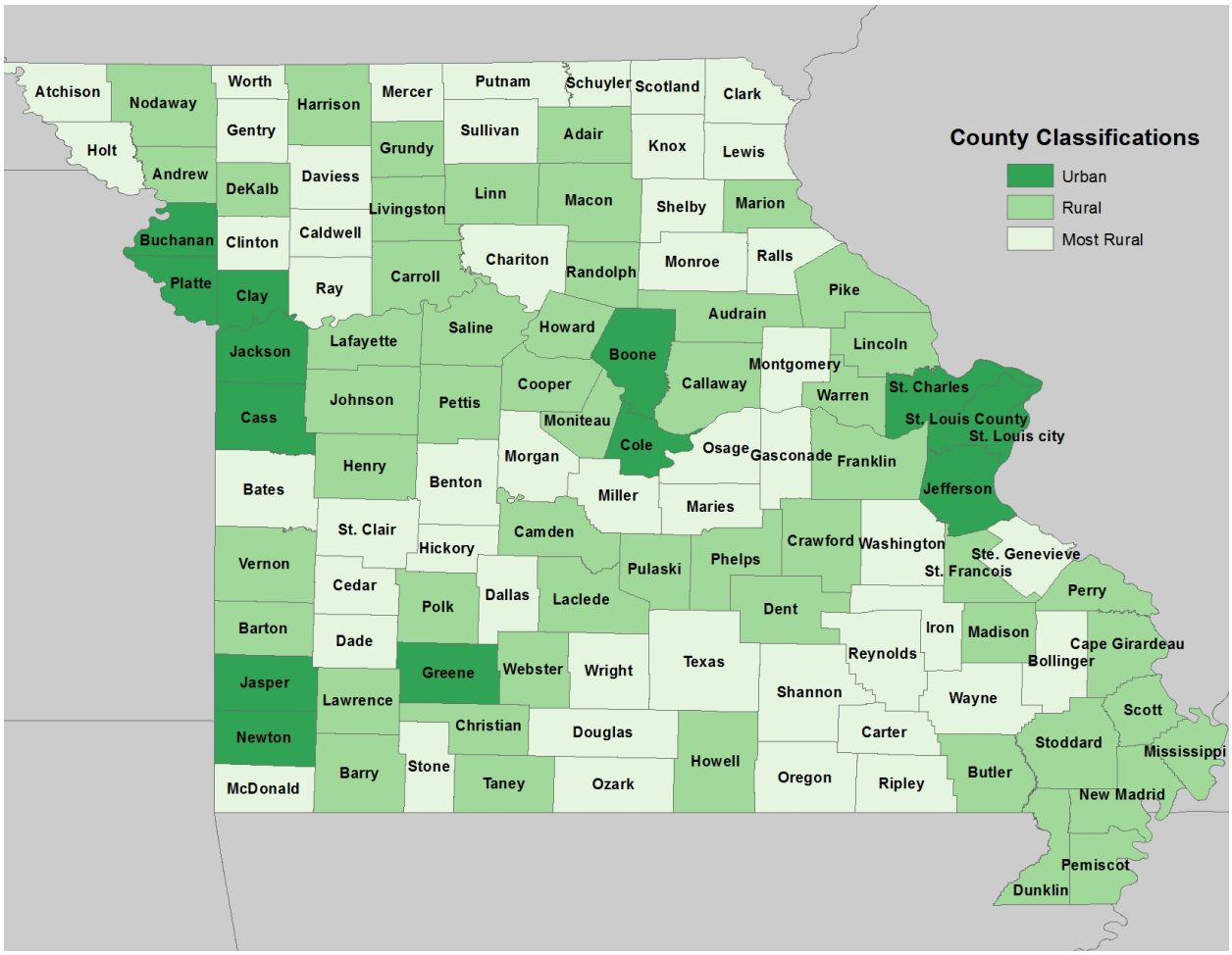
Show-Me ECHO

> "A big barrier to expanding ECHO beyond one's state is that advice that works in one place may not work in another."
>
> *—Rachel Mutrux, senior program director for the Missouri Telehealth Network, parent organization of Show-Me ECHO (interview, 2018)*

Introduction

Missouri is a very rural state: In 2016, it had just over 6 million residents, more than one-quarter of whom lived in rural areas (see Figure E.7) (U.S. Department of Agriculture, 2018). Show-ME ECHO is a state-based implementation, covering several different topics and has spread across the state, funded through appropriation of state funds.

