The University of Chicago

ECHO-Chicago: Understanding the Impact of Democratizing Medical Knowledge

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Abstract

The study in this paper examines the Project ECHO hub, ECHO-Chicago. ECHO (The Extension for Community Health Outcomes) is a workforce development model, started at the University of New Mexico, for expanding primary care capacity in underserved communities. The ECHO model has gained great popularity as an educational intervention on a global scale and therefore there is increased scrutiny on understanding the model and what its accomplishments are. ECHO-Chicago was launched in 2010 by the University of Chicago Medicine and is the longest-running urban ECHO program in the world. Through didactic presentations and case-based learning, ECHO-Chicago has been able to provide providers all across Chicago and the surrounding areas with free and low-cost trainings.

My analysis uses ECHO-Chicago as a case study of the ECHO model and evaluates the impact of their programming across three dimensions: providers, patients, and the healthcare system. Through interviews, observational sessions, and quantitative data, I was able to assess the impact of ECHO-Chicago's programming. I conclude that ECHO-Chicago has been able to most clearly demonstrate their impact on providers, i.e., the participants in the trainings. There is evidence that ECHO-Chicago has a significant impact on patients and healthcare systems, but further analysis is needed to corroborate any conclusions. The implications of my analysis are of most consequence for new and growing ECHO hubs around the world. ECHO-Chicago's successes offer valuable lessons for how other ECHO hubs should grow. I identify several initiatives for emerging ECHO hubs to implement and a feasibility analysis. Healthcare in the United States, and many other places, falls short in providing adequate care for some of the most vulnerable populations. Until ample healthcare reforms are implemented, it is crucial to take feasible steps to improve health care access.

Acknowledgements

I would like to thank the many people who helped make this thesis possible and helped me learn so much in the process. First off, I'd like to thank my preceptor, Kelsey Berryman, for being a source of constant support and feedback. I would like to also thank my second reader, Professor Sorcha Brophy, for providing me with guidance along the process—whether it was questions about data analysis, methodology, or policy implications, I have learned so much from her. I would also like to thank Professors Jim Leitzel and Sorcha Brophy, and Milvia Rodriguez, for organizing workshops, office hours, and providing many resources along the way.

My next thank you goes to ECHO-Chicago and its wonderful staff. To each member of the ECHO-Chicago team, I am forever grateful for everyone's incredible willingness to hop onto yet *another* Zoom call with me and share their passion for the work they do every day. Their commitment to helping others learn and reducing health care disparities was evident in our conversations. In the midst of the COVID-19 pandemic, I have an even greater appreciation for their mission. I would also like to thank ECHO-Chicago's Research Manager, Sandra Tilmon, for her enthusiasm while working with me and providing me with a great deal of guidance with my research and teaching me so much about health care research in the process.

Finally, when I sat in on ECHO-Chicago's sessions, I observed many health care workers who are actively seeking out an educational opportunity to learn more so that they can provide more, and better, care for their otherwise underserved patients. In the midst of the global pandemic that we are living through, and despite the burden that that has placed on health care workers, it was so inspiring to see everyone's passion and drive. So, my final thank you goes out to these health care workers—their fortitude is truly amazing.

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Introduction

Despite the medical advances in recent decades, the American healthcare system faces major challenges distributing health care resources and the result of this deficiency is uneven health outcomes across the population (Williams 2011). The maps below illustrate a relationship between health care resource distribution and health outcomes in Chicago, as an example.[1,2] **Figure 1** is a quintile map that depicts the proportion of people with income below 125% of the poverty line across Chicago's community areas and the blue points represent locations of hospitals. The spatial data indicates that hospitals in Chicago are sparsely spread out around the city and some of the communities that have the highest rates of poverty, i.e., the darkest red communities on the maps, are the farthest from hospitals. Consequently, a similar trend is reflected in a spatial analysis of health outcomes data. **Figure 2** shows the location of hospitals, the blue points, overlayed on a map of infant mortality rates (left) and cancer deaths (right). The two maps reveal that regions that have fewer hospitals nearby are the same ones with higher infant mortality rates and more cancer deaths—primarily communities in the southern and western region of Chicago.

[1] Data Source: https://geodacenter.github.io/data-and-lab/comarea_vars/ (Health & Socio-Economic outcomes)
[2] Data Source: https://koordinates.com/layer/96332-chicago-illinois-hospitals/ (Hospital Locations)

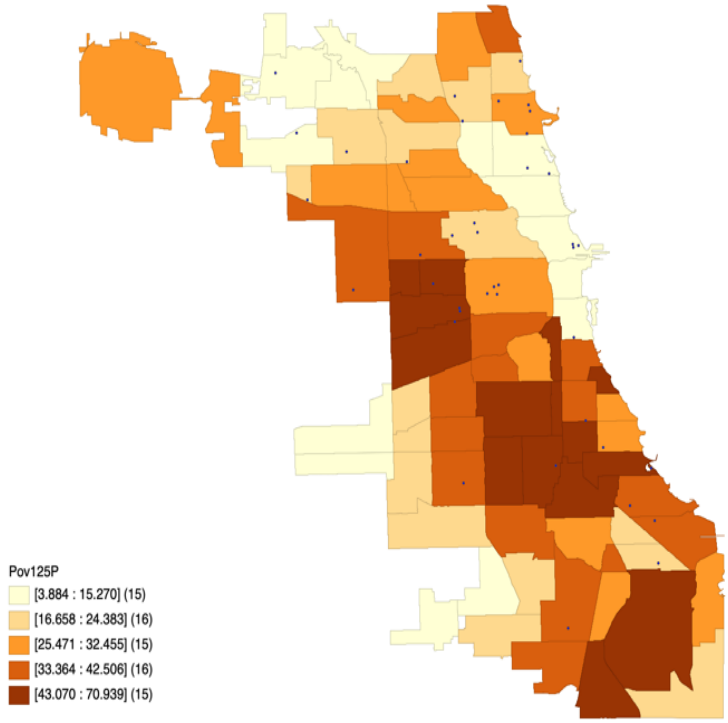


Figure 1 *Hospitals (blue dots) overlayed on proportion of people with income below 125% of the poverty line*

