

PROJECT ECHO

Review and Research Agenda



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Executive Summary

This study assesses the state of the evidence about Project ECHO (Extension for Community Healthcare Outcomes) and suggests directions for improving its performance in the field. As sometimes happens in the diffusion of a promising intervention, the state of the art—what practitioners are doing in the field—can outrun the state of the science—what researchers know with confidence about that intervention and its effects. Even with a number of publications in peer-reviewed journals, this is a fair characterization of the status of Project ECHO. In response to great need, its deployment has moved ahead at a rapid pace with little time to pause and assess.

It is always possible to improve the knowledge base about an intervention: more precisely determining just which intervention components are responsible for observed effects, how those variables interact, and the reproducibility of effects. But sometimes an intervention achieves a degree of face validity through repeated evaluations such that further tests of internal validity are less pressing than are pragmatic studies to better understand an intervention's performance under varied field conditions. That way, improvements can be rolled out as the intervention is adopted and implemented by more practitioner teams.

In this paper we introduce Project ECHO, describe its core components as an intervention, and briefly recount its ascent as a way to bring specialty health care to underserved rural populations. We review the published peer-reviewed literature about implementations of ECHO for different health conditions, first concerning patient access and health outcomes, and second about provider outcomes. We summarize these findings at the end of Sections 2 and 3, and at the beginning of Section 4. In Section 4 we prioritize types of evaluations that could best add value to what ECHO leadership and implementation teams are learning about this intervention. The highest priority for needed research about ECHO reflects the reality of interest in this model as a means of strengthening the professional engagement of, and continuing medical education for, rural primary care providers. It is ECHO's ability to affect the professional engagement and continuous learning of primary care providers that makes this model so promising for improving access to specialty care for disadvantaged patients.

The research priorities that we list do not require a slowing of ECHO implementations. We describe approaches to evaluation that can come alongside the daily work of practitioners in the field so that additional patients can continue to benefit from this model.

PRIORITY RESEARCH NEEDED ABOUT PROJECT ECHO

Priority 1: Evaluate ongoing ECHO implementations in the field. The ECHO model relies on an effective transfer of training so that implementations of the model reflect best knowledge about how to organize a team of specialists, how to recruit rural primary care providers, how to operate case-based teleECHO clinics, how to support continuous learning by primary care providers, and how to support the care delivered to patients. Intervention fidelity is a major question as it is for most complex interventions. Considerable opportunity exists to study (a) the extent to which ECHO is being delivered as intended; (b) occurrence of fidelity-consistent and fidelity-inconsistent adaptations; (c) positive deviance at the delivery system or clinic level so that high performance can be identified, explained, and modeled for other ECHO teams; and (d) the extent to which the model is sustained in practice. This priority is best answered through the conduct of mixed methods field-based research that combines clinic data with interview data.

Priority 2: Assess the robustness of the ECHO model. Only small proportions of the geographic locations and health conditions to which the ECHO model has been applied have been evaluated and reported on in published literature. There are reasons to expect that ECHO may be more effective for certain health conditions than other conditions, and more effective in certain organizational contexts than other contexts. The extent to which the model is robust in performing well across such differences can inform leadership decisions for prioritizing trainings and planning the future rollouts of the intervention. Opportunity exists to work with current and future ECHO teams so that an evaluation design is put into place that enables comparison across health conditions and locations so that explanations for observed effects can be made with confidence and misapplications of the model minimized. Qualitative data could further inform comparison across conditions and locations.

Priority 3: Conduct formative evaluation to inform a designing for diffusion strategy. Current scale up of ECHO is based primarily on market demand. Medical specialists and health care system leaders hear about Project ECHO and arrange to take part in a training. While market demand is an essential ingredient for the successful diffusion of an innovation, it frequently results in spread patterns that reinforce inequality, encounter unforeseen barriers to implementation and produce discontinuance due to poor planning for sustainability. Opportunity exists to scale ECHO more efficiently so that the motivation of adopting health care systems and their medical specialists is matched by organizational capacity for implementing ECHO and the inclusion of influential adopters so that their peers see ECHO in use and want to try it themselves. Organizational readiness assessment tools could be used as a part of this formative evaluation.

OTHER RECOMMENDATIONS

Use direct measures of patient outcomes. Access, health outcomes, and patient engagement should be measured objectively and systematically. Standardized metrics exist for such patient outcomes (teams can refer to the ECHO Institute toolbox, for example). Further, reporting on these metrics should be part of adopting the Project ECHO model.

Randomly assign providers to conditions. Random assignment of providers to conditions would rule out alternative explanations for observed results. Comparing longitudinal outcomes for (1) patients of providers who agree to participate in Project ECHO, (2) patients of providers who decline to participate in Project ECHO, and (3) patients of comparison providers maintaining standard care would ensure that Project ECHO effects are tested against an appropriate comparison group, as well as provide information about the generalizability of existing studies making use of non-random assignment.

Randomize at the clinic level. Random assignment of clinics to conditions would rule out alternative explanations for observed results and would simplify some of the logistic difficulties involved in provider randomization by using clinics or other care units as the basis for assignment to study condition. Randomizing at this level could be done within a single large health care system or involve multiple health care systems.

Plan for over-time data collection. Longitudinal studies would provide fairer tests of the efficacy of ECHO programs and would improve understanding of how quickly these programs can be expected to deliver demonstrable improvements in access to and/or quality of care to patients and for the entire population of patients served by the clinic.

Compare presented cases with patients of ECHO providers not presented. Distinguish between outcomes for patients whose cases are presented as part of ECHO programs and outcomes for other patients of participating providers.

Compare ECHO to other telehealth and telemedicine models. A study designed with multiple intervention arms would allow for comparison across similar interventions to determine how Project ECHO outcomes differ and which model may best fit specific conditions, and thus maximize what is learned about each tested model.

Test the incorporation of ECHO into graduate medical education. Formal medical education during hospital-based residency is constantly changing. Residency is an opportune time when new medical doctors and doctors of osteopathic medicine are open to new approaches to practicing medical care. ECHO could be a promising candidate module to design and test in conjunction with an association such as the Accreditation Council for Graduate Medical Education, or the American Board of Medical Specialties Research and Education Foundation.

The evidence for Project ECHO's effects on patient access to care and other patient and provider outcomes is encouraging in many ways. Yet there are clear opportunities to both add to the evidentiary basis of this promising model while progressing toward the Project ECHO goal of touching one billion lives.

SECTION 1.

Introduction

The challenge of access to care in the U.S. Access to health care is a cornerstone of developing healthy communities in the United States (American Hospital Association, 2018). It is a core component of the right to health (World Health Organization, 2017). While commonly understood to mean entry into a health-providing organization, the concept has long been recognized as multidimensional, involving availability, accessibility, accommodation, affordability, and acceptability (Penchansky & Thomas, 1981). Over time, health services scholars have come to understand access as health service utilization that is dependent on affordability, physical accessibility, and the acceptability of those services (Gulliford et al., 2002). More recently, the meaning and importance of health care has expanded to include patient-centered outcomes (Levesque, Harris & Russell, 2013), such as population members' ability to perceive need, seek services, reach those services, pay for those services, and engage in a solution. Thus, health equity is central to the concept of access: If vulnerable or marginalized people in a community do not avail themselves of health services, then access is poor despite its availability.

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How big of a problem is access to care?

- » In 2017, nearly 27.4 million nonelderly individuals were uninsured (Kaiser Health News, 2018)
- » Fewer than half of the rural counties in the U.S. have a hospital that offers obstetric care (Seigel, 2018)
- » An aging patient population paired with nursing retirements means that 1.2 million vacancies for nurses will exist by 2022 (Jimenez, 2016)
- » Forty-nine percent of physicians report often or always feeling burnt out (Sanborn, 2017) with an expected shortage of physicians of between 40,800 and 104,900 by 2030 (Association of American Medical Colleges, 2017)
- » Health disparities are expected to cost \$126 billion by 2020 (PWC, 2015)
- » Four in 10 adults with health insurance say they have difficulty affording their deductible, with 3 in 10 saying they have trouble paying medical bills (DiJulio, Kirzinger, Wu & Brodie, 2017)
- » Middle-class household spending on health care increased 20 percent from 2007 to 2014 while spending on food and clothing decreased (Sussman, 2016)
- » Chronic diseases are a major contributor to rising health care spending; 86 percent of the nation's health care spending is for patients with one or more chronic conditions (Gerteis et al., 2014)
- » Patients living in rural areas are more likely to have multiple chronic diseases and higher mortality rates (American Hospital Association, 2018) as well as financial and transportation barriers to accessing specialty care for chronic diseases (Frank et al., 2015)

Fisher et al. (2017) estimate that almost 90 million residents in the U.S. live in communities designated as Health Professional Shortage Areas. These residents struggle with an insufficient number of health professionals in their communities; they also have to travel far distances to academic medical centers for specialty care. In addition to the barrier of physical distance to care, a secondary barrier is the ability or willingness to travel repeatedly, due to various reasons that are often beyond the patients' control. Lewis et al. (2018) reported that, even if the health care for patients is free of charge, many rural patients would not travel more than 20 miles to receive health care.

The challenge of evidenced-based practice. Since the Institute of Medicine's (IOM) publication *Crossing the Quality Chasm* (Institute of Medicine, 2001), much attention has been paid to the ability, or lack thereof, of the U.S. health care system to provide safe and effective high-quality care for patients. Among the many recommendations in *Crossing the Quality Chasm*, the IOM states that we need an education system that prepares clinicians to meet patients' needs and the needs of a changing health system. In turn this system should ensure that all health professionals be educated in core competencies to deliver patient-centered care as part of interdisciplinary teams, using evidence-based practices, quality improvement methods, and informatics (Institute of Medicine, 2001). The most common barrier to realizing this goal is that what we know may not always translate to better provider performance or patient outcomes (Straus, Tetroie & Graham, 2009). A significant gap exists between the physician's daily practice of medicine and the expansion of medical knowledge (Arora, Kalishman et al., 2017). Moreover, it has been recognized since the 1990s that most clinician learning activities do not result in the application of that knowledge (Davis et al., 1999; Grimshaw, Eccles, Walker & Thomas al., 2002; Moore, Green & Gallis, 2009). Clinicians must not only learn new knowledge and evidence-based practices but also learn how to use those practices in their day-to-day work (Price, 2005).

Project ECHO as a promising solution. Project ECHO (Extension for Community Healthcare Outcomes) launched in 2003 by the University of New Mexico. It responds to the need to provide best-practice specialty care and reduce health disparities, especially in rural areas, by focusing on the expansion of access to care by providing lifelong learning and guided practice for rural health care providers. Arora, Smith, et al. (2017) state, "Project ECHO moves knowledge, not patients" (p. PS267). Created first for treating patients with chronic hepatitis C virus (HCV) infection, as of December 2018 the ECHO model has expanded to 254 sites representing 577 distinct programs addressing one or more of 66 health conditions (website: <https://echo.unm.edu/>). Most of this expansion has occurred in the United States, with 155 sites operating 400 distinct programs in 45 states, but it also includes sites in 33 other countries¹. ECHO leadership has a goal of touching the lives of one billion people by 2025.

Project ECHO incorporates four principles:

- » Use technology to leverage scarce resources
- » Share best practices to reduce disparity
- » Engage in case-based learning to master complexity
- » Use a web-based database to monitor outcomes

The organizational structure of each ECHO program involves a *hub* that is often an urban academic medical center where specialists—often including physician specialists, a behavioral health specialist, social worker, nurse, community health worker and others such as a clinical pharmacist—work as an interdisciplinary team. The hub connects via

¹ Numbers of Project ECHO countries, states, superhubs, hubs, health conditions and programs change frequently; please see the ECHO website for latest numbers, <https://echo.unm.edu/>.

videoconferencing to rural *spokes* that are primary care providers (PCPs) or other health care providers such as community health workers (CHWs). Participants can accrue free continuing medical education (CME) credits, and be reimbursed at higher levels for services delivered.

Specialists and PCPs engage in regularly scheduled one- to two-hour video conferenced *teleECHO clinics*. Knowledge transfer within the ECHO model happens through both didactic and case-based learning (Arora, Kalishman, et al., 2017). The didactic curriculum is generally driven by the hub and consists of brief (10-20 minute) sessions led by scheduled speakers. This is followed by case presentations of de-identified patients within the rural providers' care. Cases are submitted to the experts prior to the session by the rural PCPs, creating a virtual form of grand rounds. Case-based learning and guided practice is a hallmark of medical school and residency education, often expressed with the “see one, do one, teach one” axiom (Rahm & Murray, 2016). Patients are the subject of presentation and discussion during the virtual meetings, they are not participants in these meetings. Outcomes are assessed via questionnaire that must be completed to obtain CME credit for attending each ECHO session.

When a new ECHO partnership with specialists and PCPs begins, the teleECHO clinics focus on straightforward patient cases in the agreed upon type of medical need such as hepatitis C or chronic pain. Between teleECHO clinics, patients continue to be seen by their rural PCPs, who learn by doing. Rural PCPs can contact specialists for consultations between teleECHO clinics. PCPs report back to their video conferenced team of specialists about patient progress during regular teleECHO clinics. Rural patients are thus co-managed by their local provider team and the distant specialists. Over time, more complex cases are chosen as rural PCPs develop specialized expertise.

The system also functions to tie together rural PCPs with each other and the specialists around particular health conditions so that they can exchange experiences in virtual communities of practice. ECHO programs are thus tied together in knowledge-sharing networks that span geographic distance from cities to countries, meeting lifelong learning and guided practice objectives for providers.