Figure E.7. Map of Missouri's Urban, Rural, and Most Rural Counties

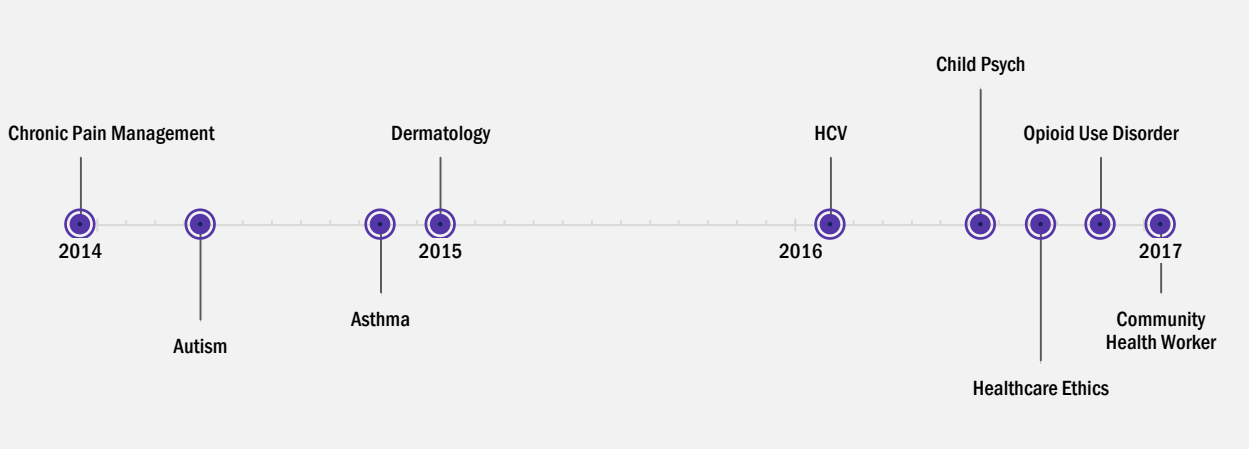


SOURCE: U.S. Department of Agriculture, 2018.

Brief History of the Program

A group of staff working on telehealth issues in Missouri, in coordination with a retired state representative and a current state representative, became interested in ECHO and traveled to UNM to learn more about the project. Their visit in December 2013 prompted efforts that led to the passage of 2014 legislation to establish Show-Me ECHO under the Missouri Telehealth Network (undated-a). This network works in concert with the Heartland Telehealth Resource Center, a federally funded network that covers Missouri, Kansas, and Oklahoma (Heartland Telehealth Resource Center, undated). The legislation passed, but a veto on spending prevented the appropriation of any immediate funding. Instead, separate funding from the Missouri Primary Care Association and the Missouri Telehealth Network was secured for a pilot. In partnership with the Missouri Primary Care Association, Show-Me ECHO opened a pilot ECHO program that focused on chronic pain management. A second effort, focused on autism, was funded by a Medicaid managed care organization looking to partner on telehealth (see Figure E.8).

Figure E.8. Time Line for Show-Me ECHO Program Start Dates



SOURCE: Missouri Telehealth Network, 2017.

With two pilots already under way, the $1.5 million bill to fund Show-Me ECHO was reintroduced in the 2015 appropriations cycle and passed, and the program was extended to cover HCV, autism, dermatology, and asthma. Since then, the program has been funded through state appropriations, though funding for FY 2018 was limited to $1.3 million.

Current ECHO offerings include chronic pain, HCV, dermatology, autism, and asthma. In 2017, Show-Me ECHO started an OUD program, in alignment with a targeted focus on the issue at the state level both within the executive (State Department of Mental Health) and the legislature. They also have a child psychiatry ECHO, one focusing on community health workers, and one on health care ethics, through a partnership with the Rural Emergency Trauma Institute, a nonprofit organization in West Virginia whose mission is to support and improve West Virginia's rural trauma system through research, data, and analysis. Topics covered included when to obtain a formal ethics consultation, medical futility and when to stop treatment,

duty to inform patients, and the obligation not to abandon someone in need of assistance. Thus far, Show-Me ECHO sessions overall have been attended by health care professionals from 217 different health organizations in 62 of Missouri's 114 counties (Mutrux interview, 2018).