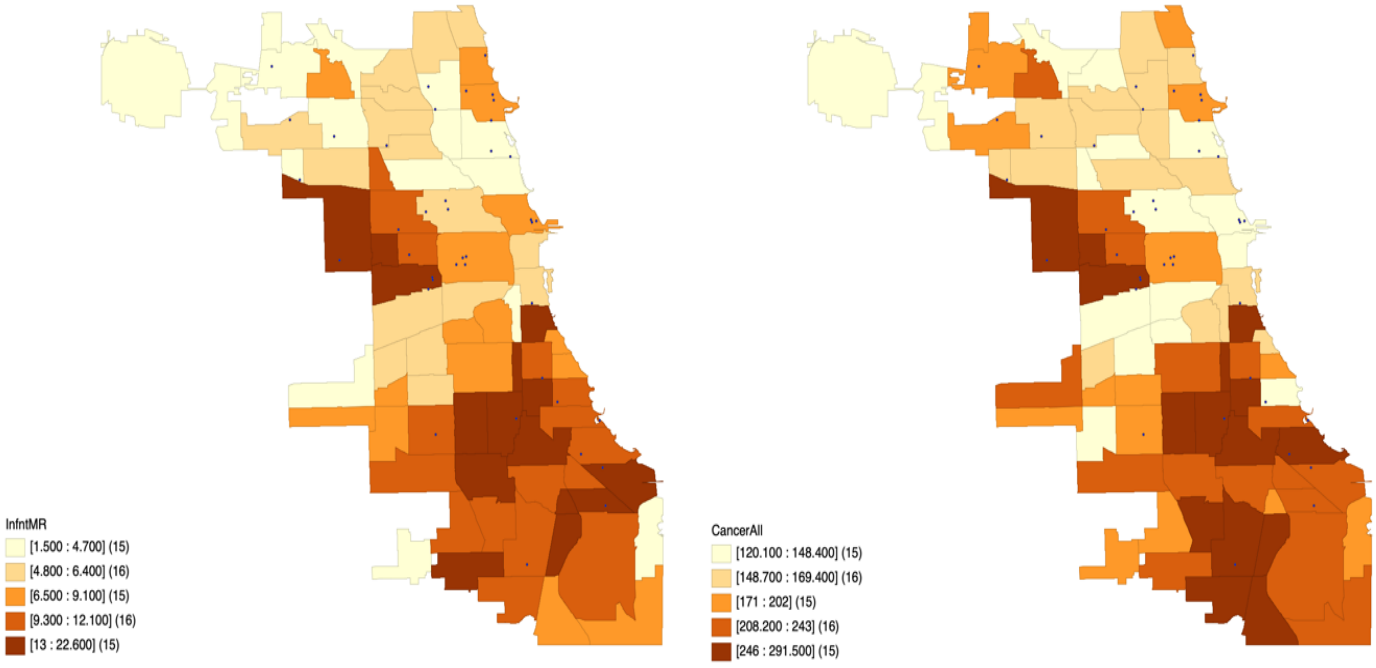


Figure 2 *Hospitals (blue dots) overlayed on (Left) Infant Mortality Rates: Deaths per 1,000 Live Births; (Right) Age-Adjusted Cancer Deaths per 100,000 Persons*

According to the Health Resources & Services Administration, “Medically Underserved Areas/Populations [MUA/MUP] are areas or populations designated by HRSA as having too few primary care providers, high infant mortality, high poverty or a high elderly population”(*MUA Find*, n.d.). Chicago has a total of 799 census tracts and of those, 365 were designated as medically underserved areas (MUA) and 91 were MUA eligible but not designated (Kim et al., 2020). The 456 census tracts that are either MUA or MUA eligible are home to almost 1.5 million people (Kim et al., 2020). Barriers to health care access impacts a large proportion of Chicagoans.

There are a variety of issues that have proliferated inadequate health care delivery to many of these communities. Four major issues, out of many other issues, are distance, wait times, stigmas, and financial burdens. Medically underserved urban and rural areas disproportionately experience difficulties while trying to access specialty care (Cyr et al., 2019). Distance, and accompanying transportation barriers, often lead to “rescheduled or missed appointments, delayed care, and missed or delayed medication use” (Syed et al., 2013). Wait times further delay care; according to a survey conducted by Merritt Hawkins in 15 of the largest cities in the U.S across five major specialties, it takes 24 days, on average, to schedule a new patient physician appointment (Hawkins, 2017). Demeaning and uncomfortable interactions between patients and providers tend to create stigmas that cause some groups to seek out less medical care, which ultimately leads to worse health outcomes (Allen et al., 2014). Finally, there is the problem of insurance and the financial burden that accessing health care is associated with. In 2018, an estimated 30.4 million people were uninsured in the United States—a number that is likely understated due to the exclusion of many undocumented immigrants (*Who Are the Remaining Uninsured, and Why Do They Lack Coverage?*, n.d.). Many of the uninsured would

be eligible for subsidized health care, but still do not try to access insurance due to affordability concerns (*Who Are the Remaining Uninsured, and Why Do They Lack Coverage?*, n.d.). These challenges are just a few of the barriers between many people and health care access in the United States.

The health care safety net in the United States is meant to help alleviate some of these challenges. The health care safety net is comprised of hospitals and other providers that provide medical services to people regardless of insurance status and ability to pay and have historically served medically and socially vulnerable populations (Sutton et al., 2006). Federally Qualified Health Centers (FQHCs) are a type of safety net hospital (SNH) that receive funds from the HRSA Health Center Program and provide care on a sliding fee scale based on ability to pay (*Federally Qualified Health Centers*, 2017). FQHCs provide comprehensive primary care services to underserved areas and include Community Health Centers (CHCs), Migrant Health Centers, Health Care for the Homeless, and Health Centers for Residents of Public Housing (*Federally Qualified Health Centers*, 2017). Under the Affordable Care Act (ACA), federal funding for FQHCs expanded greatly, and as a result FQHCs have been able to help expand access to care (*Changes at Community Health Centers, How Patients Are Benefiting | Commonwealth Fund*, 2019). **Figure 3** illustrates the locations of Primary Care Community Health Centers in Chicago, which are represented by the purple dots.[3]

[3] In this case, not all of the Primary Care Community Health Centers are FQHCs; Data Source: https://catalog.data.gov/ro/dataset/public-health-services-chicago-primary-care-community-health-centers

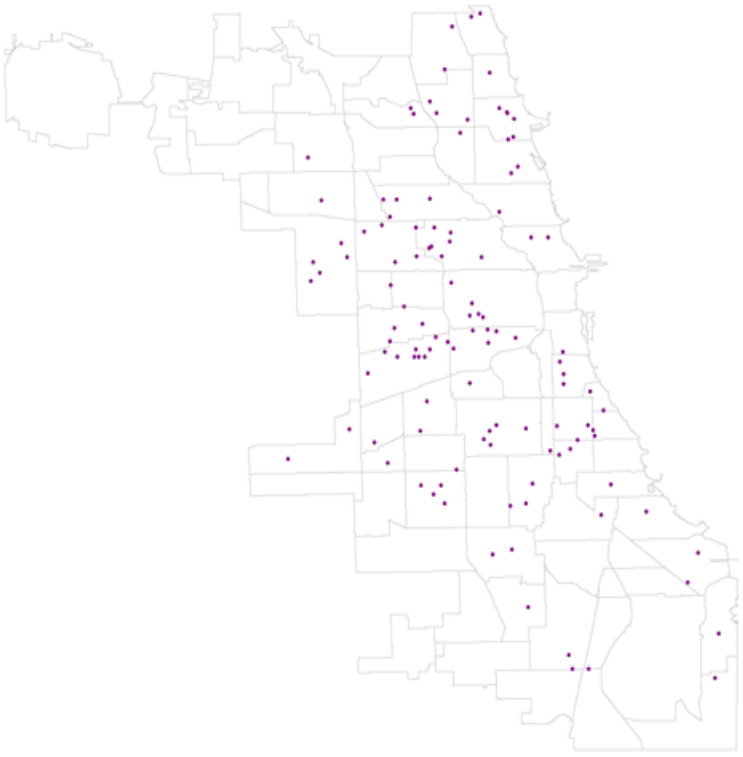


Figure 3 *Locations of Chicago Primary Care Community Health Centers*

One of the major challenges in the American healthcare system, that remains despite the efforts of FQHCs and other SNHs, is providing high-quality specialized medical care. Many specialists often have lengthy waitlists and simply because there is a low supply of specialists combines with a high demand for their services (*Access to Specialty Care out of Reach for Many*, 2014). FQHCs struggle with high vacancy rates and a report of health center clinical workforce needs notes that the hardest to fill roles are often specialty roles such as nurse practitioners and psychiatrists (Simmons, 2016). One policy implication is that health centers should be at the forefront of health professional education and training reform in order to compensate for the deficiencies in quality of care that arise from staffing vacancies (Simmons, 2016). With FQHCs often lacking the ability to fulfill the specialized service needs of their communities, there is an

opportunity to help grow the knowledge base of existing providers at FQHCs. The impetus to better equip FQHCs and other safety net hospitals is at the core of Project ECHO's genesis.