Initially, to learn how ECHO works and to establish a new ECHO hub and spoke program environment, interdisciplinary teams of specialists from academic medical centers and hospitals travel to an ECHO training site for two to three days of active learning. After the initial training, specialists return to their places of work to recruit rural providers as spokes to participate in the ensuing teleECHO clinics. Extended and detailed training in specialized care can last for six months. ECHO is a significant time commitment both for urban specialists and for rural providers.

Meeting the demand. Demand from specialists to expand the ECHO approach to new geographic locations and new conditions has not slowed. The University of New Mexico and its partner hubs have created an Opioid Addiction Treatment ECHO, Bone Health ECHO, Cancer ECHO, and Health Services ECHO, among other ECHOs. Hubs are also located within government agencies: The U.S. Department of Defense has six ECHO hubs; the Veterans Affairs Administration has nine.

How has the University of New Mexico Project ECHO staff managed this growth? Initially, the ECHO Institute was the site for all training of medical specialists who would arrive as a team and return to their worksite to begin work as a hub. As demand outstripped training capacity, ECHO responded by developing *superhubs* where hub personnel could be trained and supported in the ECHO model while maintaining fidelity to it. Currently, ECHO has 13 superhubs that function as additional training sites.

As ECHO has grown, the larger ECHO Community of providers has developed its own guiding principles of:

1. Demonopolization (democratization) of knowledge
2. Mutual respect and intellectual honesty
3. Non-exclusivity
4. Fidelity to the ECHO model
5. Empowerment of providers to perform at their maximum capacity
6. Primacy of human relationships/mentoring/sponsorship
7. Commitment to listening/learning
8. Commitment to service
9. Positive communication, motivational interviewing and empathic skills
10. Collective data and community-based research to improve patient outcomes

Superhubs have a charge and capacity to carry out many of the responsibilities of the Albuquerque-based ECHO Institute. These responsibilities include the conduct of outreach, education, model fidelity, maintenance of consistent messaging and use of ECHO logos and trademarks, issuance of intellectual property agreements, operation of trainings in approved workshop formats, recruitment of new ECHO hubs, and access for new partners to ECHO resources including teleECHO videoconferencing and quality assurance tools.

Early responses to the growth and initial results of Project ECHO have been enthusiastic.

Early responses to the growth and initial results of Project ECHO have been enthusiastic. Many of these responses are from high-status sources. For example, the American Academy of Pediatrics operates a superhub, as does the University of Chicago and Hospice UK. Peer-reviewed journal articles about ECHO have appeared in the *Annals of Internal Medicine*, *New England Journal of Medicine*, and *Health Affairs*. The U.S. Congress passed the ECHO Act, directing further federal study of the intervention. Funders have included the GE Foundation, the Helmsley Charitable Trust, the U.S. Centers for Disease Control and Prevention, the Health Resources Services Administration, the Agency for Healthcare Research and Quality, the Centers for Medicare & Medicaid Services, the Bristol Myers Squibb Foundation and the Robert Wood Johnson Foundation.

What's gained and lost when practice leads science. Some of the world's most effective advances in health care delivery do not occur through an orderly and linear research-to-practice pipeline where knowledge generation proceeds to knowledge utilization. Rather, innovations in health care delivery may arise out of a felt need by care delivery personnel and organizations to try something new. Physicians and nurses may become personally exasperated and frustrated with their inability to serve more patients more rapidly. Health care administrators may find that routinized practices and policies reach a point where they function more as impediments to change and improvement than decisions that help patients. The health care industry may also recognize that it has reached a point where costs are abnormally high, yet outcomes are only average. All these conditions contributed to the practice-based creation of Project ECHO.

Project ECHO was a radical departure from the norm that only specialists could deliver specialized care to good effect. In other ways, ECHO was familiar. It used readily available, off-the-shelf videoconferencing technology and the common case-based learning model of medical education. The combination proved attractive: ECHO seemed radical but familiar and not overly difficult to implement. In terms of the medical profession and health care delivery organizations, Project ECHO was viewed as a game-changing model of care delivery that was relatively easy to try and learn. However, ease of use and a perceived relative advantage were not the only, and perhaps most compelling reasons practitioners were willing to try it. Practitioners and organizations were also attending to who else was interested in Project ECHO.

Decisions to adopt an innovation are not often made solely based on evidence of efficacy and effectiveness—does it work, how well, under what conditions, and for whom? Adopters often watch to see who else is adopting or is interested in the innovation. Most medical specialists, just like hospital vice presidents or government and public relations or health care organization CEOs, connect with one another in informal peer networks. These professional relationships serve multiple functions, one of which is the exchange of advice about, and examples of, innovations. There are boundaries to these advice-seeking networks, but in general they connect individuals who perceive similarities with each other. Oncologists listen to oncologists; care improvement directors listen to care improvement directors, and so on. Thus, Project ECHO adoption decisions were also almost certainly being made based on the influence of peers within professional communication networks.

Although grounded initially in practice, Project ECHO leadership understood the necessity of systematic inquiry and study. Early in its development, Project ECHO was the focus of multiple funders of studies and evaluations to learn about ECHO's effect on patients, rural PCPs, specialists and, eventually, on the delivery systems involved. Early results were promising to the point that demand from others to be trained in the ECHO model built rapidly. Over the years, this excitement from the field has not dimmed. Demand keeps ECHO leadership and staff very busy, as does interest from funders to support further expansion to new geographic areas and to new medical specialties. Demand from the field and the preoccupation of staff in responding to that demand can mean that important questions about an innovation, how to best plan for its broader adoption, how to best implement it in organizations, and the fidelity with which an innovation sustains in practice settings, may not get answered in the most carefully considered ways.

Rapid scale up is warranted when an innovation is worthy of being spread, when adopting sites are motivated to learn how to use the innovation and have the capacity to do so, and when support organizations are ready with the technical assistance necessary to help implementing organizations. Rapid scale up can also be an opportunity for continued learning when the centralized host organization responsible for the innovation takes advantage of opportunities to improve the model as they continue expansion, learn about and train others in an appreciation of the model's limitations, and are prepared to attend to whether variants of the original model perform better for particular types of patients and providers, particular diseases, and particular types of settings. Sans continued introspection, however, such forward-learning lessons are easily lost.

Pausing to reflect and recommend a path forward. The purpose of this paper is to assess the evidence about Project ECHO and suggest directions for further development of its evidentiary basis. This review and research agenda are theoretically framed by the diffusion of innovations research and practice paradigm because, to many people, ECHO is still a new idea in how to improve and expand access to health care. Pausing to assess how ECHO performs for patients, providers, and health care organizations is an opportunity not just to coalesce knowledge, but also to identify unanswered questions and make design suggestions for the further spread of this model.

In this paper, we review published peer-reviewed literature about ECHO, first concerning patient access and health outcomes, and second concerning outcomes for providers. Then, we address the prospective steps that might be considered to strengthen the evidence about ECHO while propelling it forward so that its reach can be broadened and its rate of adoption accelerated while retaining high-quality implementation, while maintaining if not improving health equity.

Review procedure. Published studies and reviews about Project ECHO were identified by referring to the bibliography maintained on the project website (ECHO Institute, 2018a) and a more detailed list of publications shared by the Project ECHO staff (ECHO Institute, 2018b), as well as an internet search for other reports and publications relevant to the purpose of this paper. Via these sources, we identified 129 peer-reviewed publications that either reported outcomes of, or reviewed, Project ECHO. Publications appeared between 2007 and 2018, and have been cited more than 1900 times.

Once the full database of articles had been established, each publication was categorized based on the processes or outcomes studied, if any. Outcomes had already been coded by Project ECHO staff in the detailed list of publications (ECHO Institute, 2018b), so their codes were retained for the purposes of the present review of the literature. We used this categorization to identify which articles were relevant for assessing the efficacy and effectiveness of Project ECHO for each outcome in the present paper.

SECTION 2.

Patient Access to Care and Patient Outcomes

Project ECHO was envisioned as a means to accelerate the delivery of specialized care and bring that care to rural patients. ECHO addresses barriers of long wait times for a first appointment, the time and expense associated with long distance travel, and the disinclination to follow through on repeated care appointments in the face of these persistent barriers, all with the additional objective of achieving health equity.

Here, we summarize studies and evaluations of how various ECHO programs have affected these dimensions of health care access for people living in rural areas. Then we consider the evidence from these and other ECHO reports in relation to patient outcomes including patient health, patient engagement, and patient satisfaction.

We begin by reviewing the results of studies and evaluations about access to care for patients with hepatitis C, chronic pain, autism, dermatological problems, and human immunodeficiency virus.

ACCESS TO CARE

Hepatitis C virus. The number of practicing gastroenterologists to care for patients who suffer from chronic hepatitis C virus (HCV) is insufficient. According to Rattay, Dumont, Heinzow, and Hutton (2017), while there are an estimated 13,000 gastroenterologists in the U.S., there are 3.5 million chronic HCV patients, a ratio of 1:269. Thornton et al. (2016) estimate that only about 20 percent of HCV patients receive specialized care and antiviral therapy, while Ryerson et al. (2016) report 10 percent, even fewer of whom are ultimately able to achieve cure. Patients in rural areas face the greatest challenges. Rural HCV patients in New Mexico face an initial wait time of six to nine months to see a gastroenterologist, followed by 12 to 15 visits of several hundred miles each trip to follow through on their course of care. Many patients die while awaiting treatment (Thornton et al., 2016). The widespread nature of this medical condition is not unique to the U.S., as there are approximately 230,000 HCV cases in Australia (Mohsen et al., 2018), 301,500 cases in the Eurasian country of Georgia (Thornton et al., 2016), and 71 million cases globally (Mohsen et al., 2018).

In 2003, Project ECHO began as a way to link urban specialists to rural PCPs, for HCV care. With ECHO, at the University of New Mexico (UNM) hepatitis C clinic initial wait time decreased from eight months to two weeks within the first 18 months of implementation (Arora, Smith, et al., 2017). Although the UNM hepatitis C clinic continues to see patients, the drop in wait time demonstrates the extent to which the ECHO model can alleviate scheduling pressure at the specialty clinic by shifting care to PCPs in rural areas, who are much more accessible to patients and are able to attend to those patients much sooner than the specialists at UNM could. Rural PCPs live in patients' communities and often know patients' families and have been involved in their histories of care. Glass, Waljee, McCurdy, Su, and Sales (2017) reported an average reduction of 250 miles round trip per veteran patient after the implementation of Specialty

The drop in wait time demonstrates the extent to which the ECHO model can alleviate scheduling pressure at the specialty clinic by shifting care to PCPs in rural areas.

Access Network—Extension of Community Healthcare Outcome (SCAN-ECHO) Liver, a hub established by the Veterans Affairs Ann Arbor Healthcare System in Michigan. Its implementation also enabled veteran patients to complete the first consultation about 9.6 days sooner than in liver clinics, resulting in improved timeliness, efficiency, and likely convenience for ECHO patients compared to non-ECHO patients.

The ECHO model and the enthusiasm for its positive impact on HCV patient access to care has spread to other states. Thornton et al. (2016) reported that among the rural PCPs in Arizona and Utah who joined Project ECHO, more than 90 percent came on board despite never having treated an HCV patient with antiviral therapy before. The adoption of ECHO spread not only from New Mexico to other states, but from HCV to other medical conditions such as chronic pain.

Chronic pain. Between 100 and 126 million people in the U.S. suffer from chronic pain, making it a more pervasive and prevalent condition than heart disease, cancer, and diabetes combined (Anderson, D. et al., 2017; Katzman, Comerci, Landen, et al., 2014). Knapp and Pangarkar (2015) reported that for every 28,500 chronic pain patients in the U.S., there is only one certified pain medicine specialist to help them. Chronic pain is a major problem in the veteran population. Between 43 percent (Knapp & Pangarkar, 2015) and 50 percent (Carey, Frank, Kerns, Ho, & Kirsch, 2016; Frank et al., 2015) of all veterans are affected by one or more chronic pain conditions. Approximately 36 percent of these veterans live in rural areas (Carey, Frank, Kerns, Ho, & Kirsch, 2016), making access to specialty care an ongoing challenge for these patients. The number of returning veterans from the wars in Iraq and Afghanistan exasperates this challenge. Knapp and Pangarkar (2015) documented that these wars have meant the return to the U.S. of nearly 50,000 injured troops, many of whom have complex medical problems with chronic pain.

Chronic pain is also a financial burden on national economies, health care systems and society, beyond the burden on patients. In Canada, the wait time to see a pain specialist ranges from six months to five years, costing C\$1,462/month to the Canadian health care system simply to keep patients on waiting lists for pain clinics (Carlin et al., 2018). In the U.S., chronic pain contributes to productivity loss and medical treatments costing approximately \$635 billion annually (Katzman, Comerci, Landen, et al., 2014).

ECHO has been successfully adapted to chronic pain. Implementation of ECHO for veterans in Greater Los Angeles connects specialists at the Los Angeles VA Medical Center (hub) with PCPs in the four surrounding communities (spokes) of Santa Barbara (200 miles away), Bakersfield (210 miles away), Santa Maria (300 miles away), and San Luis Obispo (360 miles away). As a result, this ECHO network saves an average of 287 miles of traveling distance per patient (Knapp & Pangarkar, 2015). This represents a time savings of more than five hours of travel time per patient per visit. This reduction is especially critical for patients who suffer from a high level of pain since traveling long distances can add considerably to discomfort.

Wait times at the Los Angeles VA Pain Management Clinic improved through ECHO implementation. Prior to ECHO, patient wait time for an in-person visit with a specialist was as high as 30 days. Wait time was decreased after one ECHO session per month with PCPs. When ECHO sessions increased to two per month, wait times were reduced by half.