Unique Features of the Program

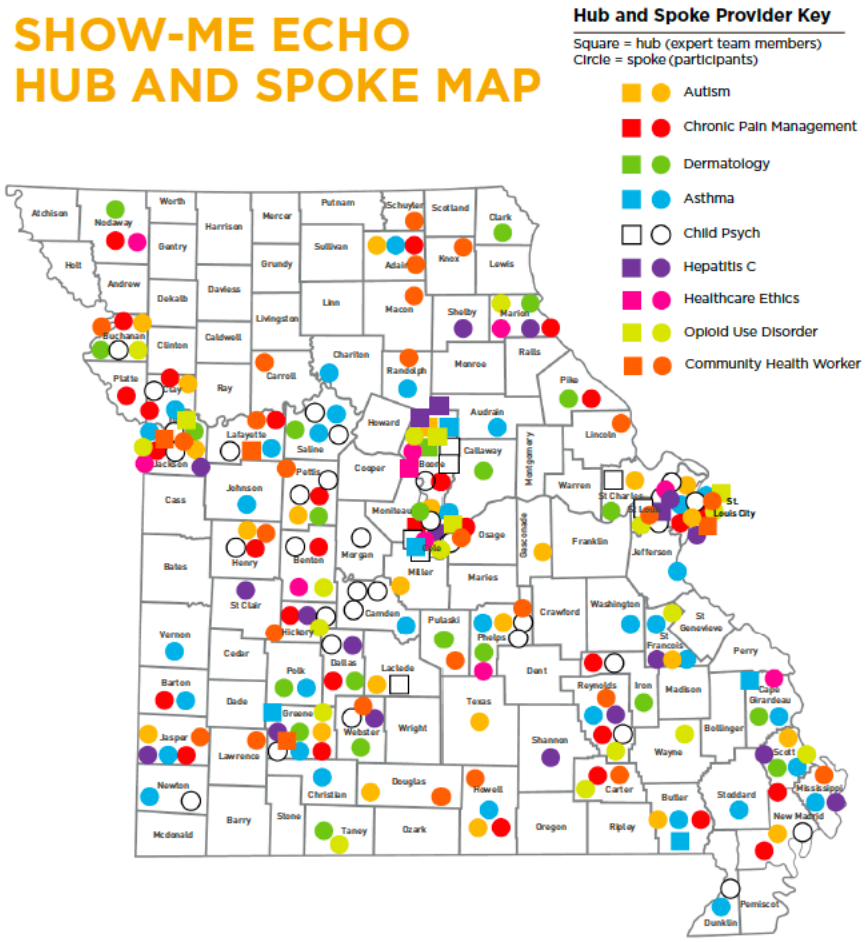
Missouri's Show-Me ECHO receives considerable financial support, given its state funding and its relationship with the telehealth resource center and the Missouri Telehealth Network. The program is highly integrated into other telehealth efforts in Missouri, with a common staff running all state-based telehealth-related efforts, such as EELM, direct-delivery telehealth, and other initiatives. This is in contrast to the programs at UNM, where telemedicine and ECHO are run as separate programs and staffed by different people.

In Missouri, not all the hubs are at the University of Missouri, as the relevant expertise might not be located at academic centers. In the child psychiatry subject area, for example, many sessions are led by people who might not have academic credentials but do have deep and long-standing knowledge of how resources can be accessed in local school districts, counties, or towns. Relatedly, Show-Me ECHO has emphasized the importance of understanding local cultural norms and tailoring medical and health service offerings to align with them (see Figure E.9).

The direct funding of Show-Me ECHO by the Missouri state legislature is unusual. The program has had unanimous bipartisan support since initiation. One result of the source of funding is that the program leaders feel an obligation to the state because they are using taxpayer dollars. As Rachel Mutrux, the Telehealth senior program director, said, "We want to be responsible with those dollars, and legislators want to know what their return is on this" (Mutrux interview, 2018).

One measure of program success has been a steady advance in the ability of spoke generalists to accurately diagnose skin conditions. When program staff started the dermatology subject area, the initial diagnosis submitted with cases matched the final expert diagnosis 37 percent of the time; this rate has increased to 77 percent to date. Program staff also note that ten melanomas have been found through the dermatology program, although it is unclear how many would have been found in any event.

Figure E.9. Map of Show-Me ECHO's Hubs and Spokes



SOURCE: Missouri Telehealth Network, 2017. Used with permission.

The Show-Me ECHO program also makes an effort to use specialist mentors from multiple sites throughout the state. In part, this is because of politics, as staff endeavor to maintain broad support in the state legislature by ensuring that specialist mentors are drawn from as many districts as possible; in part, this reflects a recognition that the University of Missouri is not the sole repository of expertise in the state. In addition, there are other reasons to favor geographic diversity, most notably that experts located in different communities might understand local realities and local resource availability. This understanding of local needs and resources is also a point of pride for the program. A Missouri provider could attend an HCV ECHO session run out of New Mexico and could receive excellent clinical advice, but this would not help the provider answer questions related to securing payment or finding local contacts, which is seen as another benefit of the program.

Lastly, Show-Me ECHO is one of ten official Project ECHO–approved "superhubs," meaning the site is authorized to train others in how to set up their own ECHO clinics (Missouri Telehealth Network, undated-b). This demonstrates that the ECHO Institute has confidence that

the program can "train and support hubs within the ECHO model while maintaining fidelity to the ECHO model" (UNM, undated-b).