Hepatitis C (HCV), for example, tends to require a liver disease specialist to assist with the treatment and management (*What Is Hepatitis C - FAQ | CDC*, 2020). In New Mexico, Dr. Sanjeev Arora was frustrated that many HCV patients were not receiving treatment, so he developed a low-cost educational model, now known as Project ECHO (Extension for Community Health Outcomes), in order to mentor community providers for free on how to treat HCV (*Project ECHO*, n.d.). Since 2003, Project ECHO has expanded to make an impact worldwide, but further analysis on its effectiveness is needed (Zhou, et al. 2016). Project ECHO has created a knowledge-sharing approach where expert teams based out of hubs across the world, such as the University of Chicago, lead virtual sessions for various community healthcare partners (*Project ECHO*, n.d.). These virtual sessions can be used for continuing medical education (CME) credit, which many medical professionals are required to earn each year, by medical boards, hospitals, and others to ensure medical professionals are staying up to date with medical knowledge.

This study aims to understand the impact of Project ECHO's hub and spoke knowledge-sharing model by using ECHO-Chicago, the hub at University of Chicago Medicine, as a case study. My guiding research question is the following: What is the impact of democratizing medical education? The impact of ECHO-Chicago, as evaluated in this study, is threefold. The first component is the impact on healthcare providers and the participants in ECHO's sessions. The second component is the impact on patients. Finally, the third component is the impact to broader healthcare system. I employed a mixed-methods approach comprised of interviews, participant observations, and survey data. I qualitatively and quantitatively assessed the impact

of ECHO-Chicago's knowledge-sharing model to answer my central research question. I found that the most apparent impact can be seen on care providers—the participants in ECHO-Chicago's programming. Through the impact on providers, there is a sort of trickle-down effect seen on patient care. Finally, the ECHO model, when utilized effectively, systemically affects health care systems by acting as a lifelong educational arena and by helping providers increase their capacity to treat patients.

Background

Benchmarking the US healthcare system against ten other high-income countries reveals the inequities that exist in the US. The US spends more on health care as a share of the economy than its peers, yet has the lowest life expectancy and highest suicide rates (*U.S. Health Care from a Global Perspective, 2019 | Commonwealth Fund*, n.d.). Furthermore, the U.S. has the highest chronic disease burden and Americans have fewer physician visits than peers in most countries, which is likely a consequence of a low physician supply in the US (*U.S. Health Care from a Global Perspective, 2019 | Commonwealth Fund*, n.d.). Finally, the US has among the highest number of preventable hospitalizations and avoidable deaths (*U.S. Health Care from a Global Perspective, 2019 | Commonwealth Fund*, n.d.). The American health care system falls short in many categories relative to its peers and demands active intervention.

Urban communities are one subset of Americans that have historically had difficulty accessing proper health care. Urban areas face some of the highest reported infant mortality rates, adult major depressive episodes, and mortality from unintended injuries (Cyr et al., 2019). Furthermore, urban hospitals are less likely to serve poorer patients than other hospitals and Medicaid tends covers a fewer children and nonelderly adults in metropolitan areas than other

suburban and rural areas ("Research Update," 2017). Focus groups with Mexican immigrants in urban parts of North Carolina, for example, found that emergency department visits resulted in less favorable experiences than visits to community health centers (Cyr et al., 2019). The research indicates disparities in existing urban healthcare networks which places a larger burden on a safety net health system that is not fully equipped to manage that burden. In an open letter to Congress in December 2019, the National Association of Community Health Centers and the American Psychological Association noted that CHCs provide care to nearly 29 million individuals in communities across America and that CHCs are at the core of the health care safety net ("Health Center Funding," n.d.).

The University of Chicago Medicine's ECHO-Chicago program brings together experts from the University of Chicago and other institutions to partner with FQHCs and other community-based providers to engage in case-based learning and disease management. ECHO-Chicago organizes series comprised of weekly sessions that begin with an instructive presentation followed by case presentations and in-depth guided discussions (*ECHO-Chicago 2018 – 2019 Series Guide*, 2019). The format is designed to foster collaboration and engagement between specialist facilitators and the participants. ECHO-Chicago's outreach data indicates that the vast majority of their participants are physicians, nurse practitioners, and nurses (*Outreach Data*, n.d.). The improved knowledge base of the participants should, in theory, translate into more efficient care since patients no longer need to wait for appointments or travel to other medical centers that would otherwise be their only source of specialized health services (*ECHO-Chicago 2018 – 2019 Series Guide*, 2019).

ECHO-Chicago's regular programming can be broken up into two main areas: pediatric series and adult series (*Telementoring for Healthcare Professionals - ECHO-Chicago*, n.d.). Due

to the onset of the COVID-19 pandemic, ECHO-Chicago has developed three different series about COVID-19 in pediatrics, adults, and those in skilled nursing facilities and long-term care facilities (*COVID-19 Sessions: ECHO-Chicago's Pandemic Response*, n.d.). Each series typically runs for a span of nine to fifteen weeks and each week's session is approximately one hour long (*Telementoring for Healthcare Professionals - ECHO-Chicago*, n.d.). From my own observations of ECHO-Chicago's sessions, the sessions typically begin with a didactic presentation from University of Chicago Medicine specialists, or an outside specialist, and the latter half of the session is focused on a patient case presentation by a participating provider. Each session is hosted via Zoom and the facilitators employ a variety of tools, such as polls and the chat feature, to encourage engagement. The remote format allows them to reach primary care providers from around Chicago and neighboring regions. ECHO-Chicago's series are aimed at helping community-based providers to build skills for managing common, chronic physical and mental health conditions.

One of ECHO-Chicago's most salient metrics for measuring "impact" is self-efficacy. Self-efficacy is defined as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (*Self-Efficacy Defined*, n.d.). Self-efficacy can guide how individuals feel, think, motivate themselves, and behave (*Self-Efficacy Defined*, n.d.). ECHO-Chicago's publicly available outreach data includes an analysis of self-efficacy increase by series. The analysis shows the highest efficacy increase for their HCV, ADHD, Opiates, and Geriatric series (*Outreach Data*, n.d.). Their programming spans a variety of clinical practice areas and are designed for a variety of participants. Some of their series include Complex Pediatric Asthma: Beyond the Guidelines, Resistant Hypertension, and Childhood Obesity and Comorbidities (*Events Archive*, n.d.). As primary care providers

participate in different series, the goal is to help providers increase their capacity to deliver evidence-based care for complex, chronic conditions to the patients that need them most (*Telementoring for Healthcare Professionals - ECHO-Chicago*, n.d.).

Not only do medical professionals attend ECHO-Chicago series, but often social workers, parents and other caregivers, and even patients will participate in the sessions. All participants are encouraged to share their experiences, opinions, and knowledge. In ECHO-Chicago's series on Serious Mental Illness, they incorporated patient voices into their curricula. Patient engagement has been thought to be crucial in medical education (Szumacher, 2019). For example, patients who have grappled with chronic illnesses for a long time can bring their experience to the table and teach the emotional, psychological, social, and economic aspects of illness (Szumacher, 2019). While ECHO and ECHO-like models (EELM) have become popular across the world and have been applied across a variety of settings and health conditions, more evidence is needed in order to fully understand the impact of the programming.

Literature Review

The Theory Behind Program Evaluation

Understanding the impact that ECHO-Chicago has had on its participants, the patients of those participants, and the broader healthcare systems is an exercise in program evaluation. Program evaluation focuses on "judging the worth" of a specific program to improve, extend, or modify the program (Shortell, 1978). More specifically, health policy analysis involves drawing together and evaluating existing research, information, and informed judgement regarding the effects of employing a given strategy, or strategies, to tackle a problem(s) that is associated with

the delivery of health services (Shortell, 1978). To answer my research question about the impact of ECHO-Chicago, I utilized some principles of evaluative research (Shortell, 1978).

There are two main purposes for conducting program evaluation in healthcare: (1) to determine the effectiveness of a given intervention and/or (2) improve the quality of the intervention (Smith & Ory, 2014). Program evaluation, moreover, can be used to improve elements of the program's implementation and, if a program is found to be successful, increase community support (Smith & Ory, 2014). The text, *Health Program Evaluation*, notes that there are five different viewpoints that should be generally considered during program evaluation: the organization, the individual program administrator, the funding agency, the public, and the program evaluator (Shortell, 1978).