ECHO may improve access for rural patients with chronic pain. Using geographic information systems (GIS) techniques and the national VHA network data, Carey, Frank, Kerns, Ho & Kirsch (2016) estimated that for every 50-mile increase in the distance from a veteran's home to a pain specialty clinic, there is only a 2 percent lower odds of access to a PCP who participates in a Pain SCAN-ECHO program, compared to a 22 percent lower odds of being treated by a pain medicine specialist in an urban area. Contrary to expectations, however, the program appeared to particularly benefit veterans who lived somewhat closer to specialty care (i.e., urban) sites. The study authors concluded that "...the Pain SCAN-ECHO program affected patients with both low and high spatial access to existing specialty pain care" (p. 152).

By receiving diagnostic evaluation from local PCPs, families accessed services an estimated 2-6 months sooner than if they had been referred for evaluation at the nearest autism center.

Autism. According to Baio et al. (2018), about 1 in 59 children in the U.S. are affected by autism spectrum disorder (ASD) and the number of new diagnoses is on the rise. An evaluation of the Missouri-based ECHO Screening Tool for Autism in Toddlers and Young Children (STAT) model (Mazurek, Curran, Burnette & Sohl, 2018) found that 80 percent of the pilot PCPs participating in an autism ECHO clinic reported an increase in the number of children with autism on their case-loads. By receiving diagnostic evaluation from local PCPs, families accessed services an estimated 2-6 months sooner than if they had been referred for evaluation at the nearest autism center. This reduction in wait time eliminated the lag between screening and diagnosis. This reduction is critical because early identification can help children with ASD receive early intervention, which maximizes treatment benefits. Further, rural families saved 173 miles of travel distance (round-trip) by having their children receive care locally. The reduction in travel distance could additionally be important because children with autism sometimes attempt to free themselves from vehicle safety restraints.

Dermatology. Approximately 36.5 percent of patients who visit their PCPs seek medical care for skin-related problems. Improper treatments can lead to serious medical outcomes, such as “a long-lasting infection, increased patient morbidity, and excessive healthcare costs” (Lewis et al., 2018, p. 5). Thus, it is important that PCP visits are quickly followed by appointments with dermatologists. Unfortunately, 32 percent of PCPs report having trouble in referring patients to dermatologists (Lewis et al., 2018). Even when there is a successful referral, access problems remain. For example, in Missouri, most dermatologists practice in Kansas City, St. Louis, Springfield, or Columbia. Rural patients usually have limited or no access to specialists unless they travel to one of these four cities, which can involve travel time of up to five hours each way, especially for patients who live in southeast Missouri (Lewis et al., 2018).

Lewis and colleagues (2018) discussed the case of a 69-year-old woman in rural Missouri who had a skin infection that was misdiagnosed for 63 days throughout all five visits with her local PCP. Despite multiple treatments, there was no relief and her skin infection persisted. After her case was presented by her PCP during an ECHO session with the University of Missouri Department of Dermatology team, however, the patient’s condition was correctly diagnosed. With proper treatment, the patient’s skin condition dramatically improved within a month of the correct diagnosis. This example demonstrates how an ECHO program can help rural patients with skin disease without having the patient repeatedly travel far distances to see a specialist.

Human immunodeficiency virus (HIV). Moeckli et al. (2017) report that 74 percent of rural veterans living with HIV reside at least an hour’s drive away from the nearest VHA HIV clinic. Ness et al. (2017) reported an average travel distance of 30 miles (and up to as far a distance as 598 miles by plane), for HIV-seropositive pregnant patients to reach a specialist. The prevalence of HIV among rural veterans made HIV a promising test of ECHO. Accordingly, three VHA health care networks began implementation of the ECHO model for HIV care in 2012. Moeckli et al. (2017) analyzed qualitative data and shared the perspectives of HIV specialists about the HIV ECHO programs. They reported that specialists believed that ECHO could make care more convenient for rural patients by reducing the required time off from work from a full day to a couple of hours for an appointment. These specialists cited similar advantages of ECHO as other studies have shown, such as reduced travel time benefiting older HIV patients who may find driving long distances to be difficult, which can lead to a reluctance to seek care and missed appointments. Yet Moeckli and colleagues also found that a majority of eligible veteran patients did not take advantage of the local access that ECHO provided, preferring to maintain “a sense of solidarity or group support in the HIV specialty clinic” (p. 330), suggesting a less successful demonstration of ECHO for improving patient access.

PATIENT OUTCOMES

Hepatitis C virus (HCV) and other liver diseases. As of late 2015, Beste et al. (2017) estimated that there are 120,000 patients in the VA system awaiting care for HCV and antiviral treatments. Untreated HCV can lead to complications such as cirrhosis, liver cancer (Beste et al., 2017), hepatocellular carcinoma, and death (Mohsen et al., 2018). In one of the first studies of ECHO's efficacy on patient health outcomes, Arora, Thornton, Murata et al. (2011) reported that sustained viral response rates did not differ between patients treated at the University of New Mexico HCV clinic and patients treated at rural ECHO sites, including patients from 21 rural and prison sites in New Mexico. Results demonstrated equivalency of the ECHO model to face-to-face specialty care.

A more recent study by Su et al. (2018) shows improved survival for patients via ECHO compared to patients who had no liver clinic visit. These authors also reported evidence that the VHA SCAN-ECHO is effective not just for HCV treatment, but for patients with all liver diseases. They reported that patients with hepatitis B, cirrhosis, and cirrhosis complications were more likely to have received care if their providers had participated in a SCAN-ECHO clinic. For patients with and without advanced fibrosis, Su and colleagues found that a SCAN-ECHO visit was associated with reduced mortality in patients. This result suggests a survival benefit for ECHO liver patients that is similar to one found for in-person specialty consultations (Mellinger et al., 2016).

There is also evidence that the occurrence of serious adverse events for HCV patients is lower for patients treated at ECHO sites (6.9 percent) than at academic medical centers, such as at the University of New Mexico HCV clinic (13.7 percent) (Arora Thornton, Murata et al., 2011; Lewis et al., 2018). Lewis et al. (2018) argued that this is evidence that health care is best when delivered to patients who have longer term and sometimes multi-generational relationships with their providers. Furthermore, Beste et al. (2017) found that patients with a VA-ECHO case review were more likely to receive medical treatment for HCV, suggesting that simply making it possible for rural patients to receive antiviral therapy from a local PCP removes an important barrier to treatment for some patients.

Chronic pain. Opioid prescriptions quadrupled between 1999 and 2014 (Anderson, Zlateva, et al., 2017). Opioid analgesic overdoses were responsible for 18,000 deaths in 2014 alone (National Center for Health Statistics, 2015). The negative health outcomes of misuse and abuse of opioids are especially challenging for patients with chronic pain living in rural communities.

In a pragmatic trial of two large federally qualified health centers (FQHCs) with multiple sites in Connecticut and Arizona, Anderson, Zlateva, et al. (2017) compared longitudinal data from patients whose PCPs participated in an ECHO as an intervention for opioid prescription for chronic pain to data from patients receiving usual care. Based on prescription and referral data from the year prior to the ECHO intervention (January to December 2012) and the year after the intervention (January to December 2014), Anderson and colleagues compared the number of patients treated with opioids, the number of opioid prescriptions per patient, and the number of patient referrals to behavioral health specialists across the two study arms.

Statistical analyses supported the efficacy of the ECHO intervention in improving patient health outcomes in the intervention group. Within the intervention group, Anderson, Zlateva and colleagues (2017) reported a statistically significant reduction in the percentage of chronic pain patients treated with an opioid medication in the treatment group, and a statistically significant increase in the number of opioid prescriptions per patient in the usual care group, while there was a non-significant difference in the intervention group. Finally, they identified a statistically significant increase in the number of referrals to behavioral health specialists in the intervention group, while there was no significant difference in the usual care group. These findings suggest increased adherence to protocols, increased referrals to behavioral health and physical therapy, and reduced opioid prescribing.

Diabetes. In 2010, 26 percent of U.S. residents aged 65 years and older had diabetes, a percentage that is projected to increase (Watts, Roush, Julius, & Sood, 2016). Watts and colleagues reported that for patients whose providers participated in SCAN-ECHO, mean HbA_{1c} (or glycosylated hemoglobin, which indicates the three-month average plasma glucose concentration in diabetes patients) dropped from 10.2 percent to 8.4 percent, a statistically significant mean decrease. They concluded that high-risk diabetes patients in rural areas can receive effective glycemic control care from local ECHO PCPs.

Mental health. ECHO has generated positive health outcomes among rural patients suffering from mental health issues. In a study based at the University of Rochester Medical Center between September 2014 and February 2016 involving 10 New York counties, Fisher et al. (2017) examined the impact of Project ECHO Geriatric Mental Health (GEMH) on conditions including Alzheimer's disease, Lewy Body Dementia, post-traumatic stress disorder, generalized anxiety, and depression. After analyzing qualitative interviews with health professionals about their patients, Fisher and colleagues reported that ECHO helped patients with mental health issues improve their quality of life, social and behavioral patterns, and relationships with caregivers, and contributed to a reduction in psychotic symptoms. While these positive outcomes are opinions and beliefs of specialists about their patients, they encourage the expansion of the ECHO model into mental health.

Care transitions. According to Moore et al. (2017), there is a high risk for rehospitalization and death among older adults recently discharged from a hospital to a skilled nursing facility, especially within the first 30 days after discharge. From 2000 to 2006, the hospital readmission rate from skilled nursing facilities increased by 29 percent. In 2013, the Beth Israel Deaconess Medical Center in Boston, Massachusetts, implemented the ECHO model to improve transition care between the medical center and skilled nursing facilities for older adults. In the following year, Moore and colleagues (2017) compared health outcomes between a usual care group and an intervention group for the 12 months of 2014. They reported readmission rates and average length of stay at the skilled nursing facility that were statistically significant lower in the intervention group compared to the usual care group. The readmission rate dropped from 18.2 percent to 15.5 percent for the intervention group while rising from 18.3 percent to 24.3 percent for usual care. In a further analysis after adjusting for baseline rates and covariates, readmission rates were still lower in the intervention group compared to usual care. The average length of stay at the skilled nursing facility was 5.52 fewer days in the intervention group, though there was no difference in the 30-day mortality rate between intervention and usual care groups.

PATIENT ENGAGEMENT

Komaromy, Madden, et al. (2018) argue that patient engagement is strongly associated with health outcomes. These authors defined patient engagement as “behaviors and cognitive-emotional states reflective of patients’ pro-active stance vis-à-vis their health and healthcare” (p. 524). Patient engagement can include health literacy and numeracy, shared decision-making, and feedback for health care quality improvement. Patients who are more “activated” tend to have higher medication compliance and adherence, fewer hospitalizations and less emergency department use, and overall lower health care costs (Greene et al., 2012). The Project ECHO goal “to serve the underserved” (Mohsen et al., 2018, p. 7) presents challenges for the engagement of patients because engagement requires a degree of empathy with the social, psychological, and economic conditions of disadvantaged patients (Belperio et al., 2017).

In a study of patient experiences with ECHO Care, an adaptation of the model for low-income patients with multiple diagnoses and comorbidities, Komaromy, Madden, et al. (2018) reported that while challenging, the ECHO approach could help with patient engagement. They modified the ECHO model to focus on a primary care team delivering care to patients at patients’ homes. Patients reported developing trust with their PCP team due to the providers’ availability for extended interactions, providers’ nonjudgmental attitude and sensitivity to their complex health conditions and material and financial needs, and the opportunity for social interactions for patients suffering from social isolation.

Anderson, Zlateva, et al. (2017) demonstrated that PCPs who participated in a chronic pain ECHO acquired new knowledge and those PCPs reported they became more attuned to the psychosocial aspects of patients who suffer from chronic pain. Through ECHO, specialists helped rural PCPs appreciate that pain treatment requires a comprehensive approach to engagement. PCPs, in turn, were able to help patients to think about pain in a different way, by refocusing their attention away from pain. These results suggest that the ECHO program helps rural PCPs acquire new skills to engage patients in improving their own pain management.

PATIENT SATISFACTION

While studies have examined job satisfaction of providers as the result of participating in ECHO (e.g., Beste et al., 2016; Glass et al., 2017; Mohsen et al., 2018; Sayre et al., 2017), little has been done to understand patient satisfaction. The only quantitative study we identified that relates to patient satisfaction was Anderson, Armstrong et al.'s (2017) HCIA report which showed that patient satisfaction increased from 28 percent to 56 percent after six months of provider enrollment in an ECHO program, and to an even higher level of 71 percent after a full year. In a qualitative study, Mazurek, Curran, Burnette, and Sohl (2018) reported that the ECHO model improved providers' perception of their relationships with families. Mazurek and colleagues presented excerpts of comments made by providers such as "They trust me more" (p. 8) and "There is much more communication and ease w/ these patients" (p. 8). Due to the limited number of studies about patient satisfaction because of provider involvement in ECHO, Sayer et al. (2017) called for a greater focus on this topic.

SUMMARIZING RESULTS ABOUT PATIENTS

The rationale for the creation of Project ECHO was its promise for increasing patient access to specialty care. Given improvements in and wider availability of telecommunication hardware and software, the challenge for ECHO's designers was to increase access without a corresponding loss in quality of care. Since its inception in 2003, evidence about ECHO's efficacy and effectiveness in improving rural patients' access to specialized care has steadily increased (Sayre et al., 2017; Mazurek, Curran, Burnette, & Sohl, 2018).