Participation statistics from 2017 are shown in Table E.3.

Table E.3. Participation Statistics, Show-Me ECHO, January–December 2017

Overall numbers	• 169 sessions • 549 CME hours • 803 unique individuals
Missouri participation	• 652 unique individuals • 130 unique physicians (doctors of medicine and osteopathic medicine) • 26 FQHC organizations • 217 health care organizations (including satellite sites and departments) • 62 counties and the City of St. Louis
Out-of-state participation	• 151 unique individuals • 86 organizations
Promotion	• 16 statewide conference exhibits • 39 Telehealth and Show-Me
ECHO presentations	• 5 ECHO posters presented • 24 media placements

SOURCE: Missouri Telehealth Network, 2017.

Program Challenges and How They Were Addressed

As with other implementers of EELM, the implementers of Show-Me ECHO cited funding, evaluation, and spoke recruitment as their biggest challenges (Mutrux interview, 2018).

Funding

Although the program has secured a state appropriation, its funding is still subject to changes in the political landscape over time, meaning it could be subject to cuts or might not be renewed in future years. The current year's decrease in funding shows the potential vulnerability of depending on one source for the majority of funding, even for a program with apparently broad support.

Evaluation

It is hard to determine the number of people touched by Show-Me ECHO, which in the view of program staff is key to understanding impact. Missouri staff suggested that it is likely that there is a multiplier—that for each trainee or case presented, some larger number of patients are affected—but that multiplier is hard to determine and could differ by condition. It is not clear how many patients will be similar enough to those presented for the training experience to improve treatment of other patients. As one key informant asked, "What is the multiplier, 20 or 30? In child psych, it's probably high, and in dermatology, too, but maybe in autism it's just

limited to those children with autism or the question of autism. Figuring out that multiplier of the patient impact is really hard" (Mutrux interview, 2018).

As with other EELM, multiple efforts are under way at the same time. For example, there is an active listserv of providers around OUD, and they consult each other for advice. This simple activity serves the clinicians well, but it can complicate measuring the impact of ECHO alone.

Recruitment

Recruiting generalist mentees at spoke sites has been a continuing challenge, as it has been for many of the other EELM profiled. Missouri might be the first site to hire a full-time outreach person to help recruit and retain sites.

Lessons Learned

- Partnership within a telehealth center can help place the ECHO strategy within the broader context of all telehealth efforts for the state and make it easier and more affordable to start new ECHOs by leveraging existing funding and infrastructure for implementation.
- There are advantages to centralization, especially with regard to funding, but there are also advantages to having multiple local hubs for specific policy and resource knowledge, and having more than one hub also helps ensure a diverse set of experiences with local resources and how to access them.
- It is difficult to identify a potential multiplier effect in terms of evaluation.
- Direct funding by a state legislature creates a particular imperative for accountability and to demonstrate results.

ECHO Colorado

ECHO to Meet the Needs of a State

> "We tried to avoid a top-down structure—our goal was to ensure that people's needs were being met."
>
> *—Fred Thomas, director, ECHO Colorado (interview, 2018)*

Brief History of the Program

In 2015, the state of Colorado decided to invest in a statewide ECHO program, run expressly for the benefit of the state and its citizens. The team began with a one-year planning grant, funded by the Colorado Health Foundation, which supported the time needed to assess the needs of potential generalist-mentees in Colorado and to visit successful ECHO programs, including the pioneering program in New Mexico. Before building any programs, the team traveled around Colorado, soliciting feedback from end users and stakeholders about what needs the programs would meet. In 2016, the team began building a program in earnest, incorporating the feedback it had collected. In that first year, it rolled out 20 time-limited ECHO subject areas (see Figure E.10), and in 2017, it set up an evaluation core to lead evaluations of all ECHO offerings (ECHO Colorado, undated).