In my study, I focus on the interests of the first four viewpoints mentioned. For the organization, I aim to provide evidence that helps answer questions about whether or not ECHO-Chicago is "effective" in accomplishing its goals and thereby either making, or refuting as needed, the case for expanding their programmatic activities (Shortell, 1978). The interests of individual program administrators are likely biased towards bringing favorable attention to ECHO-Chicago, however they are also likely interested in providing as much evidence that increases program support (Shortell, 1978). On the flip side, funding agencies—which are of particular interest because ECHO-Chicago is grant funded—need to understand the efficiency and impact of programming (Shortell, 1978). Finally, for the interest of the public, I focus on collecting evidence that informs the public about the direct and indirect influence of ECHO-Chicago on communities' abilities to access health care and the quality of that health care (Shortell, 1978). The methodology, which I describe after discussing current research on the guiding principles of my topic, was designed with these major considerations in mind.

Research on Continuing Medical Education

To better understand the role of ECHO-Chicago in the healthcare system, it is important to begin by understanding the rationale behind Continuing Medical Education (CME). The healthcare system in the United states tends to fall short in delivering care that addresses the complex needs of many urban residents, evidenced by poor urban residents experiencing some of the worst health conditions in the world (Gibbons et al., 2010). Delivering quality care demands rapid and comprehensive evaluation of medical information and, in the age of electronic recordkeeping, the sheer amount of information available has expanded exponentially (Gibbons et al., 2010). Therefore, it is increasingly critical to streamline the ways to identify relevant data, information, and knowledge to support effective healthcare decision making because doing so can fill knowledge gaps, which ultimately help advance the quality of care delivered, especially in urban settings (Gibbons et al., 2010). Furthermore, there is an important distinction between information and knowledge. In the healthcare context and this paper, information is raw, unprocessed numbers coupled with contextual details and knowledge, on the other hand, is the interpretation of this information by practitioners using their unique processes of identifying connections (Gibbons et al., 2010). Knowledge is, thus, constantly being created and it becomes all the more important to develop channels for effective knowledge sharing (Gibbons et al., 2010). Effective training processes can be utilized to reduce knowledge gaps over time, especially as many healthcare organizations experience shortages of healthcare experts across a variety of specialties (Gibbons et al., 2010).

Limited resources within the healthcare system has increased the burden on primary care providers, a burden that once was on secondary care practitioners, and this new expectation demands new skills and knowledge through Continuing Medical Education (Fletcher, 2007).

Continuing Medical Education, abbreviated as CME, consists of educational activities that are meant to maintain, develop, and/or increase the knowledge, skills, and professional performance and relationships that a physician uses (*What Is CME Credit?*, 2017). Generally, CME refers to educational activities that are approved for CME credits, by the American Medical Association Physician's Recognition Award, and these credits are often required by state medical boards annually (*What Is CME Credit?*, 2017). Knowledge sharing in Continuing Medical Education through trainings for practitioners can help ensure that primary care providers are appropriately-trained to provide consistent, high-quality care for a variety of conditions (Fletcher, 2007; Gibbons et al., 2010).

Educational interventions in medicine can be characterized as initiatives to improve the quality of health care through using strategies and tools such as, educational materials, group-based learning and computer-generated reminders (Wensing, 2008). A review of articles assessing CME and other medical education interventions by employing randomized control trials, from 1975 to 1994, showed that 70% of the interventions studied displayed a change in physician performance and 48% of interventions yielded a change in health care outcomes (Davis, 1998). The same review highlighted that practice-based methods, such as reminders and patient-mediated strategies, were among the most effective educational interventions; this finding is of particular interest because a hallmark of ECHO models is the focus on case-based learning (Davis, 1998). Current literature provides evidence supporting the theory that education improves the confidence and competence of practitioners (Fletcher, 2007).

Research on the Impact of Educational Interventions in Healthcare Settings

Current research illustrates that, overall, educational interventions for health professionals have *some* impact on professional performance and health outcomes—but

educational interventions also show a large variation in their effectiveness (Wensing, 2008). An experimental study illustrates that after receiving training, performance in completing medical tasks improved significantly (Leopold et al., 2005). Statistically significant improvements have been demonstrated in physician performance in a variety of studies (Haynes et al., 1984). A 2012 comparative study of critical reading and problem-based learning interventions showed that problem-based learning can be effective, particularly in a small-group context (Gongora-Ortega et al., 2012). Despite evidence that illustrates the benefits of continuing medical education for practitioners, the argument for continuing medical education programs is incomplete without a discussion of the impact on patient outcomes (Fletcher, 2007).

A study of the effect of a training intervention on patients living with rhinitis showed significant improvements in the quality of life of patients according in the intervention group, where general practitioners and practice nurses received additional training, but not in the control group (Fletcher, 2007). Linking educational interventions to better patient outcomes is positive evidence given that the purpose of medical education is to ultimately improve patient outcomes (Haynes et al., 1984). Yet, there still exists a significant challenge in measuring the direct impact of professional education to patient outcomes (Fletcher, 2007; Haynes et al., 1984). Prior to the study on rhinitis patient outcomes, most studies were not able to detect an impact of educational interventions and patient outcomes (Haynes et al., 1984). The evidence base for the impact of medical education interventions on patient outcomes is incomplete and necessitates more research (Fletcher, 2007; Haynes et al., 1984).

Research on Prescriptions and Screenings on Patient Outcomes

A component of the curriculum in many of ECHO-Chicago's series is how primary care providers can best prescribe medications and screening techniques. There is a large body of

literature that highlights the impact of prescribing behavior and screening on health care and patients. First, I will talk about the significance of prescribing behavior and then follow it up with a discussion of the empirical impact of screenings on patient outcomes.

In 2019 the total nominal spending on medicine in the United States was approximately $511 billion and over the last decade spending has increased rapidly by over $200 billion (*U.S. Total Medicine Spending 2002-2019*, n.d.). Total health care spending in the United States in 2019 was about $3.8 trillion which makes medicine 13.4% of health care spending (Martin et al., 2021). In addition to the economic stakes, prescribing behavior is important in terms of preventable morbidity and mortality (Soumerai et al., 2005). For example, a large population-based case-control study linked the common use of long-acting sedatives in elderly patients with falls and fractures of the hip (Ray et al., 1987). On the flip side, the underuse of effective agents for treatable diseases also has an impact on the care patients receive (Soumerai et al., 2005). For example, one study found that newly diagnosed hypertensive patients were not followed up adequately for treatments 6 to 12 months after diagnosis (Soumerai et al., 2005). Survey results indicate that community-based physicians do not feel that information on prescription drugs are comprehensive enough to inform their prescribing decisions (Anderson & Lexchin, 1996). Moreover, printed material alone is unlikely to drive change in prescribing practices, but coupled with specific education and feedback prescribing practices could improve (Anderson & Lexchin, 1996). Prescribing behavior effects health care from both an economic standpoint and a patient care standpoint.

In addition to prescriptions, screenings are an important component of health care because screenings mitigate the effects of disease through early detection and intervention (Drowos, 2019). Early detection is crucial because treatments tend to be most effective, such as

in the case of many cancers, and ultimately early interventions can improve health outcomes (Drowos, 2019). For example, the US Preventive Services Task Force (USPSTF) found that screening women aged 21 to 65 years significantly reduced cervical cancer incidence and mortality and as a result the USPSTF encouraged screening (US Preventive Services Task Force, 2018). Similarly, the USPSTF found adequate evidence that accurate screening for latent tuberculosis infection (LTBI) is available and that it provides a health benefit in preventing progression to active disease (US Preventive Services Task Force, 2016). Screening is especially important today due to the uptick of the number of people impacted by preventable chronic illnesses (Grunfeld et al., 2013). Primary care, which is often the first line of defense for patients seeking care, tends to fall short in providing adequate screening due to the complexities that arise from managing multiple conditions (Grunfeld et al., 2013). Prescribing practices and screenings impact the way care is delivered and the quality of care that patients receive to a large extent. As a result, interventions to improve the practices associated with both prescribing and screening must be studied carefully.