Across health conditions, the evidence suggests that the ECHO model can improve patient access to specialty care by training and supporting rural practitioners to deliver specialized care to their patients. Studies and evaluations of ECHO programs consistently find that as rural health care practitioners change their caseloads to include patients with specialty care needs, patients travel shorter distances and wait times for diagnosis and treatment are reduced. Reducing these barriers to access to specialty care are especially important for low-income people and hourly employees for whom time off from work and child care can make repeated long-distance visits to an academic medical center difficult, which in turn reduces kept appointments and follow-up care. Some studies have also found that ECHO programs have positive effects on patient health, specifically for HCV, chronic pain, diabetes, mental health and in-transition care, especially at skilled nursing facilities. A few studies suggest that patient engagement and satisfaction is higher among ECHO treatment groups compared to usual treatment groups.

Across health conditions, the evidence suggests that the ECHO model can improve patient access to specialty care by training and supporting rural practitioners to deliver specialized care to their patients.

The studies reviewed here are the products of different study designs, with different types of patients who have various illnesses. There is not as much replication of research as one might want, nor do the published studies address more than 20 percent of the health conditions to which the model has been applied. Some of the studies involve small numbers of providers and patients and a few of them rely on provider self-report rather than direct indicators of patient access and health outcomes. Still, ECHO appears to fulfill its mission of serving the underserved by moving knowledge to rural providers, thus helping their patients overcome the challenges of geographical distance and wait time that make specialty care practically inaccessible for many of them. Patient health outcomes are generally positive, though the literature suggests a need for more work to understand how the model affects patient engagement and patient satisfaction.

SECTION 3.

Provider Outcomes

Innovations that go on to benefit the most people do so in part because they address needs at multiple levels. This is true in the American health care system where the individual-level needs of patients and families and their health care providers are embedded within point-of-care clinics, health care organizations that support and tie together those clinics, nurse and physician professional associations, quality assurance organizations, and federal reimbursement programs. Effective innovations that provide benefit to patients but not to those who provide care or those organizations that employ care providers are less likely to diffuse and sustain in practice.

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In reviewing how the ECHO model affects provider outcomes, we begin by reviewing reports of provider attendance in teleECHO clinics. This process measure, while not itself of high value in leading to more meaningful outcomes, is easily collected and thus often reported in studies and evaluations. It also reflects a necessary precondition for the ECHO model to work. If providers do not continue to participate, patients cannot benefit. We then discuss provider outcomes associated with knowledge and self-efficacy. There is less to share about changes in provider behavior but there is some evidence about this to report. Lastly, we review results of provider engagement as an indicator of interest, enthusiasm, and commitment.

Provider attendance. Some ECHO programs purposely select participants and/or require attendance as part of a research study, while others are structured on a purely voluntary basis, which can better reflect actual practice constraints and incentives. A practitioner-champion at the rural site (a spoke) or at the central hub can improve provider attendance. Project ECHO provides tools to assist with tracking and conferring CME credit for each ECHO clinic session, which requires attendance. The hub teams record and monitor attendance.

Many studies report on attendance, typically identifying the number of participants overall, the average number of participants in weekly sessions, and the number of workshops participants attended overall. Below are just some of the many studies that included attendance information:

- » An ECHO program adapted to Substance Use Disorder (SUD) in India (Chand et al., 2014)
- » The VA system's Specialty Care Access Network-Extension for Community Health Outcomes (SCAN-ECHO) (Ball, Wilson, Ober & Mchaourab 2018)
- » The SCAN-ECHO program to address women's health issues broadly across three VA systems (Cordasco et al., 2015)
- » The ECHO model adopted by the United States Air Force Diabetes Center of Excellence (Swigert, True, Sauerwein & Dai, 2014)
- » An ECHO program created in Ontario, Canada, for chronic pain (Dubin et al., 2015)
- » A program in the Pacific Northwest that addresses multiple sclerosis (Johnson et al., 2017)

- » The Chronic Regional Pain Syndrome (CPRS) ECHO model hosted by the University of New Mexico and delivered at 191 sites, across 29 states and the District of Columbia (Katzman, 2013)
- » A cervical cancer screening ECHO model in Texas (Lopez et al., 2017)

A few studies did look critically at attendance patterns. For example, Ball, Wilson, Ober and Mchaourab (2018) noted that clinicians who answered surveys had a median attendance of 28 sessions compared to a median of seven sessions for those clinicians who did not complete an outcomes survey. Coradaso et al. (2015) found that clinicians with dedicated time allotted by their organization to participate attended 78 percent of teleECHO sessions while clinicians at systems without dedicated time only attended 14 percent of the total sessions despite sessions being held during provider lunch hours. Swigert, True, Sauerwein and Dai (2014) note that scheduling constraints were cited as a reason for not attending. Johnson et al. (2017) found that providers with more patients attended more sessions.

We could not, however, discern patterns of results across the many studies reporting on attendance. It is possible, for example, that no two participants in any ECHO program attended all the same sessions. This possible variation in training experience might suggest that each primary care provider is exposed to a somewhat different intervention. However, the design of the program allows for repetition of content across teleECHO clinics, thereby increasing the likelihood that participants who attend somewhat regularly may be exposed to the same or similar content. Other than provider internal motivation and lack of time, which have been suggested by some studies, we find little evidence about motivation of PCPs to attend sessions.

Provider knowledge and self-efficacy. ECHO programs provide CME credit, and many programs require at least some assessment response to receive the credit. The basis for CME credit often draws on Moore's framework for assessing CME activities (Moore, Green, & Gallis, 2009). Using this framework, declarative knowledge (what the activity intended them to learn) and procedural knowledge (how to do what the activity intended them to learn) can be measured by pre-post comparisons of knowledge. Participants' ability to do what the activity intended can be measured by observation of the activity or by self-reported competence/efficacy or intent to change.

Regardless of method, time point, or context, nearly all studies or evaluations reporting on provider knowledge and self-efficacy indicate an improvement in these provider outcomes. We summarize a select few studies below to demonstrate knowledge and self-efficacy outcomes associated with a variety of ECHO programs.

- » Project TEACH (Tobacco Education and Cessation in the Health System) extended the ECHO model to smoking cessation with clinical staff at MD Anderson's Tobacco Treatment Program by offering mentoring via teleECHO clinics to rural providers in Local Mental Health Authorities (LMHAs) in Texas (Cofta-Woerpel et al., 2018). In one small study, 17 of 22 responding providers had previous tobacco cessation training and a moderate to high ability/confidence to address tobacco dependence with patients prior to participating in the program. Despite providers' high pre-program knowledge scores (answering 69 percent to 85 percent of items correctly), 13 of 22 believed that the program improved their practice in at least one area and planned to make a practice change as a result (Cofta-Woerpel et al., 2018).
- » Project ECHO for Diabetes (Endo ECHO) connects 10 health care centers across New Mexico with medical experts to facilitate management of complex diabetes in medically underserved communities. Bouchonville et al. (2018) measured self-efficacy pre- and post-intervention with PCPs. After two years of participation in the program (95 sessions), PCPs reported a 60 percent increase in self-efficacy.

- » An ECHO program for hypertension management created a network of six urban FQHCs in Chicago and evaluated provider knowledge and confidence between intervention and control clinicians after 12 bi-weekly ECHO sessions (Masi et al., 2012). Knowledge and confidence in caring for patients with hypertension increased from baseline to program end in the intervention arm but not the comparison condition in this small nonrandomized sample (12 providers participated, with nine providers self-selecting into ECHO and three only completing surveys as a comparison arm).
- » The U.S. Indian Health Services participated in an ECHO Pain program as part of a mandated training in substance use disorder (Katzman, Fore et al., 2016). From January to June, 2015, 1,315 clinicians from 28 states participated in the training with 1,079 completing pre- and post-training surveys. Unlike other ECHO interventions, this training was conducted at a single point in time. Survey results suggested improvement in knowledge and self-efficacy as measured with standardized scales in pre- to post-training improvement. Knowledge scores on the KnowPain-12 scale increased from 58.9 percent to 63.19 percent (on a 0 percent to 100 percent scale). Similarly, after the U.S. Army rolled-out ECHO hubs and spokes nationwide in their medical system, surveys of providers indicated increased knowledge in pain management of all participants after a two-day intensive training with the ECHO Pain program (Katzman, Galloway, et al., 2016).
- » Sustained knowledge was reported in one study conducted at the Gumballi primary health care center in southern India (Hariprasad et al., 2018). Twenty-seven rural health providers participated in a three-day training about cancer screening procedures supplemented by ECHO sessions every two weeks. Although the most significant gain in knowledge (from 6 to 13 out of 15 total points) was seen after the three-day training, the average knowledge score increased to 14.4 points at the end of six months, after 10 bi-weekly ECHO sessions (Hariprasad, et al., 2018).
- » Furlan and colleagues (2018) measured dose in their chronic pain ECHO program in Ontario and found no difference in knowledge gain with increasing session attendance or with case presentation (compared to attendees who did not present a case).
- » When reviewed over time, an evaluation of the SCAN-ECHO programs in the Pacific Northwest VA system found that clinicians (comprising 88 respondents out of 159) who attended sessions for longer than one year had higher knowledge increases, improved self-reported confidence, and improved self-reported patient access and care coordination. Clinicians also recorded higher feelings of team integration compared to clinicians with less than one year engagement with an ECHO program. Providers attending for more than a year also reported improved usefulness in guiding care of other patients in their panels (Beste et al., 2016).
- » A modified ECHO model within the VA SCAN-ECHO program for training providers to care for transgender veterans found a 40 percent increase in confidence among 13 respondents from the first 33 provider participants in the program (Kauth et al., 2015). After 111 providers participated in the program and presented 39 cases of veterans during the sessions, other outcomes in addition to increased knowledge were noted including team cohesion and increased willingness to treat additional transgender veterans (Shipherd et al., 2016).

- » The ECHO model has also improved knowledge and confidence in non-medical providers. Community Health Workers (CHWs) have variable training, and there are no standardized core competencies across U.S. states for CHWs. Few states have any required CHW certification. Through ECHO programs, CHWs have been trained to become part of diabetes care teams. An evaluation of 23 CHWs who participated in a three-day in-person training and weekly ECHO sessions for six months found increased self-efficacy to provide care and satisfaction with expansion of role and the opportunity to learn (Colleran et al., 2012). Further evaluation of additional cohorts of the program demonstrated a 13 percent increase in confidence from pre- to post-training for 101 participants and a 7 percent improvement in knowledge scores (Zurawski, Komaromy, Ceballos, McAuley & Arora, 2016). Most CHW program participants have no more than a high school diploma and five years of work experience (Komaromy, Ceballos et al., 2018).

Studies reporting provider outcomes of knowledge and self-efficacy appear to show gains. Moore’s CME framework could provide some consistency in measurement about knowledge and self-efficacy, but not all providers seek credit and not all assessments of knowledge and confidence are part of CME evaluation. The ECHO Institute promotes the use of standard scales of knowledge and confidence across programs. ECHO program teams can also design their own scales for those assessments as part of conferring CME credits.

Provider practice change. For health care providers, Project ECHO focuses on changes in knowledge and subsequent behaviors. A focus on prescribing behaviors was the intent of a chronic pain SCAN-ECHO study across the Veterans Administration (Frank et al., 2015). A total of 322,435 patients with chronic pain saw a PCP in one of seven VA hospitals with a SCAN-ECHO program. An adjusted analysis indicated that SCAN-ECHO consultation resulted in a significant increase in physical medicine and rehabilitation among patients whose providers participated in ECHO compared to patients of providers who had not sought SCAN-ECHO consultation. Provider participation was also associated with significant increases in antidepressant and anticonvulsant initiation in patients. The use of opioid medications did not increase in patients of participating providers (Frank et al., 2015).

A hybrid ECHO model was created to extend the training of providers about the use of an observational assessment for autism—the Autism STAT (Screening Tool for Autism in Toddlers and Young Children)—to allow PCPs to diagnose children with clear signs of autism and identify those requiring further specialist assessment. Moore, Green & Gallis (2009) found that 16 of 18 providers using Autism STAT achieved reliability in its use through the ECHO program. One hundred percent of respondents (up from 80 percent) reported using the Modified Checklist for Autism in Toddlers (M-CHAT) or other screening tools after training, and well-child visits where the tool was administered increased from 65 percent to 91 percent (Mazurek, Curran, Burnette & Sohl, 2018).

Health care providers have reported that participating in teleECHO clinics reduces their feelings of isolation.

Provider communities of health care professionals. Health care providers have reported that participating in teleECHO clinics reduces their feelings of isolation by providing a virtual community to interact with around patient care and feeling supported and encouraged by ECHO experts (Katzman, Comerchi, Boyle, et al, 2014). Providers also said that they felt that they had “backup” for their most challenging cases (Dubin et al., 2015). Focus groups with regular participants in the ECHO Pain program suggested that providers acquired information they were “able to apply directly to help the patients” and had used slides from the program to educate patients and pharmacists locally (Shelley et al., 2017).

Some ECHO programs actively attempt to create a community of care by recruiting rural champions of the program at that site (e.g., Katzman, Galloway et al., 2016), or by training providers who self-select into a challenging area, such as

transgender care, and who then report planning to treat more patients (Kauth et al., 2015). This community of care also extends to the hub experts. When the U.S. Army created its own ECHO Pain hubs, focus groups of hub experts reported increased communication between faculty and spoke-site general practitioners from participation in the ECHO program as well as appreciation for interdisciplinary care with expanded roles for pharmacists and behavioral health specialists (e.g., Katzman, Galloway et al., 2016).