Unique Features of the Program

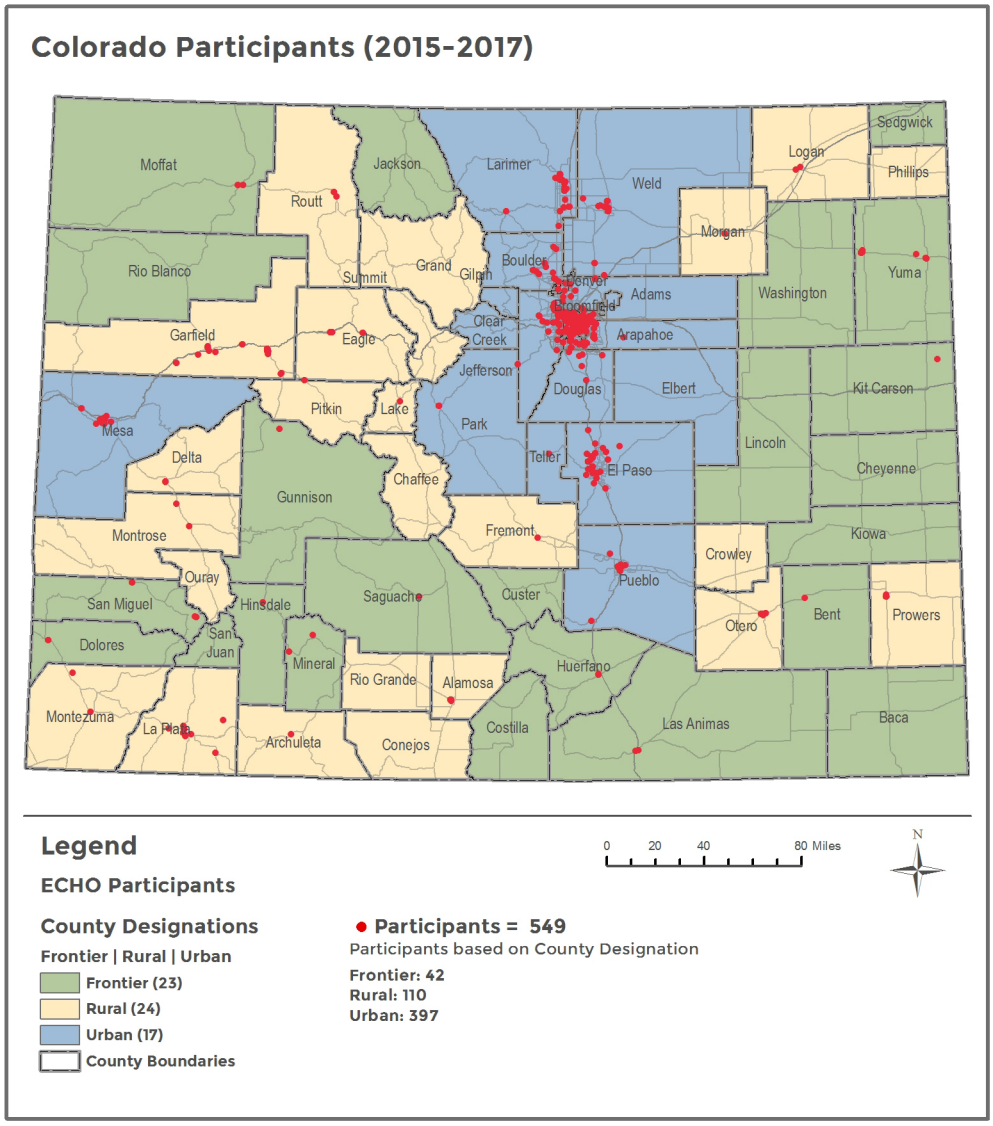
Colorado ECHO deliberately embraced a start-up model, which stands in contrast to the more organic development of early ECHO programs. From the beginning, the program was distinguished by its goal to serve the entirety of the state according to the state's priorities.

The relationship between CU and the ECHO program is different than the relationships that many other ECHO programs have with academia. CU provides certain in-kind resources, such as hosting the Zoom network, but it has no "ownership" of ECHO Colorado. The program is a chartered independent program with ties to both the university and the state. Thus, unlike some other ECHO models, the university participates in the program, but does not dominate it.

ECHO Colorado has begun to attract a lot of interest from potential participants, both experts to deliver content and generalist mentees to receive it. Program staff have chosen partners selectively; for example, they partnered with the Kempe Center to deliver content regarding child abuse and neglect to geographically isolated teams in some of the state's most rural counties. ECHO Colorado receives many requests in part because it is the only ECHO infrastructure in the state. This lack of competition among different ECHO programs decreases confusion and duplication of effort.

ECHO Colorado uses a basic evaluation core for its offerings. All ECHO offerings now receive the standard basic evaluation, which includes tracking attendance and a satisfaction survey. Some ECHO offerings have more-ambitious evaluations as well. To date, the purpose of these evaluations has been internal quality improvement.

Figure E.10. ECHO Colorado Spoke Locations, 2015–2017



SOURCE: Thomas interview, 2018.

A key difference from the original Project ECHO is that ECHO Colorado has an end date for all of its subject areas and conceives of them as time bound (some other sites have adopted cohort models as well, such as Oregon, but it is not the typical design). Program staff have found that a time-limited commitment might facilitate more consistent attendance.