Existing Evaluations of Project ECHO Hubs

Literature on the impact of Project ECHO focuses primarily on the creation of ECHO hubs and ultimately ascertaining self-efficacy changes, competence changes, and/or changes in proxies for patient outcomes. A study conducted on an ECHO hub in Maine illustrates some of the gaps in the current understanding of how effective ECHO models are. The Maine Endocrinology ECHO program's evaluation results showed that 36% of respondents experienced an increase in knowledge regarding the topic of the session and 48% of respondents felt an increase in confidence in the ability to manage the case presented (Brodsky et al., 2019). There is some doubt that ECHO's model of virtual case-based learning sessions is more effective than

alternative educational methods, however the doubt could be a byproduct of the relative newness of the program and the initial implementation challenges the program faced (Brodsky et al., 2019).

ECHO models have also gained traction globally. For example, Project ECHO's model of virtual telementoring was used in India to train healthcare providers on oral cancer screening and tobacco cessation by implementing eight, weekly, hour-long sessions (Nethan et al., 2020). Oral cancers are widely prevalent in South Asia and are one of the leading causes of cancer mortality among Indian and Sri Lankan men (Nethan et al., 2020). In addition to knowledge gains, participants indicated that there were gains made on a self-efficacy scale as measured by pre-participation and post-participation surveys for program evaluation (Nethan et al., 2020). The study of this ECHO hub showed far more significant knowledge gains among participants—as compared to the Maine hub—and coupled with the fact that the ECHO model is relatively low-cost due to its virtual nature, ECHO models are promising educational tools to help expand the knowledge bases of care providers in traditionally underserved areas (Nethan et al., 2020).

The ECHO model has been applied to women's health programs. Female veterans traditionally lack access to comprehensive women's health services through the Veterans Health Administration's (VA) community-based out-patient clinics (Cordasco et al., 2015). The VA, in efforts to address this issue, has invested in initiating the WH Specialty Care Access Network-Extension for Community Healthcare Outcomes which provides VA primary care providers with educational sessions with virtual specialists (Cordasco et al., 2015). In post session surveys, nearly 90% of respondents agreed that the information in the surveys was useful and/or would be useful to their clinical practice (Cordasco et al., 2015). This is evidence that ECHO's model for knowledge sharing can be advantageous to practitioners. However, this particular study does not

directly address the impact of ECHO sessions on patient outcomes (Cordasco et al., 2015). Since ECHO hubs provide educational interventions for healthcare professionals, there is a gap in linking the impact of the trainings on patient outcomes.

The final case study, I will address is a study conducted by ECHO Ontario Chronic Pain & Opioid Stewardship. The widespread opioid epidemic has, among other issues, highlighted the lack of training for clinicians with respect to the intersection of chronic pain, substance use, and behavioral health disorders (Katzman, 2020). ECHO Ontario Chronic Pain & Opioid Stewardship studied the impact of their programming on providers grappling with the opioid epidemic through semi-structured interviews (Dubin et al., 2015). A key finding of this study was that the ECHO model creates a "community of practice" which allows providers to build strong relationships between providers who may otherwise feel isolated (Dubin et al., 2015). A unique limitation of the ECHO model that this study identifies is that the providers that participate are a self-selected group of providers that may be more passionate about the subject material and may not reflect the broader provider populations in these areas (Dubin et al., 2015). This limitation means that benefits of this model may not yet be generalizable to all medical professionals (Dubin et al., 2015). The ECHO model allows for knowledge sharing which is crucial in practice areas where there is evidence of knowledge gaps, such as pain management and opioid use, but there are still biases that need to be overcome in the analysis of its true effectiveness.

In summation, across the clinical areas discussed above, there is substantive evidence highlighting the potential benefits of ECHO models for training primary care providers to improve their competencies and even to improve patient care. Nonetheless, there is a need for further studying the impact of ECHO trainings on healthcare providers as well as patients in

order to understand whether this is a model that should be expanded and invested in to tackle salient issues that exist in the way health care is delivered today.

Methods

In order to evaluate the impact of ECHO-Chicago, I employed a qualitatively driven mixed-method design for my study. The core component of my study was a qualitative analysis of interviews which were complemented by an analysis of a podcast series created by ECHO-Chicago on their programming. In addition to analyzing interviews, I conducted participant observation sessions by sitting in on three of ECHO-Chicago's sessions across three different series. The supplementary component of my study is a quantitative analysis of pre-series and post-series survey data from participants collected by ECHO-Chicago.

Qualitative Analysis

Podcasts

The qualitative piece of my study begins with the ECHO-Chicago podcast series and interviews conducted with ECHO-Chicago series facilitators, community health partners, and ECHO-Chicago administrators. The first iteration of qualitative data analysis was a thematic analysis of podcast transcripts. The podcasts I used were created by ECHO-Chicago and focus on a range of their series. The episodes are guided interviews administered by ECHO-Chicago's staff and are primarily reflections from staff, the series' facilitators, and participants. I specifically focus on utilizing the podcasts to better understand the perspectives included in these podcasts include major stakeholders that ECHO-Chicago aims to serve, namely the ECHO-Chicago administrators, facilitators, participants, patients, and community health partners.

A full list of the podcasts I analyzed can be found in Appendix A.

I created summaries of each podcast to identify initial key themes that occurred across each episode. I utilized a software, Otter.ai, to generate transcripts of each episode and used a qualitative coding application, Dedoose, to aid in coding the podcasts for analysis. The key themes I identified in my summaries were the parent codes used while analyzing each transcript. As additional themes emerged from individual episodes, I added those as subcodes. The analysis I conducted via coding allowed me to develop a foundational narrative about ECHO-Chicago. A limitation of using the podcast as a data source is that there is a selection bias in the voices that are included because they are all volunteers. The individuals being interviewed likely had positive experiences with the ECHO-Chicago series and thus do not, necessarily, provide a holistic evaluation of the program. Thus, the findings from this analysis will primarily be used to prime the more detailed analysis that will come from the interviews and observational sessions.

Interviews

To provide an additional perspective on ECHO-Chicago's impact, I conducted semi-structured interviews from January 2021 through February 2021 with ECHO-Chicago's staff These interviews lasted approximately forty-five minutes on average and broadly focused on the following areas:

1) Introduction to interviewee's academic and professional background
2) The interviewee's role at ECHO-Chicago
3) The interviewee's approach to understanding the impact and outcomes of the work ECHO-Chicago does and reflections on this subject
4) The participant response they've witnessed—from both an anecdotal and data-driven perspective

5) Persisting issue areas and general barriers that ECHO-Chicago is experiencing moving forward

A more comprehensive list of questions can be found in Appendix B.

Recruitment of the interviewees occurred through cold-emails and referrals. I retained transcripts of the interviews along with identifiers, unless otherwise determined prior to an interview, due to the fact that their role and experience was pertinent to the analysis of the interviews. These interviews were analyzed in the same way as the podcast episodes. I generated transcripts of each interview, followed by summaries, and finally conducted a thematic analysis of the transcripts using the themes described above. I supplemented these key themes with emergent subthemes that arose throughout the interview process. A limitation of these interviews may be that participants did not feel comfortable sharing any concerns or criticisms regarding ECHO-Chicago's programming if they believed it may reflect negatively on the organization. To mitigate the impact of this problem on my results, I asked for consent to retain names and attribute quotes to specific interviewees.

Interview memos can be found in Appendix C.