In a program using ECHO to improve inter-professional communication and reduce medical errors during care transitions, post-acute care providers felt that discussing all patients discharged to their facility (10-20 patients per week) enhanced their communication and provided much needed information to better care for patients and improve care transitions. Providers identified and rectified more than 100 medication discrepancies over a two-year period (Farris et al., 2017). No significant change in knowledge was noted after the program; however, self-reported behavior improvement included more communication with outside providers, checking for understanding during discharge counseling, and feeling comfortable transitioning complex patients (Vanka, Farris, Bortinger, Huan & Mattison, 2015). In the evaluation of the Integrated Addictions and Psychiatry teleECHO program, Komaromy, Bartlett, Manis & Arora (2017) found that 77 percent of the 84 participants returning a survey reported making changes to a patient care plan.

Qualitative results suggest that participating ECHO providers sometimes transfer their ECHO-based learning across their entire patient panel and some described the positive experience of becoming the local expert or champion to their peers (Katzman, Comerci, Boyle, et al, 2014). This experiential spillover follows the learning theories upon which ECHO is based and provides an opportunity for ECHO participants to solidify the knowledge they have gained through ECHO by teaching others in a “train-the-trainer” or a “see one, do one, teach one” approach.

SUMMARIZING RESULTS ABOUT PROVIDERS

Regardless of sample size, sampling strategy, length of sessions, frequency of sessions, expert hub, or end-user clinician, increases in either actual knowledge or provider self-reported knowledge because of ECHO were reported. Increases in self-efficacy to treat the condition in question were also found.

In some of these studies and evaluations, rural providers also reported that because of participation in ECHO, they felt that they belonged to a larger community of care, or that they had become the local “expert” for answering peers’ questions and seeing patients locally. Results like these suggest that especially for rural PCPs, participation in ECHO is meaningful for one’s career and sense of self.

From a provider perspective, Project ECHO appears promising based on published studies and evaluations. Nevertheless, there is much that we do not know about impacts on providers, especially specialists. We suspect a selection bias; provider participation is likely highly dependent upon self-selection/motivation to participate in an intervention like ECHO, let alone become a champion at a hub or spoke location. If participation is not made a priority or supported by the organization, it can be nearly impossible for all but the most dedicated expert or rural provider to sustain their engagement in an intervention like ECHO.

As a general type of process innovation, ECHO has been reinvented over time by its designers from condition to condition and from patient population to population. ECHO has undoubtedly also been subject to unrecorded, unstudied adaptations in the field by practicing health care providers. These planned and unplanned alterations to the ECHO model reflect well on its continued potential growth. These changes also contribute to knowing less about ECHO’s efficacy and effectiveness than one might like.

Many of the published studies about provider outcomes are the products of weak study designs and necessarily biased samples. Pre- and post-intervention surveys can produce valid and reliable data, but when results are based only on those few providers voluntarily responding (which is often the case here), formal tests for effects cannot be conducted. Several of the reviewed studies involved a treatment and usual care comparison. This is typically a stronger design, but we see fewer of them perhaps because the data were collected for evaluative purposes and not for research and because such studies of providers directly or indirectly through administrative/HER data are often only possible in organizations such as the VA or other integrated health care systems.

SECTION 4.

Next Steps With a Research Agenda

As described in the preceding sections, a body of research now exists examining the effects of Project ECHO on access to care and patient outcomes of several types, as well as research that has assessed how ECHO affects the health care providers who participate in teleECHO clinics. For the present white paper, we culled evidence from journal articles about ECHO programs that we had screened from all ECHO publications catalogued on the Project ECHO website that is maintained and updated by staff at the ECHO Institute in Albuquerque. Our emphasis was on peer-reviewed journal publications that report the results of empirical studies about ECHO programs in the field, though we reviewed other publications as well.

The preponderance of evidence from the publications we reviewed for Section 2 of the present report suggests that Project ECHO improves patient access to specialized care. That it does so without lessening the quality of the care received by patients is less certain, though some of the reviewed studies do inspire confidence in such a claim. It would be remarkable if the Project ECHO model can increase access with no loss of care quality, as increases in scale and efficiency often produce real or perceived decreases in quality of care. Indeed, a delivery model that expands access for disadvantaged populations might be deemed acceptable even if it produced somewhat lower quality of care, on the basis of health equity objectives.

Specialists and PCPs may benefit from Project ECHO as well. Several studies we review in Section 3 indicate that participation in ECHO is satisfying for specialists and for PCPs, and does successfully “move knowledge.” Positive outcomes for rural primary care providers, in particular, is important: Just as recruitment and retention of physicians to rural areas has become a major challenge, it is forecast that the U.S. will require 52,000 more primary care doctors by 2025 (Pettersen et al., 2012). Just as important, and alarming, is the continuing closure of rural hospitals and of specialties such as obstetrics in many of those rural hospitals that remain (Seigel, 2018). Perhaps Project ECHO is one way to encourage more physicians to practice in rural areas and or to stay there by helping them feel more connected to a community of practitioners and enabling them to achieve continuing education goals.

The studies reviewed in the current report are mostly of an evaluative nature, carried out by the teams of specialists trained to deliver ECHO and their research colleagues so that they could get a sense of how well the intervention was performing. These studies have tended to be pragmatic, some the result of convenience, some of rather modest scale with few providers and patients involved. These studies have not necessarily been designed to rule out alternative explanations for the observed results at patient, provider and clinic level and therefore leave many questions unanswered, including questions about improved patient access to high quality care, other patient outcomes, and impacts on providers. Published studies have been specific to conditions (e.g., liver disease, HIV) and location (e.g., New Mexico, Washington, VA Centers) but few studies have been conducted concerning outcomes such as access to care, health outcomes, patient engagement or provider learning that involve multiple interventions, multiple locations, or many points-in-time measurement. It is also the case that in the effort to train teams of specialists that then work to recruit rural partners and implement the intervention, key questions about how this model scales, including how it diffuses, how it is adapted or modified, and how or if it is sustained have not yet been studied in ways that rule out alternative explanations for observed results. This observation of ours is not a criticism that is particular to Project ECHO. This is the normal state of much health care practice-based evaluative work performed by people who are excited about the possibilities that a new care model may really make a difference.

So a health services researcher might be left to wonder just how the model works and why, for whom, under what conditions, and as compared to alternatives and usual treatment. Project ECHO leaders and key stakeholders recognize the need for additional studies. Initially, studies were needed to meet the needs of early funders of Project ECHO. At the same time, demand from newcomers to be trained in the ECHO model built rapidly. Now, with application of ECHO across many health conditions and geographic settings, there is an opportunity to step back and consider which type of knowledge about this promising intervention is most important to generate at this time so that more people can benefit from this model of care.

Here we offer several suggestions for more systematic study of Project ECHO. We begin with a call for three types of pragmatic research that can improve existing and new deployments of ECHO. While we prioritize these three suggestions, it is entirely plausible to roll them together into a plan for improvement. They deal with ECHO implementation in the field; effectiveness of the model across health conditions and settings; and formative evaluation to make the further diffusion and scale up of ECHO as efficient as possible.

Also called for is more use by decentralized ECHO evaluation and study teams of standardized patient measures, and research designs that enable high degrees of confidence in assessing patient access and provider engagement and learning. Lastly, we call for pilot work to test ECHO as a component of graduate medical education for new medical doctors during their hospital-based residencies.

PRIORITY 1: EVALUATE ONGOING ECHO IMPLEMENTATIONS IN THE FIELD

Implementation science is the study of what happens after adoption of an innovation occurs, especially in organizational settings (Century & Cassata, 2016). A wide variety of frameworks for cataloguing the factors important to effective implementation of innovations in health care settings now exists (e.g., Birken et al., 2017). This burgeoning field of research is increasingly codified and useful for improving practice in the field (Brownson, Colditz & Proctor, 2018). Examples of implementation research questions include:

- » What proportion of health care organizations invest resources in ECHO adoption (taking the time to learn about the program, attend trainings, train-the-trainer materials, become certified as coaches, etc.) but then never implement the program, and why?
- » What proportion of adopting organizations actually offer an ECHO program but then discontinue or pause it?
- » How many organizations stay in a holding pattern of adopting/not implementing/not discontinuing?
- » What is the yield rate of specialists recruiting PCPs in rural areas?
- » What proportion of ECHO implementers offer the program as its designers intended with the same content, same number of modules, same behavior stimuli, same support and checks on enrollee or client performance? Is ECHO ever offered exactly as taught? Is such precise fidelity even desirable?
- » What types of adaptations to the ECHO model do implementers make? Do they offer all the program's core components and with what regularity? Are they true to ECHO's theory of behavior change? Do they drop some components, customize others, and/or create their own to better suit their health care organization and their patients?
- » Does implementation of ECHO change in ways unanticipated by the ECHO Institute designers? Is collection of field-based process evaluation data assessed and used by ECHO Institute staff to monitor and consider improvements to ECHO as it is deployed?

- » Does learning the ECHO model serve as a trigger or precipitating event for hub-based health care organization decision-makers to adopt other, consonant or complementary telehealth or telemedicine programs?
- » Do hub-based implementers think they are offering ECHO as the designers intended but, in practice, do something quite different?

Since the ECHO model relies on an initial in-person off-site training at the ECHO Institute and at its superhubs, and can be augmented with other trainings offered through the ECHO Institute including in online formats, it is important to understand the effective transfer and persistence of the principles and manifest components that characterize the ECHO model. Training research, much of it focused on measuring transfer of training back to practitioners' sites of work, could be applied to ECHO so that training assessments and improvements could be reliably made (Baldwin, Ford & Blume, 2016; Bell, Tannenbaum, Ford, Noe & Kraiger, 2017). Field-based research at ECHO sites could be used to study fidelity to the ECHO model, correct understanding and implementation of both conceptual principles as well as manifest components of the model, identify fidelity-consistent and fidelity-inconsistent adaptations by implementing teams (made knowingly or not), including what sorts of peripheral (non-causal contributory) components have been added to ECHO and with what effect (Hoekstra et al., 2017; Mowbray, Holter, Teague & Bybee, 2003; Rabin et al., 2018; Stirman et al., 2015), as well as what purposeful reinventions of the model have been made at superhub, country, or health care system levels of analysis by ECHO advocates and system leadership so that ECHO is compatible with new contexts (Larson, Dearing & Backer, 2017).

Field-based research at ECHO sites could be used to study fidelity to the ECHO model.

Research and evaluation about health-related interventions usually ends along with external funding, whether the research is testing the efficacy of a new health promotion intervention or assessing the effectiveness of a broader scale community-oriented program. For several decades, researchers of health, governmental, and education programs have been exploring research questions concerning what happens in adopting organizations and their communities after external funding stops (Bamberger & Cheema, 1990; Goodman, McLeroy, Steckler & Hoyle, 1993; Scheirer, 1990; Yin, Heald & Vogel, 1977). Sustainability research about the persistence of implemented innovations could be conducted to answer questions such as:

- » To what extent do hub health care organizations and PCPs in rural areas continue in their participation, financial support and FTE support for ECHO? Has ECHO become a part of routine health care service in these organizations?
- » In what proportions are each of the ECHO model components sustained in practice?
- » Which aspects of the model are least popular with providers and why is that the case?
- » Does enthusiasm among rural PCPs persist? What are the post-treatment opinions of patients in rural areas?
- » Is fidelity to the ECHO model, or adaptation to it, a better predictor of sustainability of offering the model and of its effects on providers and patients?

Sustainability is the continued use of program components and activities for the continued achievement of desirable program and population outcomes (Scheirer & Dearing, 2011). Measurement of sustainability is necessarily closely related to the measurement of model fidelity (Stirman et al., 2012; Stirman & Dearing, 2019). The likelihood of sustainability is heightened when there is an alignment, compatibility, or convergence of (1) problem recognition in the external organizational environment or community, with (2) the program in question, and (3) internal organizational objectives and capacities.

Concerning ECHO programs, for hubs there is a significant amount of time required to create the curriculum, coordinate the trainings, review the submitted cases, and manage the assessments and awarding of CME credit and other outcomes. Resources are available from the ECHO Institute to assist in some of these processes; however, there still must be organizational and/or other funding support for experts at the hub locations for each program. Sometimes this commitment is funded by the state, by the organization, or by grants (federal or foundation). In some studies, the expert time has been reported as donated or volunteered. This could be problematic for expansion/dissemination if the experts are not in an academic medical center where this is feasible or rewarded. One review (Khatri, Haddad & Anderson, 2013) reported on the logistics and budget involved in creating a new ECHO program in a new content area and context (Kauth, 2015). Organizational budget and support was required not only for the experts, but for a full-time program manager to coordinate the invitations, registrations, curriculum, and other day to day running of the ECHO program. Data analysts were required to manage the evaluations and outcomes. There is also the time required for experts to attend in-person ECHO boot camps and trainings at the University of New Mexico or at a superhub to understand how to replicate the model with fidelity in the new context/condition. The U.S. Army replication of the ECHO program also described challenges with competing demands and lack of dedicated time for primary care clinicians to attend sessions that led to low attendance (Katzman, Galloway et al., 2016).

Several potential research designs could be relevant for use in a study of ECHO sustainability, with each one emphasizing different research questions and different aspects of sustainability. If data can be collected from a large enough number of organizations that have implemented ECHO, some of which report they have not sustained it, then statistical models can assess the strength of relationships between the hypothesized set of influencing factors (independent variables) with one or more sustainability outcomes, such as the number of components or activities sustained within each organization, number of clients who accessed health care from clinicians involved in ECHO, or the presence or absence of teleECHO clinics while controlling for underlying differences among the health care delivery organizations or clinics in the study (O'Loughlin, Renaud, Richard, Gomez & Paradis, 1998). Potential sources of bias in this type of research are that non-sustained teleECHO clinic staff may be less likely to respond to data collection requests, and it may be more difficult to locate knowledgeable respondents for ECHO programs that were not sustained.