Program Challenges and How They Were Addressed

Long-term financial sustainability is a major issue for all ECHO programs. Diversification of funding sources is seen as key to long-term sustainability. ECHO Colorado has a five-pillar approach for sustainability:

1. gaining grant support (which has included CDC, HRSA, CMS Innovation Center, and AHRQ, as well as PCORI)
2. alignment with state goals, such as those of the state's departments of public health, health and human services, Medicaid, and education
3. obtaining funding from philanthropic foundations, which have included the Denver Foundation and others
4. selling contracting and consulting services, such as advising on setting up ECHO programs or evaluation support, to other states or programs
5. integrating with CU, including its clinical networks, which allows the program to use existing resources rather than needing to create them.

It is also apparent that ECHO Colorado has successfully addressed one of the key limiting factors for ECHO programs: the startup cost to begin an ECHO offering. Staff from other ECHO programs generally reported costs of $100,000–$120,000 to set up each ECHO subject area. ECHO Colorado generally requires approximately half as much, which program staff believe is because of the investments they have already made in setting up key core infrastructure that makes effective use of specialist mentors' time, which is the biggest expense. By developing a streamlined process to take care of administrative matters, such as setting up session times, specialist mentors are free to focus on content development and delivery.

Lessons Learned

- In contrast to other programs, which developed organically over time, the developers of ECHO Colorado were deliberate in their effort to build key infrastructure first, by obtaining a grant to support a full year of planning and information-gathering before building a program.
- An ECHO program can be conceived of as a common utility in service to the entire state. Being the sole provider of ECHO in Colorado reduces confusion about who provides these kinds of services.
- A model of continuous solicitation of feedback can help an ECHO program ensure that it is meeting the needs of generalist mentees.
- Time-bound ECHOs, with clear end dates, could result in lower barriers to entry for generalist mentees, in contrast with the classic ECHO model, which is indefinite in duration.

Weitzman Institute

ECHO in an FQHC

"Project ECHO is exactly what we needed."

—Daren Anderson, director, Weitzman Institute (interview, 2018)

Introduction

The Weitzman Institute is a research and innovation center located within Community Health Center, Inc. (CHC) of Middletown, Connecticut, one of the largest FQHCs in the country. CHC provides comprehensive primary care at 13 sites across Connecticut for more than 145,000 patients (Community Health Center Inc., undated), most of whom have household incomes below 200 percent of the federal poverty level (Anderson et al., 2017). Dr. Daren Anderson, a clinician-researcher at Weitzman, reported that he was flipping through *NEJM* one evening in 2011 and saw an article about Project ECHO's efforts in New Mexico (Arora, Thornton, et al., 2011), which seemed applicable to the challenges CHC had been facing in training PCPs to appropriately manage pain in the midst of the opioid crisis. He thought, "This is exactly what we need" (Anderson interview, 2018).

Brief History of the Program

The Weitzman Institute stood up its own ECHO program within six months of being introduced to the concept. The program began at two sites in Connecticut in early 2012, focusing on HCV, similar to the original program at UNM. In addition, Weitzman quickly established an HIV/AIDS program, and, by 2013, began two more ECHO programs: one focusing on pain management and the other on MAT for OUD. More recently, in 2017, Weitzman launched a new subject area in complex pediatrics for nurse practitioners and PCPs in underserved schools and communities. The reach of the Weitzman ECHO now extends well beyond Connecticut to FQHCs and similar clinics across the United States.