The rationale for a large qualitative component to my study design was that these podcasts and interviews were able to be synthesized into a general story that told a narrative about the impact of ECHO-Chicago. Since the podcasts about ECHO-Chicago were structured similarly to each other and each interview covered roughly the same overarching topics, my expectation was that a common narrative would become apparent as the transcripts are analyzed.

Observations

To provide a less biased perspective into ECHO-Chicago and how its programming impacts its participants, I conducted three observational sessions of their sessions across three, substantially different, series. ECHO-Chicago's programming is Zoom based and I was provided the Zoom meeting details by the program staff. During each of the sessions, I joined the meetings with my video and microphone off since I was joining as an observer as opposed to an active participant (*Participant Observation*, n.d.). The first series I sat in on was Opioid Use Disorder in the Emergency Department and the topic covered in the hour-long session I sat in on was "Legal Issues and Communication Skills." After that, I observed the AHRQ ECHO National Nursing Home COVID Action Network series which touched on several COVID-19 related topics over the course of the hour and a half long session. Finally, I observed the introductory session of the long running Hepatitis C series, which lasted an hour. For the duration of each session that I observed, I took detailed field notes about quotes that were said, as well as quotes that were typed in the chat box in the Zoom meeting, and general observations I had. All of the quotes and details of the participants have been de-identified for the purpose of this thesis. After each session concluded, I typed up a brief summary of my takeaways.

Notes from my observations of the three sessions can be found in Appendix D.

The participant observations were valuable data sources for two main reasons. A major advantage of the observational sessions is that the findings were unbiased, in the sense that none of the participants were changing their behavior due to my presence. I was able to witness the participants' natural engagement throughout the session. The second benefit of the observational sessions is that it provided me with an opportunity to examine the interactions among

participants and between facilitators and participants, which ultimately informed my understanding of the relationship within cohorts of the series that ECHO-Chicago conducts.

Quantitative Analysis

Appendix E includes a detailed breakdown of the specific surveys I looked at

The quantitative component of my analysis focused on analyzing results from ECHO-Chicago's pre-series and post-series surveys. During each session, participants are asked to fill out a survey before starting the series and then the same survey after completing the series. The surveys ask a variety of questions but the data that I am analyzing focuses on the 'self-efficacy' questions. The self-efficacy questions ask the respondents to self-report their perceived comfort in several different areas. For example, a self-efficacy question would ask the participant before and after the series to self-identify their "ability to identify school-age children at risk for ADHD during well child and sick visits" on a seven-point scale.[4] To statistically gauge whether there was a change in the respondents' answers before and after the series, I applied paired t-tests. The hypotheses I tested are:

> *H_0: There is no change, on average, in self-efficacy before and after the series*
> *H_a: There is a change, on average, in self-efficacy before and after the series*

The paired t-tests were conducted at a 95% confidence interval and the hypotheses were be tested at a significance level of $\alpha = 0.05$. If the p-value for the paired t-test was less than 0.05, that meant I rejected the null hypothesis (H_0) which indicated there is a change, on average, in self-efficacy before and after the series.

[4] The seven-point scale is defined as: 1, None or no skill at all | 2, Vague knowledge, skills, or competence | 3, Slight knowledge, skills, or competence | 4, Average among my peers | 5, Competent | 6, Very competent | 7, Expert, teach others.

While examining the data, I noticed that some respondents filled out the pre-series survey but not the post-series surveys, so I dropped those responses to minimize any bias their singular responses could introduce. Additionally, some of the surveys were updated with additional questions over time. I tested the updated surveys before and after their changes (the original surveys are marked with a (1) and the updated surveys are marked with a (2)). For all of the remaining participants, I calculated each person's average self-efficacy before and after the series and ran the paired t-tests on those values. The results of those t-tests are displayed in **Table 2**. I also looked at a specific subsets of self-efficacy questions, specifically those that pertained to participants' confidence providing screenings and prescribing specific medications. For the screening and prescription-oriented questions, I followed the same process for conducting paired t-tests and the results of this analysis can be found in **Table 3**. Both tables also include the mean difference between the average pre-series survey self-efficacy scores and post-series average.[5] An important limitation of the data that I am using here is that the surveys capture self-reported self-efficacy changes which can have bias and I will acknowledge this in my analysis. However, given the large volume of data I am working with, the analysis is valuable and helps measure the impact of the programming on primary care providers that participate in ECHO-Chicago's programming.

Results & Discussion

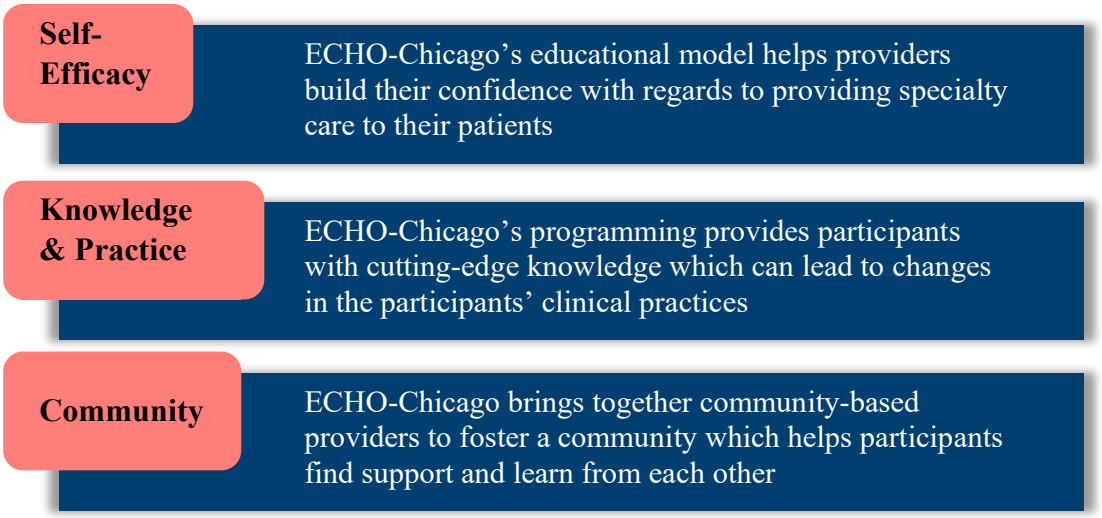
Research Question: What is the impact of democratizing medical education?

In total, I conducted seven long-form interviews, analyzed nine podcasts, and observed three sessions of ECHO-Chicago's various series. In addition to the qualitative data that I

[5] For reference, a one-point increase in the scores would equate to a 14% increase in confidence (+1 on a 7 point scale is a 14.3% increase).

collected and analyzed, I was provided with de-identified pre-series and post-series survey data from ECHO-Chicago for fifteen different series over the last several years. By analyzing these data sources, I can trace the impact of ECHO-Chicago's programming on the following three stakeholders: health care workers (the participants in the programs), patients, and, finally, health care systems. The most salient impact is seen on health care workers, which is to be expected since Project ECHO and ECHO-Chicago's educational programming is for health care providers. However, the less apparent result is the story of ECHO-Chicago's impact on patients and the systemic impact it is beginning to demonstrate and can continue to build on.

The Impact on Health Care Workers



Self-Efficacy: Building Confidence

Self-efficacy changes are a key outcome that ECHO hubs, including ECHO-Chicago, measure. In this section, I discuss how ECHO aims to produce self-efficacy changes and the qualitative and quantitative evidence of the impact. As mentioned previously, self-efficacy is defined as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (*Self-Efficacy Defined*, n.d.).

One of the major intended outcomes of ECHO-Chicago's series is to increase primary care providers' confidence in treating conditions that would otherwise be referred to specialists for treatment, such as Hepatitis C, ADHD, and hypertension. In my interview with Karen Lee, Executive Director at ECHO-Chicago, she explained that

> [Health care workers] know what the recommendations are; what they really have a challenge with, is how to actually do that within the context of their clinic in their practice… And that's the indicator for self-efficacy that we see by the end of the series: do you feel more confident in being able to do these things?