Tracing the processes that occur in organizations that implement and sustain teleECHO clinics, along with parallel examinations in organizations that did not sustain, can be illuminated by in-depth case studies about what happened and why in each organization (Stetler, Ritchie, Rycroft-Malone, Schultz & Charns, 2009; Wright, 2009). Indeed, for answering certain research questions concerning implementation and sustainability, multi-method case study research that includes site visits by the researchers to interview multiple informants per site would be particularly valuable to obtain and compare the perspectives of diverse persons involved with ECHO at the study sites. Strong methods are available for cross comparisons of multiple cases to generate valid conclusions (Yin, 1984). An example of comparative case study research about program sustainability is Savaya, Spiro, and Elran-Barak's (2008) study of social programs in Israel, which included analysis of program characteristics, host organization factors, and environmental factors.

PRIORITY 2: ASSESS THE ROBUSTNESS OF THE ECHO MODEL

As interventions are validated in terms of efficacy, a frequent next step is effectiveness research to learn the extent to which observed effects during controlled efficacy trials replicate when the intervention is implemented in close-to-normal practice conditions. Chief sources of variance that could affect the efficacy of ECHO include different health conditions, different organizational types, and different geographic contexts. ECHO proponents naturally want ECHO to work well across a range of conditions, organizations and places. Does it? The question here is one of robustness: The extent to which

an intervention will be effective across a range of health conditions, organization types and population settings, and, thus, be a good candidate for broad or alternatively, delimited, spread. While some external validity research is conducted at a formative point in time prior to dissemination to potential adopters of an intervention, external validity research can also be conducted post hoc, though the latter necessarily is shackled with research designs that do not rule out as many alternative explanations for observed results as do a priori designs that are put into place before dissemination. A mix of research methods can be usefully applied in either case (Leviton, 2017). An external validity study could answer:

- » Are medical specialists of some types more favorable towards and more likely to participate in teleECHO clinics?
- » Do PCPs in rural areas more readily learn some medical specialties rather than other medical specialties?
- » Does type of local health care delivery organization matter in patient willingness to adhere to care recommendations?
- » Does ECHO improve patient access to care depending on country level health care infrastructure?
- » Is financing for ECHO better sustained in certain types of countries and certain types of health care delivery systems?

Every new site where a model like Project ECHO is deployed is distinct. Those distinctions are made more unique if a new application of the model is to a different health condition, a patient population with important different characteristics, or to a delivery system that is different in some consequential ways from delivery systems that have previously been engaged in implementation (Cronbach, 1982). ECHO could be studied by systematically varying one or more of these types of characteristics, as well as by using longitudinal methods to compare processes and results over generations of sites (Aarons, Sklar, Mustanski, Benbow & Brown, 2017). It is in these areas where the evidence for ECHO is probably least well developed. Tests of ECHO's robustness across one or more of these types of variation, if incorporated in a carefully considered research design, can provide estimates of the model's external validity (Leviton & Trujillo, 2018). Understanding the robustness of ECHO for international implementations is particularly vital given the wide variance that characterizes the institutional contexts prevailing in many low- and middle-income countries as they relate to innovations and prospects for diffusion (Zanello, Fu, Mohnen & Ventresca, 2016).

Every new site where a model like Project ECHO is deployed is distinct.

Compare ECHO effectiveness across locations. Only five studies about access to care and health outcomes have been conducted at hubs outside of the U.S. (two in Argentina, one in Canada, one in India, and one in Australia), even though ECHO hubs are now located in 33 other countries. Excluding the studies conducted by the Veterans Health Administration (VHA), which cover several geographic areas, evaluations have also been conducted at fewer than 10 of the 155 hubs in the U.S. (in New Mexico, Utah, Arizona, Massachusetts, Washington, and Missouri).

When it comes to location, for example, Carey, Frank, Kerns, Ho, and Kirsh (2016) found that for some of the Veterans Affairs' SCAN-ECHO hubs, increasing distance to specialty care was not strongly associated with the odds of having access to a participating SCAN-ECHO provider. In two health networks they examined, greater distance to specialty care corresponded to better access to SCAN-ECHO providers, but in the other five health networks, greater distance actually corresponded to less access. In other words, although some networks were able to accomplish the ECHO goal of providing access to the most rural and geographically disadvantaged groups, the majority were still providing better access to care for those already living closer to urban specialty clinics.

In addition, of the 31 published studies, 11 have been conducted by the VA, which introduces other challenges with generalizability. Specifically, Sayre et al. (2017) report that “the VHA, unlike much of the U.S. healthcare system, is fully integrated, employing salaried PCPs and specialists, and an electronic health record, thus generalizability...may be limited” (p. 32). It is unclear whether the findings from VA studies (which provide some of the strongest evidence available about patient outcomes from Project ECHO) can be generalized to other areas that may have very different health systems.

Compare ECHO effectiveness across health conditions. According to the Project ECHO website (ECHO Institute, 2018c), there were 254 sites with 577 distinct programs addressing one or more of 66 health conditions in 34 countries as of December, 2018. Existing studies, however, evaluate outcomes for only 13 of the 66 health conditions; 18 studies report outcomes relevant to access to care, and 21 report outcomes relevant to quality of care. The impact of Project ECHO on patient outcomes for the remaining 53 of 66 focus areas listed by existing hubs has not yet been formally evaluated and published.

At least one study suggests that Project ECHO may not be universally effective. For one, when Moeckli et al. (2017) attempted to implement an HIV ECHO as part of the Veterans Affairs’ SCAN-ECHO network, they found that reach and adoption were extremely limited. None of the three sites where the HIV ECHO was implemented maintained the program for the duration of the study, and only 6.1 percent of eligible veterans were seen through HIV ECHO during that time, regardless of their travel time to the specialty clinic. There were several barriers to uptake of the HIV ECHO model identified in the study. In particular, many specialists were reluctant to give up ownership of HIV treatment to PCPs, and many patients shared this sentiment—many had longstanding relationships with clinicians and wanted to keep their care centralized at the specialty clinic, even if that meant long travel times. Many specialists felt that HIV care was special and so should not necessarily be integrated with primary care at all. They noted that HIV care involves a much higher standard of individualized, integrated care than is typical in primary care clinics, and this type of care is simply not sustainable in unspecialized settings (i.e., one person cannot have all of the knowledge and time necessary to provide comparable care). Some specialists also noted that treatment loops may be too slow in HIV to make the Project ECHO learning process very helpful—learning cannot be re-implemented across patients as learning can for a rapidly-treated disease like HCV. The authors conclude that the ECHO model is not very well suited to HIV care, though they suggest that the model could work in areas where there are no specialists available and PCPs have been tasked by necessity with delivering HIV care.

A study by Cordasco et al. (2015) suggests that ECHO may not be as well suited to broad health care topics as it is to more specific diseases and conditions (though also see Anderson, Armstrong et al., 2017; Catic et al., 2014). When the VA attempted to implement a women’s health clinic as part of their SCAN-ECHO program, researchers found that many providers felt a tension between the breadth of topics covered in ECHO lectures and the specificity of their caseloads. Providers sometimes wanted to present cases that were not relevant to the lecture being given in a particular week (e.g., having a gynecology-related question in a week when a cardiologist was speaking), which led some providers to seek other ways of getting information.

Because of concerns that Project ECHO may not be equally effective across contexts and conditions (and thus more effective for certain health conditions, organizational types and locations), it is clear that more studies are called for that compare how the model performs in diverse situations.

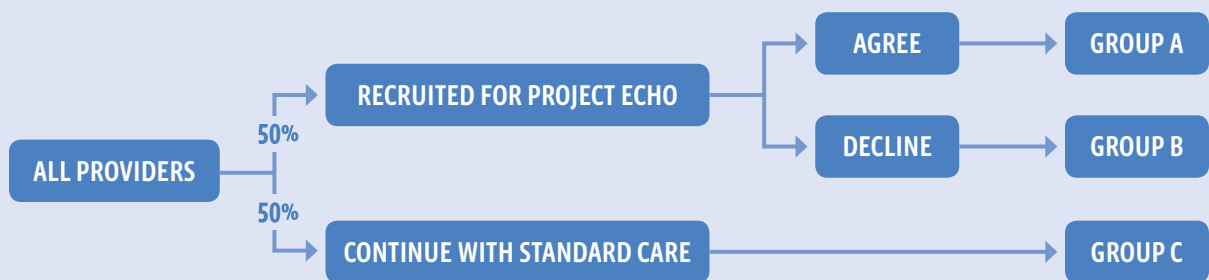
To increase confidence in the robustness of ECHO’s impact on access to care and quality of care, the model should be evaluated across a wider range of conditions and geographical locations for which hubs currently exist. As hubs undertake to fill this gap in the literature, it would also be helpful for future studies to employ designs that more readily enable comparisons across sites or locations (e.g., see Figure 5) and that employ a combination of methods so that explanation for observed effects can best be understood (NIH Office of Behavioral and Social Sciences, 2018). Combining diverse methods of study can be focused on better description of ECHO as actually implemented, enable more persuasive inferences about causality,

enable better assessment of how the theory of change underlying ECHO and its key components are operationalized and delivered, and better account for the perspectives of medical specialists and PCPs (Leviton, 2017).

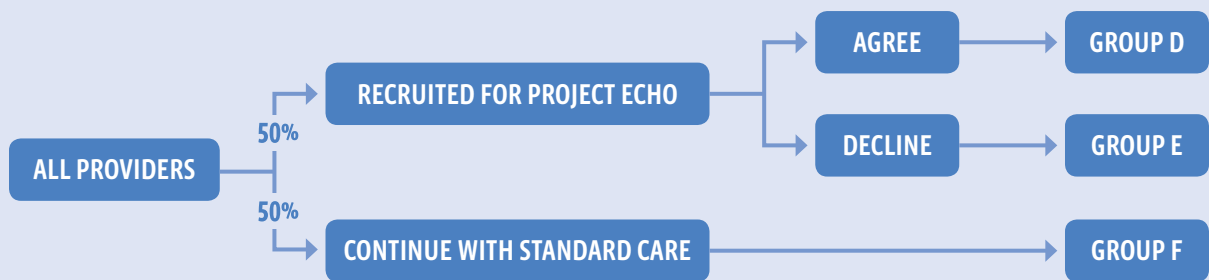
A study such as the one depicted in Figure 1 would allow for comparisons across locations or contexts and conditions to identify best practices that could be adopted elsewhere.

Figure 1.
Hypothetical design for comparing Project ECHO across locations or conditions using random assignment.

Location or Health Condition A



Location or Health Condition B



GROUP	OUTCOMES				
GROUP A	T ₀	T ₁	T ₂	...	T _K
GROUP B	T ₀	T ₁	T ₂	...	T _K
GROUP C	T ₀	T ₁	T ₂	...	T _K
GROUP D	T ₀	T ₁	T ₂	...	T _K
GROUP E	T ₀	T ₁	T ₂	...	T _K
GROUP F	T ₀	T ₁	T ₂	...	T _K

PRIORITY 3: CONDUCT FORMATIVE EVALUATION TO INFORM A DESIGNING FOR DIFFUSION STRATEGY

Diffusion is a social process that occurs among people in response to learning about an innovation such as a new evidence-based approach for extending or improving care. In its classical formulation, diffusion involves (1) an innovation that (2) is communicated, through certain channels (3) over time (4) among the members of a social system (Rogers, 2003). Diffusion concepts have received special attention recently as means for stimulating the spread of health care delivery innovations such as ECHO (Balas & Chapman, 2018; Horton, Illingworth & Warburton, 2018), including the importance of using data to drive diffusion of new models of health care delivery (Dorr, Cohen & Adler-Milstein, 2018). Here are example questions that diffusion research can answer:

- » Does the ECHO Institute identify and target health care organizations that are not just motivated to adopt ECHO but also have the organizational capacity to implement it well?
- » Are health care organizations that adopt ECHO influential so that decision-makers in other health care organizations will take notice and in turn consider ECHO?
- » To what degree are adopting health care organizations serving high proportions of low-income or disadvantaged populations? Do they have existing relationships with providers in rural underserved areas?
- » Are criteria such as population need, organizational motivation, organizational capacity, and organizational social influence being used to prioritize who should be trained in the ECHO model first, or is training just first-come, first-served?
- » Has formative evaluation been conducted to understand which approaches to training work the best and for which types of providers?
- » Have demonstration projects at highly successful ECHO sites been used to invite potential adopters (including funders and government regulators) in so that well-informed decisions about ECHO can be made?
- » To what extent does the change agency strategically consider *when* to introduce the new program or do they just disseminate information as it becomes available?
- » What proportion of organizations targeted with dissemination messages about ECHO respond by contacting the ECHO Institute for more information?
- » How many specialists try the new program (which might qualify them as adopters) of all those targeted (a measure of *reach*)?