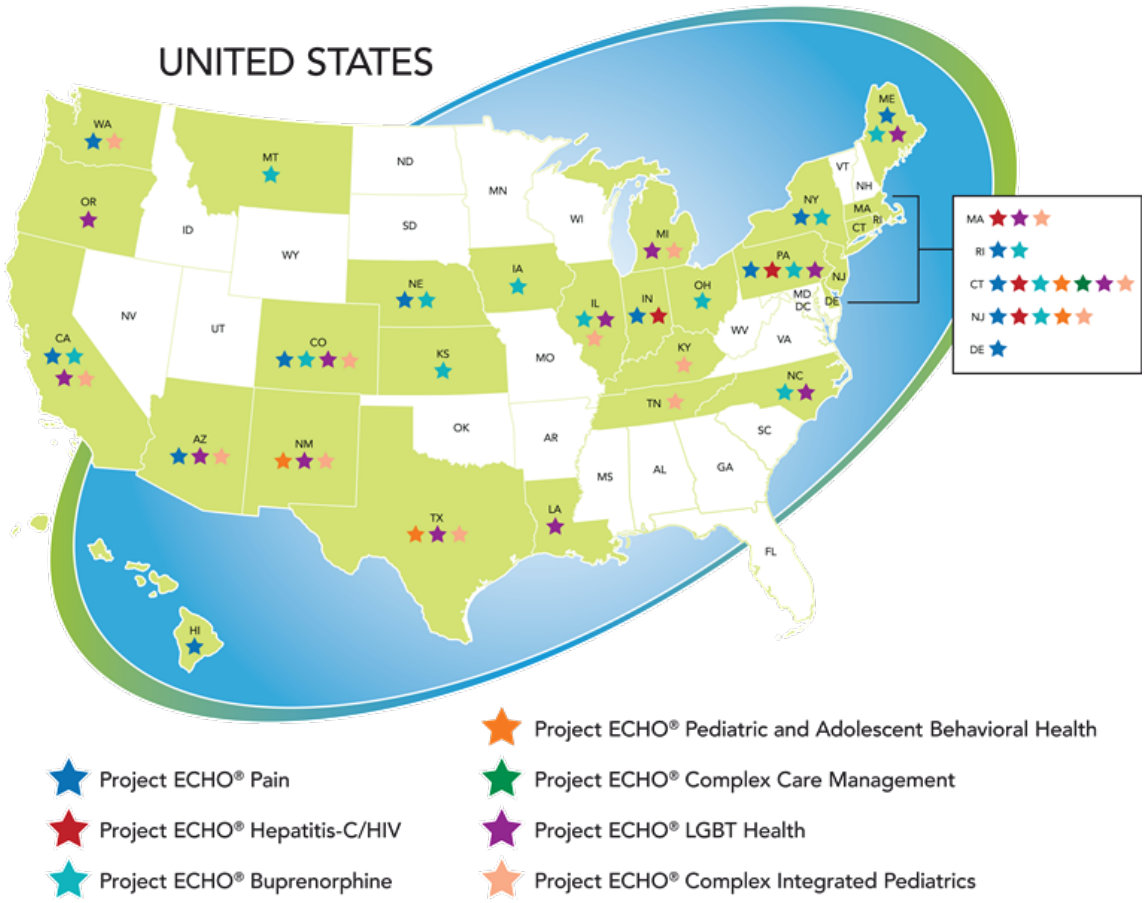
Connecticut is a small state with many hospital systems and thus does not face some of the challenges with great distances between providers that other programs have described. It is not considered rural, and patients are not usually physically far from major medical centers. However, despite the proximity to specialists, only a small percentage of CHC patients with HCV—10 percent, per an internal audit—were being seen by specialists. This is likely related to the well-known challenges that FQHC patients experience with accessing specialty care because many specialists do not accept Medicaid insurance. As an FQHC with a focus on creating a PCMH, CHC aimed both to deliver care within the medical home as much as possible and to improve patients' access to specialty care.

Unique Features of the Program

CHC is the only FQHC to organize and run its own Project ECHO programming (Weitzman Institute, undated-a), unlike many other EELM, which are organized by experts (who wish to

deliver content). Whereas other EELM are mostly run by specialist mentors, this program is run by generalist mentees who drive the choice of topics. This seems likely to help the program be more centered on the needs of the generalist mentees; indeed, we were told that Weitzman ECHO programming is designed to meet the specific needs of safety-net PCPs and their communities. Spokes are recruited from FQHCs and similar clinics across the United States (see Figure E.11). Specialist mentors could be drawn from diverse locations.

Figure E.11. Locations of Weitzman Project ECHO Spokes



SOURCE: Weitzman Institute, undated-b. Used with permission.

Subject Area Selection

Weitzman offers a fairly small number of ECHO offerings at any particular time, selected to address conditions that are commonly seen in primary care and can likely be managed by PCPs with additional support. Some common primary care conditions, such as diabetes, were not selected by Weitzman for its ECHO because these conditions are already perceived to be core competencies for PCPs, though other programs do include them. Other conditions, such as pediatric epilepsy, were felt to be too uncommon to succeed as subject areas. A time line of Weitzman's ECHO launches is shown in Figure E.12.

Weitzman developed and led a novel LGBT ECHO in collaboration with CDC, the National Association of Community Health Centers, and the Fenway Institute from 2015–2016. The focus was on health issues particular to LGBT patients, such as HIV prevention regimens and transgender hormone therapy. The Fenway Institute has many experts in these clinical areas and provided many of the faculty. This project ended, but the Fenway Institute (which is located in Boston) created its own LGBT ECHO, which continues to operate.

Figure E.12. Time Line for Establishment of ECHO Programs at the Weitzman Institute

SOURCE: Anderson, 2018; Anderson interview, 2018. Used with permission.
NOTE: The Pediatric and Adolescent Behavioral Health curriculum was expanded in scope and the name was changed in October 2017 to Complex Integrated Pediatrics. A new chronic pain subject area was started in early March 2018, funded by HRSA, also called ECHO Pain. LGBT Health ended in June 2017, and ECHO Colorado Chronic Pain ended in June 2017.