Sandra Tilmon, Research Manager at ECHO-Chicago, elaborated that these surveys illustrate whether "feeling confident enough to engage in some more specialty care within their home clinic." In the podcast episode on the Complex Pediatric Asthma series, Sandra specifically noted that the surveys displayed a high increase in self-efficacy when trying to select the right ventilation devices and medications (*Complex Pediatric Asthma*, 2020). A participant in the Women's Health series named Laura Bauman shared the personal impact of the series. Laura, a manager at Community Health Clinic in West Town, explained that

> I can now confidently speak to patients about their relative risk and help them make an informed decision about when to start mammography because we are able to refer them before they're 50 years of age. And the series really helped me speak to patients when they're inquiring about when they should start, and make an informed decision on their end, about when they should start screening for breast cancer (*Women's Health*, 2020).

The anecdotal evidence coupled with the analysis of survey data from many series will provide greater context to the degreed of the impact of ECHO-Chicago on providers.

ECHO-Chicago facilitates building confidence through the case presentations. In my interview with Kathryn West, Transformation Impact Manager at ECHO-Chicago, she proposed that the case presentations are valuable because

> That's where providers are bringing in the most challenging cases that they have. Oftentimes the facilitators are encouraging the providers that they're doing so much, so well. And so, I think part of it is a confidence boost that they, they really do know a lot, especially when it comes to really tough issues and when it comes to things that they aren't as used to or comfortable treating.

Throughout my participant observations the importance of case-based learning was made apparent. In my second observation session, I sat in on a session that was a part of the AHRQ ECHO National Nursing Home COVID Action Network series.[6] According to the ECHO-Chicago website, this series focuses on sharing best practices and case-based learning to support the on-the-ground efforts of nursing home staff to manage the COVID-19 pandemic (*AHRQ ECHO National Nursing Home COVID-19 Action Network - ECHO-Chicago*, n.d.).

In this specific case presentation, a nursing home representative presented several of the challenges their facility faced at the beginning of the pandemic. The presenter shared their facilities approach to resolving the issues using the structure of the Plan, Do, Study, Act (PDSA) model.[7] Following the presentation, the facilitators vocalized their praise and offered encouraging feedback. The facilitators said that the presentation was a "great example" of QI in practice, which is a major focus of the series' curriculum, and this sentiment was echoed by the other participants via the chat feature. My observations helped illustrate that the case presentations are an excellent forum for providers to receive support and encouragement, while also receiving constructive feedback.

Below is a table that displays the self-efficacy results for all the surveys that I used to conduct my analysis. For all but the Behavioral Health Integration - Systems Collaborative Care

[6] During the AHRQ ECHO National Nursing Home COVID Action Network series, they shared that in the United States, about 40% of COVID-19 deaths have been in nursing homes. As a result, this series has become increasingly important.

[7] PDSA, or Plan-Do-Study-Act, is an iterative, four-stage problem-solving model used in quality improvement.

series, the survey results show a statistically significant increase in self-efficacy after completing the series. The results of the Behavioral Health Integration - Systems Collaborative Care series may be an outlier due to the small sample size. A statistically significant increase in self-efficacy from the surveys I analyzed means that there was an increase in how confident providers felt treating patients with the conditions that were focused on in the series. In the column in **Table 2** labeled 'Difference in Self-Efficacy,' I included the average score change from before the participants completed the series and after completion. Across the surveys that I was able to analyze, on average there was a 1.04-point increase in self-efficacy after completing ECHO-Chicago's trainings. For more context, the 1.04-point increase can be understood as a 15% increase in confidence. Some series, such as Hepatitis C, Childhood Adversity & Trauma, and Opioid Use Disorder, show more significant self-efficacy increases. Additionally, the p-values are very small compared to the significance level of 0.05 that I used to conduct my analysis. The self-efficacy analysis provides convincing quantitative and qualitative evidence that ECHO-Chicago's programming builds up the confidence of providers when it comes to providing specialty care services.

Table 1 *Paired t-test results from the pre- and post-series survey data*

Series Name	t-statistic	Degrees of Freedom	Difference in Self-Efficacy[8]	p-value
Pediatric Attention Deficit Hyperactivity Disorder (1)	8.23	33	1.06	0.0000000017
Pediatric Attention Deficit Hyperactivity Disorder (2)	13.06	75	1.51	$< 2 \times 10^{-16}$
Adolescent Health	5.49	34	0.79	0.0000040
Behavioral Health Integration - Systems Collaborative Care	2.47×10^{-16}	14	1.48×10^{-16}	1

[8] The difference used here is the mean of the differences between the answers to the self-efficacy questions on the post-series survey and the pre-series survey.

Behavioral Health Integration - Common Psych Issues in Primary Care	6.60	44	0.90	0.000000044
Childhood Adversity & Trauma: Strategies for Promoting Health (1)	3.79	13	1.08	0.0023
Childhood Adversity & Trauma: Strategies for Promoting Health (2)	7.69	24	1.47	0.000000062
Complex Pediatric Asthma: Beyond the Guidelines	7.66	65	0.72	0.00000000012
Complex Diabetes: Managing Medical and Social Issues	4.38	24	0.69	0.0002
Geriatrics (1)	3.03	10	0.98	0.013
Geriatrics (2)	11.61	95	1.10	$< 2 \times 10^{-16}$
Geriatrics for Skilled Nursing Facilities	3.53	44	0.63	0.00099
Hepatitis C	22.02	275	1.57	$< 2 \times 10^{-16}$
Resistant Hypertension	11.45	91	0.99	$< 2 \times 10^{-16}$
Childhood Obesity and Comorbidities	8.32	93	0.77	7.39×10^{-13}
Opioid Use Disorder	10.43	65	1.16	1.61×10^{-15}
Women's Health: A Multidisciplinary Approach to Complex Care (1)	6.19	16	1.17	0.000013
Women's Health: A Multidisciplinary Approach to Complex Care (2)	8.96	25	1.21	0.0000000028
Serious Mental Illness	9.59	74	0.85	1.28×10^{-14}

Practice: Accessing Expertise & Gaining Knowledge

As with any educational programming, ECHO-Chicago endeavors to help participants gain new knowledge. The ECHO model teaches participants through didactic sessions with experts, typically the facilitators, and colleagues. Dr. Sandra Naaman, the lead facilitator in the Women's Health series, shared that as a facilitator, she sees herself "playing an important role in transforming community health care by arming peers with the knowledge and the clinical guidelines that will enable them to provide exceptional care to their patients and hopefully

reduce disparities in access to medical care" (*Women's Health*, 2020). Throughout the podcast episodes, a common theme that emerged in the reflections of ECHO-Chicago affiliates was that the programming offers an opportunity to access expert specialists that otherwise would be challenging to access.

In a podcast episode on ECHO-Chicago's COVID-19 partnerships, Dr. Jay Chauhan, of the Chicago Medical Society, noted that he believes that ECHO-Chicago helped by "allaying some of the concerns that doctors [are having during the pandemic that] the information that they're receiving is accurate and well vetted," so providers "know that they're actually treating their patients as best as possible" (*ECHO-Chicago's Partnerships & COVID-19*, 2020). Phoenicia Graham, an MD who works exclusively at FQHCs, noted that "working with the ECHO-Chicago program has been extremely helpful because it puts you in touch with specialists and gives you tools that you can use, but also people that you can then reach out to if you need clarification or like to use the tools" (*Bonus Episode*, 2020). For Dr. Graham, having direct access to specialists allows her to "provide more help" to her patients if getting specialty care is not feasible (*Bonus Episode*, 2020).