When diffusion of a new care model occurs, it can be a result of strategic steps to disseminate information about the model. Information about an innovation is transmitted or advertised in what is usually a one-to-many process using social, mass, or specialty media channels, though simply making information available is probably more common. Even when a lot is done to increase the reach of an innovation by establishing branch offices, licensing affiliate organizations as franchises, or partnering with distribution networks as a pathway to scale, demand from direct service providers such as physicians will still be critical for diffusion so that a model such as ECHO can be scaled up in more locations to benefit disadvantaged rural populations (Larson, Dearing & Backer, 2017; Simmons, Fajans & Ghiron, 2007). Dissemination activity alone is rarely effective in convincing potential adopters of a consequential innovation to try it unless dissemination activity can trigger

a diffusion effect. ECHO, while having replicated to hundreds of sites, still has a very long way to go to produce as much benefit as it might (Dearing & Cox, 2018). This is why a purposeful strategic approach to dissemination so that it triggers a resulting diffusion effect (Berwick, 2003; Dearing & Kreuter, 2010; Dearing, Smith, Larson & Estabrooks, 2013) could usefully be applied to the ECHO model.

In the case of voluntary adoption decisions, as has been the case with Project ECHO to-date, acceleration in the rate of adoption is usually the result of influential members of the social system—both at the individual physician and health care organization level—making the decision to adopt and their decision being communicated to others who then follow their lead (Bunger, Doogan, Hanson & Birken, 2018). Mapping and identifying the most influential potential adopters of ECHO for particular health conditions and/or geographic regions can be done as a formative basis for a diffusion intervention to accelerate the spread of ECHO in as efficient and equitable a way as possible (Dearing et al., 2017; Valente & Davis, 1999). This type of social influence (i.e., opinion leader) strategy or other approaches for identifying influential providers or health care organizations can comprise single intervention arms in tests of ECHO dissemination, or be compared in multiple arm dissemination research designs (Centola, 2011; Holliday, Audrey, Campbell & Moore, 2016; Jonnalagadda, Peeler & Topham, 2012; Lu et al., 2016; Zhang, Chen, Dong & Zhao, 2016).

A frequent first step in well-designed dissemination studies is to perform formative evaluation readiness assessments so that an intervention team has indications about where an innovation such as ECHO is likely to be well received by motivated medical personnel and at which sites the capacity exists to implement ECHO well. One can assess both motivation and capacity in health care systems, whether in domestic or international settings (Dearing et al., 2012; LaFond, Brown & Macintyre, 2002). Researchers have developed instruments and tools for assessing organizational readiness to adopt and implement health interventions (Dearing, 2018; Gagnon et al., 2011; Shea, Jacobs, Esserman, Bruce & Weiner, 2014; Stamatakis et al., 2012). When combined with social influence strategy (incorporating, for instance, carefully managed demonstration projects featuring ECHO), readiness assessments could make the continued spread of the ECHO model more efficient, more equitable, and self-sustaining.

ADDITIONAL RECOMMENDATIONS

In addition to the priority recommendations, we call for more use of standardized patient measures, research designs that enable high degrees of confidence in assessing patient access and provider engagement and learning, and pilot work to test ECHO as a component of graduate medical education.

Recommendation: Use direct measures of patient outcomes. The studies we reviewed typically focus on outcomes as defined by access, quality (or outcome) of care, patient satisfaction or engagement, and provider satisfaction or engagement. For several of these studies, at least some of the conclusions about outcomes rely on the perceptions of the PCPs participating in teleECHO clinics (Beste et al., 2016; Carlin et al., 2018; Cordasco et al., 2015; Knapp & Pangarkar, 2015; Mazurek, Curran, Burnette, & Sohl, 2018; Ness et al., 2017; Sayre et al., 2017) rather than on objective measures of patient outcomes. Sometimes it is also assumed that access has improved based only on the fact that Project ECHO-trained providers are available in new areas (Arora, Kalishman, et al., 2017; Komaromy et al., 2016; Mehrotra et al., 2018; Thornton et al., 2016), even though no explicit tests of this conjecture are reported. This is not to suggest that provider perspectives of an intervention are unimportant, nor that extending access for disadvantaged patients is not an important step in realizing improved access. Nevertheless, such studies do not do much to rule out alternative explanations for observed effects.

To firmly establish the efficacy of Project ECHO, future studies could provide more patient-centered evidence of improved access to care and potentially of care quality and would also benefit from greater exploration of patient-centered outcomes such as engagement and satisfaction (see Mehrotra et al., 2018; Sayre et al. 2017). Especially given concerns with non-random selection and differential response rates (see below), it may be problematic to assume that provider perceptions necessarily correspond to tangible outcomes for patients. For example, Frank et al. (2015), in a study of the VHA's SCAN-ECHO program for pain management (SCAN-ECHO-PM) found that ECHO had more limited patient outcomes than might have been expected. Exposure was associated with increased visits to physical medicine clinics but did not affect the rates at which patients visited mental health, substance use, or specialty pain clinics. Exposure was also associated with increased use of antidepressants and anticonvulsants but did not change the use of opioid medications. In other words, although provider perceptions of SCAN-ECHO have generally been quite favorable (e.g., see Sayre et al., 2017), the impact on measurable aspects of care access and quality has been more limited in some cases.

Several types of studies about ECHO could produce data that would help move forward with the democratization of specialized knowledge for disadvantaged populations. Engaging in one or more of these types of studies could help to ensure through empirical evidence that Project ECHO does the most good for the most people as efficiently as possible. Just as in the science of disease prevention, decisions when planning studies about patient care hinge critically on the question of research design (Flay et al., 2005).

In health services research, efficacy research often relies on experimental and quasi-experimental research designs with clearly articulated measures of dependent and independent variables. Efficacy research is enhanced when data are collected and compared over time, as well as when alternative interventions are compared in terms of outcomes. We discuss these topics below.

Recommendation: Randomly assign providers to condition. One can compare ECHO to standard care to assess access to care for disadvantaged populations, or quality of care delivered to them. Relative to standard care, Project ECHO has been found to improve outcomes for geriatric patients (Moore et al., 2017) as well as for patients with complex health conditions (Komaromy et al., 2018), chronic pain (Anderson, Zlateva et al., 2017; Frank et al., 2015), HCV (Beste et al., 2017; Su et al., 2018), diabetes (Watts, Roush, Julius, & Sood, 2016) and autism, (Mazurek, Curran, Burnette, & Sohl, 2018). Evidence also suggests that, at least for HCV, the quality of care patients receive through Project ECHO is comparable to care received at a specialty clinic (Arora et al., 2011; Su et al., 2018). Several studies also note that Project ECHO improves access to care by reducing travel times and wait times for patients (Glass et al., 2017; Knapp & Pangarkar, 2015).

Despite these encouraging findings, other study designs would permit more confident conclusions about the efficacy of Project ECHO, both in terms of access to care and quality of care received. Specifically, one major concern is that none of the studies testing Project ECHO's impact on patient outcomes has used random assignment; providers must voluntarily choose to participate in the program. Non-random assignment introduces the possibility that providers who participate in Project ECHO differ in meaningful ways from providers who do not participate. Indeed, data reported by several studies suggest that important differences do exist. Beste et al. (2016), for example, reported that providers who had participated in ECHO for a year or more were much more likely to respond to surveys than providers who had participated in ECHO for less than a year (70.4 percent vs. 43.5 percent). These long-term participants also felt more positively about the program than their short-term counterparts, and perceived their participation to have had a substantially greater impact on patient access to care, quality of care, coordination of care, and knowledge.

In some cases, providers may even be recruited for ECHO programs based on their unique interests or qualifications. In the Veterans Affairs' Specialty Care Access Network-ECHO (SCAN-ECHO), for example, the providers targeted to be a part of Women's Health SCAN-ECHO clinics were those already focusing on or interested in women's health (Cordasco et al., 2015).

Likewise, in the Chhattisgarh Integrated Mental Health and Addiction ECHO operated by the National Institute of Mental Health and Neurosciences in India, counselor who participated were all specifically nominated by the state for participation (Mehrotra et al., 2018). In both cases, the selection procedures raise concerns that providers participating in teleECHO clinics may be those who are more motivated, engaged, and high performing than other providers.

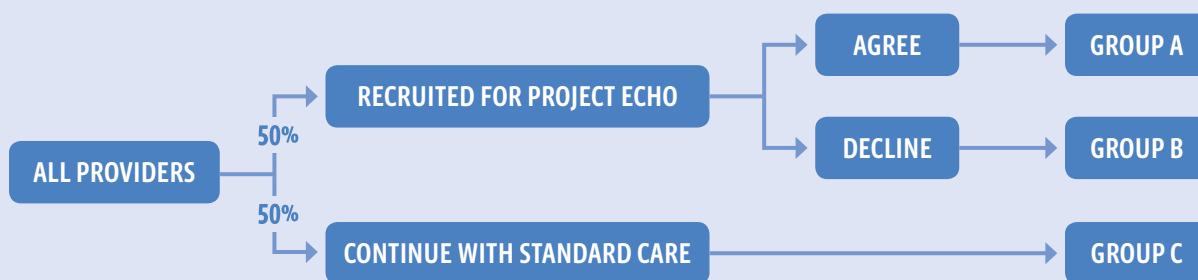
For several reasons, these non-random selection procedures make it challenging to draw strong conclusions about the efficacy of Project ECHO. For one, if providers who feel ambivalently or negatively about participating in ECHO are less likely to engage in the program or to participate in studies evaluating its impact, then samples of providers that make up most studies of Project ECHO are likely to be those most eager to report positive effects. As a result, reported outcomes, particularly those based on perceptions of participating providers, are likely to present an overly optimistic view of its effects.

In addition, if providers who participate in Project ECHO are uniquely motivated, qualified, or engaged, it becomes difficult or impossible to distinguish results that are due to provider differences from results that are due solely to Project ECHO participation. As Su et al. (2018) note, this raise concerns that patient outcomes “may reflect providers with baseline elevated knowledge or interest in practice improvement” (p. 13). In other words, without random assignment, it cannot be concluded with confidence whether patient outcomes are improved because their providers participate in Project ECHO, because they are fortunate enough to have better providers to begin with, or some combination of these factors.

To address these issues, additional studies that make use of random assignment of providers to conditions would be highly beneficial (see Figure 2) because they could rule out such alternative explanations for observed results.

Figure 2.

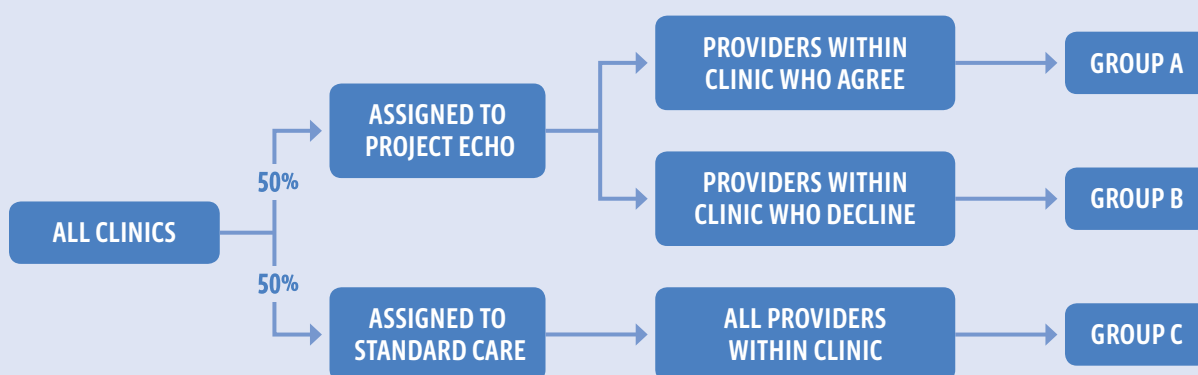
Hypothetical design for comparing Project ECHO to standard care using random assignment at the provider level.



GROUP	OUTCOMES				
GROUP A	T ₀	T ₁	T ₂	...	T _K
GROUP B	T ₀	T ₁	T ₂	...	T _K
GROUP C	T ₀	T ₁	T ₂	...	T _K

Recommendation: Randomize at the clinic level. The same type of study design could also be applied more simply at a clinic level rather than a provider level, again done either to measure access to care for disadvantaged populations or quality of care delivered to them. Studies making use of random assignment of clinics to conditions would retain the same benefits as studies focusing on provider-level randomization, and would have the added benefit of simplifying some of the logistics involved by concentrating on implementation at a more selective number of health care sites. This would also have the advantage of evaluating for the “local expert” role of the motivated and engaged physicians who may have more influence over their local peers who may be more resistant to participating in the program directly. A design of this type (a modification of the design depicted in Figure 2) is presented in Figure 3.

Figure 3.
Hypothetical design for comparing Project ECHO to standard care using random assignment at the clinic level.