Innovation

Although the HCV ECHO was closely modeled after the UNM template, Weitzman staff began innovating early on with their pain programs. They did not have people with the subject-matter expertise to serve as specialist mentors because their FQHC does not have a pain center. But staff realized that both the spokes and the hub specialists could be remote—that is, they sometimes engage remote experts. For ECHO Pain, specialists are drawn from a multidisciplinary pain center in Tucson, Arizona. Weitzman also began making these programs available to PCPs in other locations that did not have a local community of practice to "come together in virtual community." Weitzman's ECHO Pain has become especially popular, drawing PCPs from more than 30 states since its inception.

Some of the ECHO programs organized by Weitzman meet weekly; others are held biweekly (or, in one case, monthly). The length of the sessions also varies. Generalist mentees are asked to

make a commitment to attend at least 75 percent of sessions, and recordings are provided after each session to help accommodate schedules.

Concurrent Interventions

In addition to the ECHO efforts, Weitzman supports e-consults and learning collaboratives to support training and care, and many physicians take advantage of a combination of these services (see Figure E.11 for a map of locations). Weitzman also created a separate parallel platform to allow PCPs to send an e-consult question with content from the patient chart directly to a specialist in their network. E-consults allow for fast answers to time-sensitive questions because they do not require waiting for the next ECHO session to present one's case.

Learning collaboratives, which have certain similarities with EELM, focus on building community through recurrent meetings. Meetings are usually face to face, and the emphasis tends to be on creating processes and structures to support quality improvement, as opposed to telementoring in a specific clinical discipline through case studies in the ECHO model. Learning collaboratives are usually led by a combination of content matter experts and quality improvement coaches rather than clinical experts.

The combination of these options, particularly with regard to managing pain (Weitzman Institute, undated-c), offers providers a wealth of resources and tools to advance their knowledge and better care for their patients. However, having multiple ongoing programs also increases the challenge of evaluating the impact of any specific program in isolation.

Program Challenges and How They Were Addressed

Funding

Program challenges include funding, particularly for specialist mentors, who generally must be compensated for developing and delivering content. Sustainability is a related challenge. So far, Weitzman has achieved an agreement with only one insurance company to make capitated payments to the ECHO program, but there are hopes that this can be replicated. Funding has also been secured from a range of sources, such as federal organizations (CDC, HRSA, SAMHSA), state Medicaid agencies, private and philanthropic organizations, and others (Weitzman Institute, undated-a).

Evaluation

Similar to other sites, Weitzman aims to measure the impact of ECHO but faces challenges in doing so. Despite the challenges, this work is felt to be important because of a sense on the part of its organizers that ECHO's expansion has outpaced its evidence base.

Two papers have been published to date on Weitzman's ECHO offerings, with another under review. In a 2017 paper by Anderson et al., researchers conducted a quasi-experimental pre-post intervention, with a comparison group to examine the impact of ECHO Pain on knowledge of pain care and processes of care. Compared with controls, intervention clinicians (those who participated in the ECHO Pain program) showed increased pain knowledge and self-efficacy to

treat pain; improvement on such process measures as the use of formal assessment tools and opioid agreements; and, most importantly, a measurable decrease in opioid prescribing (Anderson et al., 2017). Unlike diabetes, which has an objective measure to follow over time (HbA1c levels), pain is more difficult to quantify, and that is why they used this evaluation method of assessing knowledge, processes, and outcomes. The research team is also working on a manuscript describing the impact of LGBT ECHO on practices around documenting sexual history, sexual orientation and gender identity data, and screening for sexually transmitted diseases.

Lessons Learned

- EELM can play a role in increasing access even in places that are not rural. Patients have difficulty accessing specialty care, even when it might be located very close by, as did the FQHC patients in Connecticut who experienced access barriers because of wait times, lack of insurance coverage, or lack of information.
- EELM do not necessarily require any geographic connections—spokes can be across the country or the world, and hubs can also be teams of experts who are separated geographically. Here, ECHO programs are organized around a common set of needs (i.e., the needs of FQHCs and similar providers) rather than a geographic designation (e.g., within a state).
- ECHO programs could operate alongside other programs designed to improve access to specialty care, such as e-consults, which is beneficial for providers and patients but could lead to challenges with evaluating the impact of any one intervention.
- Having a program organized by generalist mentees rather than specialist mentors could result in a product that is more focused on meeting the needs of the learners.

Appendix F. Inventory

Please see the separate related file, RR-2934z1, for an inventory of active EELM across the United States and in select other countries, describing the program, topic areas, and funding sources, where available.

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