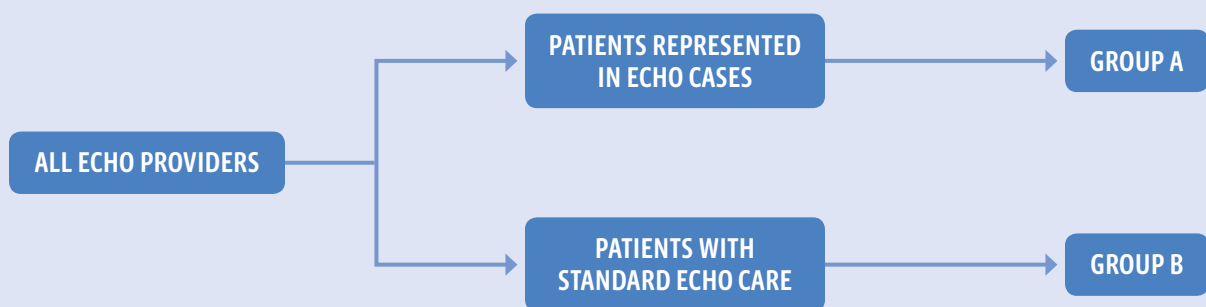
GROUP	OUTCOMES				
GROUP A	T ₀	T ₁	T ₂	...	T _K
GROUP B	T ₀	T ₁	T ₂	...	T _K
GROUP C	T ₀	T ₁	T ₂	...	T _K

Recommendation: Plan for over-time data collection. As suggested by the hypothetical outcomes tables in Figures 1, 2 and 3, studies of Project ECHO would also benefit from longitudinal designs that examine its effects over an extended period of time. Specifically, Beste et al. (2016), in a study of providers working in a variety of specialty areas across the Veterans Affairs’ SCAN-ECHO network, found that providers need to participate in ECHO for about a year before reaping the most substantial benefits from the program. Similarly, Anderson, Armstrong, et al. (2017), in a report prepared for the Centers for Medicare and Medicaid Services about the University of New Mexico Project ECHO program focusing on complex condi-

tions, found that substantial improvements in patient outcomes might take time. Specifically, it was not until the program’s second year of operation that there were statistically significant improvements in hospitalizations, emergency department visits, readmissions, and potentially avoidable hospitalizations. Despite these findings, however, many studies of Project ECHO focus on early outcomes within a program’s first year-and-a-half of implementation (Catic et al., 2014; Fisher et al., 2017; Frank et al., 2015; Gordon et al., 2015; Mohsen et al., 2018; Moore et al., 2017). To be fair, in many cases Project ECHO hubs have been established too recently to collect data about long-term outcomes but creating a plan for long-term data collection and monitoring would be extremely valuable for generating more confident conclusions about ECHO.

Recommendation: Compare presented cases with patients of ECHO providers not presented. On this point, it would also be helpful for future studies to distinguish between outcomes for patients whose cases are presented as part of ECHO programs and outcomes for other patients of participating providers. Specifically, Beste et al. (2017) found that although ECHO did increase rates of treatment initiation and medication prescription rates, decrease wait times for treatment, and reduce specialty clinic use, these benefits were mainly conferred to patients whose cases had been presented during ECHO clinics. Patients whose cases were not presented, even if their PCP was participating in ECHO, did not have different outcomes than patients whose providers did not participate in ECHO. As a result, overall rates of sustained virologic response and early medication discontinuation did not differ between exposed and unexposed patients. This finding contradicts the claim that Project ECHO may have a *force multiplier* effect (Harvard Medical School, 2017, p. 20)—an “exponential increase in workforce capacity created...by empowering primary care providers to gain new knowledge and expertise to treat patients in their own communities.” Future studies could help clarify if this finding is localized to this particular study or if it indicates a wider result across ECHO programs, as well as potential reasons for this issue and indications of how it might be overcome. A hypothetical design of this type is presented in Figure 4.

Figure 4.
Hypothetical design for comparing Project ECHO patients presented as cases to standard care.



GROUP	OUTCOMES				
GROUP A	T ₀	T ₁	T ₂	...	T _K
GROUP B	T ₀	T ₁	T ₂	...	T _K

Recommendation: Compare ECHO to other telehealth and telemedicine models. A point of emphasis for Project ECHO has been that “it is different from telemedicine” (ECHO Institute, 2018c) as a telehealth-based guided practice model. Specifically, the ECHO model is unique in its focus on helping providers develop expertise in a subspecialty and on democratizing specialty knowledge, as well as in its goal of positioning PCPs to deliver care that matches the quality of specialist care. Consistent with these claims, the positive effects of Project ECHO on provider learning are well documented (see Zhou, Crawford, Serhal, Kurdyak, & Sockalingam, 2016). However, we found no studies that examine whether or not these unique improvements in provider learning translate to better patient outcomes when compared to other telehealth or telemedicine models. A study design with multiple intervention arms would provide useful information about ECHO as well as any other included interventions. For example, Moeckli et al. (2017) found that for HIV care, a simpler telehealth program that connected patients directly to specialists, was more effective than the Project ECHO model.

There are two models in particular for which a comparison test would be especially useful: The Vermont Hub and Spokes Health Homes program (Brooklyn & Sigmon, 2017) and the Maryland Collaborative Opioid Prescribing (CoOP) model (Stoller, 2015). The Vermont model, like Project ECHO, relies on collaboration between physician *spokes* and specialist *hubs*, which are based at opioid treatment programs across the state. Specialists at the hubs make initial evaluations and stabilize patients, and then make the determination about whether or not patients can be transferred back to their PCP or to a medical home for continuing treatment. After patients are transferred, the hub specialists continue to communicate with spoke providers and give advice, and patients are quickly transferred back to the hub if necessary. A support team also helps each spoke physician with logistics and coordination, consults with spoke physicians about cases, and helps evaluate patient needs in case of relapse. This team also recruits additional PCPs to undergo waiver training so that they can prescribe buprenorphine for opioid treatment, which adds additional spokes to the hub and thereby increases access to care in areas where no waived providers were previously available. Both the support team and spoke physicians are part of a learning collaborative, which provides lectures about best practices and other topics relevant to opioid treatment. Brooklyn and Sigmon (2017) report that in its first few years, the hub and spoke model had almost tripled the number of patients receiving treatment each year and had enabled many more patients to receive specialty care at a hub, many of them with much shorter wait times than before. The number of waived physicians in the state has also increased by 64 percent and hub support has permitted physicians to take on many more cases than they had previously.

The CoOP model (Stoller, 2015) is very similar to the Vermont hub-and-spoke model. Similar to the Vermont model, specialized treatment centers make initial evaluations and stabilize patients, then transfer patients to PCPs for ongoing treatment. The key distinction in this model is that the treatment centers continue to have more direct interaction with patients, provide counseling and take on a more direct role in dispensing medication when it is judged necessary. Patient outcomes for this model have not yet been reported in the literature, though Stoller suggests that they are encouraging.

Though both the Vermont and CoOP models focus specifically on opioid addiction, they are similar to the ECHO model in many ways. In particular, all three models focus on increasing provider capacity to treat specific conditions, and all three also seek to enhance patient and provider access to specialist knowledge and support. Korthuis et al. (2017, p. 274) even suggest that “the ECHO model may be considered a rural adaptation of the hub-and-spoke model or the collaborative opioid prescribing model.” The reason why it would be worthwhile to conduct a comparative test of the efficacy of these models is not their similarities, however, but their important differences. Specifically, both the Vermont and CoOP models have systems for triaging patient care, such that high-risk patients are immediately referred for specialist care rather than remaining in the care of their PCP.

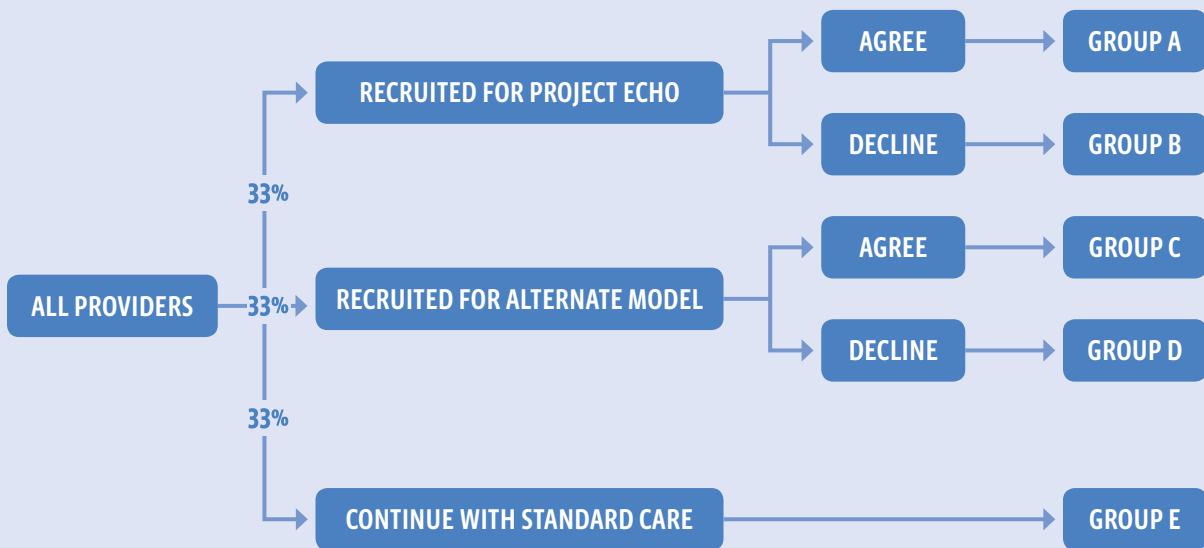
In addition, both the Vermont and CoOP models are explicitly designed so that all patients have at least some face-to-face interaction with specialists. In contrast, the Project ECHO model focuses on replacing specialist care with primary care, with the expectation that patients may never see a specialist face-to-face. Although this lack of direct access to specialists

may be necessary or desirable in areas where travel times or other barriers prohibit patients from seeking specialty care in the first place, this feature may be a drawback in areas where specialists are more readily available (see Korthuis et al., 2017). As Project ECHO continues to expand, the challenge will thus be to demonstrate that it is equally or more effective than more specialist-centered models across contexts and conditions. Especially in the case of opioid addition and other substance use disorders, for which the Vermont and CoOP models were explicitly designed, studies of Project ECHO would need to demonstrate very compelling increases in access and quality of care in order to make a strong argument that it is superior to competing models.

A comparative effectiveness study of these models would also make use of random assignment of providers to conditions, such as the hypothetical design in Figure 5.

Figure 5.

Hypothetical design for comparing Project ECHO to alternate model and standard care using random assignment.



GROUP	OUTCOMES				
GROUP A	T ₀	T ₁	T ₂	...	T _K
GROUP B	T ₀	T ₁	T ₂	...	T _K
GROUP C	T ₀	T ₁	T ₂	...	T _K
GROUP D	T ₀	T ₁	T ₂	...	T _K
GROUP E	T ₀	T ₁	T ₂	...	T _K

A study such as the one depicted in Figure 5 would provide helpful information for health system decision-makers seeking to determine whether or not the ECHO model may be the option best suited to their system structure and patients, including comparisons of the models' relative impacts on key indicators of access and quality of care. Feedback from providers participating in each model could also provide suggestions for how to augment and improve the existing ECHO model. For example, one of the challenges that Project ECHO has faced is a lack of provider buy-in (e.g., see Arora, Kalishman et al., 2017; Carlin et al., 2018). Comparing recruitment success across different models could provide insights into why ECHO has encountered this problem and what other programs may have done to overcome it.

Recommendation: Test the incorporation of ECHO into graduate medical education. Formal medical education during hospital-based residency is constantly changing (Batalden, Leach, Swing, Dreyfus & Dreyfus, 2002). Residency, which typically lasts from three to seven years at teaching hospitals and ambulatory settings, is an opportune time when new medical doctors and doctors of osteopathic medicine are open to new approaches to practicing medical care. ECHO could be a promising candidate module to design and test in conjunction with an association such as the Accreditation Council for Graduate Medical Education, or the American Board of Medical Specialties Research and Education Foundation, organizations which have in the past used residents' experiences to test novel ways of training health care providers and of providing and supporting care delivery (Price, 2017). Given the considerable investments to-date in ECHO trainings of several types, GME would seem a logical next step.

SUMMARY

Although the evidence for Project ECHO's impact on access to and quality of care is encouraging in many ways, there are clear opportunities to both add to the evidentiary basis of this promising model, as well as to design studies that could propel ECHO forward toward its goal of touching one billion lives.

First, the need to answer questions about ECHO in the field is pressing. Implementation science, drawing on multiple methods of data collection, can provide useful and timely information about a variety of questions for improving this model in the short term. An effort of this type would potentially help all of the teams currently using the ECHO model.

Secondly, when viewed through the lens of effectiveness research, the weight of evidence in support of Project ECHO's effects on access to care and care quality can appear rather meager. There is simply no evidence yet available to speak to how Project ECHO performs in the majority of geographical contexts in which it has been adopted, nor for the majority of health conditions and focus areas to which it has been applied. This shortfall would not be a concern if there were strong evidence that studies were generalizable across contexts and conditions, but such evidence does not at present exist. Redressing this void in the evidence base about ECHO would be a major contribution that could help decision-makers to invest in ECHO in the right ways.

Third, there is a strong and present opportunity to use existing formative evaluation tools to strengthen the next stage dissemination and scale up plans for the ECHO model. Applied research about the ECHO model could benefit further scale up of the model to new health conditions, new patient populations, new types of delivery organizations and new geographic areas. As with our discussion of ongoing implementation and effectiveness research, formative evaluation of this type would be strengthened through the incorporation of mixed methods.

The need to answer questions about ECHO in the field is pressing.

We concluded this section with several additional recommendations, beginning with the desirability of consistent use of direct measures of patient outcomes and of rigorous study designs that, if applied to this model, would help to build the evidence base about Project ECHO. While its impact relative to standard care is fairly well established, this evidence would be strengthened by (1) use of random assignment of providers to conditions, (2) longitudinal studies that pay careful attention to the timeline for effects, (3) a greater emphasis on patient-centered outcomes, and (4) more careful tests of the force multiplier effect. No clear evidence yet exists pertaining to Project ECHO's efficacy when compared to alternative telehealth and telemedicine models. This type of evidence could be instrumentally useful not only for Project ECHO but for any comparison access-to-care models. Comparison tests would speak to the claim that Project ECHO is different from these models in important ways and provide meaningful insights for decision-makers. Lastly, we discussed the potential for the ECHO model to augment existing graduate medical education during residencies so that doctors are better prepared to accept, understand, and excel at this new model of care support.

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