The result of building the connection between primary care providers and specialist experts is significant. While observing a Hepatitis C (HCV) session led by Dr. Aronsohn, I learned that Illinois Medicaid Fee-For-Service requires HCV prescriptions to be written by or in consultation with a specialist.[9,10] Dr. Aronsohn explained he was willing to serve as the specialist consultation for providers in the series. Additionally, a participant shared in the chat that in some cases Medicaid accepted ECHO certifications as a substitute for specialist consultations.

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[9] Find the Illinois' State of Medicaid Hepatitis C Access Report Card here

[10] Fee-For-Service - A method in which doctors and other health care providers are paid for each service performed. Examples of services include tests and office visits (*Fee for Service - HealthCare.Gov Glossary*, n.d.)

Requiring specialists to prescribe, or consult on prescriptions for, HCV treatments is a barrier that impacts the ability of patients to receive adequate and efficient care. ECHO-Chicago is able to bridge that gap and help providers deliver the necessary care. Not only does specialist access allow providers to get reliable advice, but it also helps bridge gaps for many providers.

During my interview with Isa Rodriguez, Associate Director of Outreach at ECHO-Chicago, she pointed out that she is finding that "nurse practitioners are really interested in ECHO because they can gain so much knowledge that they didn't gain in school" and that after a ten to seventeen-week series "they can begin to be treating those patients for illnesses that they weren't able to for before [the series]." Esperanza Health Center's chief medical officer, Dr. Andrew Van Wieren, echoed the same sentiment by saying that Esperanza had been hiring more nurse practitioners (NPs) to fill their staffing shortages and ECHO "is an important part of" helping their NPs advance their clinical knowledge base quickly (*Bonus Episode*, 2020). ECHO-Chicago's sessions focus on health care in the real world which helps give participants new perspectives on how to deliver better patient care.

A potential pitfall of ECHO-Chicago is that the focus is not always relegated to the granular clinical details. For example, the sessions are not always focused on diving into the biological mechanisms of certain therapies. Instead, the sessions are typically more application based. With health care workers and FQHCs overextended and lacking resources, it could seem counterproductive to ask them to dedicate their, already scarce, time to these sessions. But the case-based learning component of each ECHO-session fills a serious gap for many participants. Dr. Magda Houlberg, the chief clinical officer at Howard Brown Health Center, rationalized Howard Brown's active participation in ECHO-Chicago saying that many of their providers, across all roles, are "very new to practice" and do not have a lot of clinical experience (*Bonus*

Episode, 2020). The expertise that the facilitators lend to all of the series and best practices that ECHO-Chicago teaches are of value to its many participants.

Community: Fostering a Network in the Safety Net

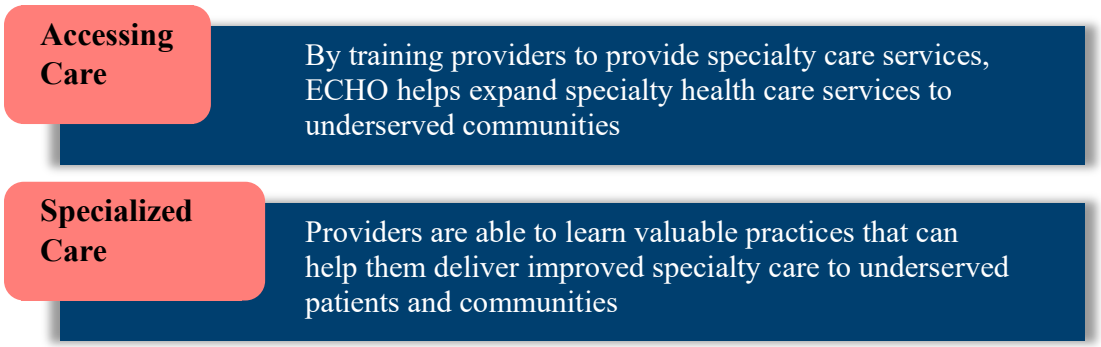
The final component of impact that I will address is the idea of community. Kanika Mittal, the Director of Operations at ECHO-Chicago, explains that ECHO's purpose is to create a "safe learning environment" where providers are "not just learning from the experts, or the specialists, or the sub specialists that are giving out those lectures, but they're also learning from each other." The concept of community is present in many of the testimonials from participants. Dr. Phoenicia Graham explains that when providing care for underserved communities, "there are times where you can feel like you're just in it by yourself" but that ECHO helped her realize that she was not alone and had a network that she could tap into if she needed support (*Bonus Episode*, 2020). Risa Hayes, a facilitator for the AHRQ ECHO National Nursing Home COVID Action Network series, hopes that "our facilities, our participants, feel supported by [ECHO]" (*ECHO-Chicago and the AHRQ Nursing Home Project, Part 2*, 2021). Dr. Magda Houlberg, of Howard Brown Health Center, also noted that

> [through ECHO] we get to learn about some of the other people's kind of programs around that specific topic area. And it kind of gets us information much more quickly about what's actually happening on the ground. So, we don't know if what we're seeing with our patients is really isolated. There's just something we're missing that we don't know that would help us navigate it better, or if this is, in fact something that like there's a widespread challenge that all the health centers are facing (*Bonus Episode*, 2020).

A common thread in my interviews and the podcasts I analyzed was that healthcare workers, especially at FQHCs, are struggling—generally and in the face of the pandemic—and ECHO provides these providers with a supportive community that helps them cope.

I saw a community that ECHO-Chicago helped build while observing an AHRQ ECHO National Nursing Home COVID Action Network session. During the presentation, the facilitators asked questions such as "how long are you seeing the wait time for COVID-19 test results?" to encourage participation and engagement over the hour-and-a-half long program. Many participants shared their responses via the chat feature on Zoom. Other questions were more complex, such as the hypothetical questions that were asked so participants could apply the concepts they were learning. Some questions prompted participants to share their clinics' approaches to handling patient care in the face of the pandemic (i.e., quarantining and social distancing). The questions typically received 15-20 responses in the chat box on Zoom. Given the virtual nature of the sessions, there was considerable engagement, although there may be room to improve this engagement in the future. The act of participants sharing their knowledge and experience with each other builds the foundation for a supportive community.

The Impact on Patients



Increasing Access to Specialty Care

The story of ECHO-Chicago is incomplete without understanding its impact on patients. One of its intended goals to help increase access to specialty health care services to otherwise medically underserved areas. Karen Lee, Executive Director at ECHO-Chicago, explained to me that "when the waitlist [for specialist appointments] is six months, during that six months

[patients are usually] not getting [any treatment] from their primary care, and they're still waiting." Beyond wait times, there are other deterrents that prevent people from accessing specialty care. Dr. Magda Houlberg of Howard Brown Health Center explained that

> Many of our patients, particularly in the city of Chicago, stay local to their neighborhoods—and that can be for many different reasons. Some of them are cultural, some of them are around safety. So many traveling around the city may not be safe for some of our patients. So, accessing care close to where they live is going to be important (*Bonus Episode*, 2020).

Accessing specialty care at large institutions is often undesirable for underserved populations. Safety net hospitals, such as FQHCs, help bridge some of the gaps in health care access in these underserved communities. The question then becomes, does ECHO-Chicago help FQHCs increase access to care? As discussed in the previous section, ECHO-Chicago helps providers become more confident in caring for their patients. Across the podcasts I analyzed, three stories stuck out to me that informed the idea of access to care.

The first story is from the Women's Health Series. Laura Bauman shared that after completing ECHO-Chicago's series on Women's Health, she was "able to perform a manual breast exam as a nurse" and "refer our patients for their mammography" (*Women's Health*, 2020). After completing the series, Laura felt better equipped to help increase access to screenings at the clinic she works at. More screenings at local clinics, such as the one Laura works at, means seeking out health care is more accessible.

The second story is from the Serious Mental Illness series. A participant in the series explained that after the series, he felt that "we can handle this type of patients" and "help with the crisis of lack of psychiatrists" (*Serious Mental Illness*, 2019). Primary care providers are not necessarily always equipped to provide the best care to patients with mental illnesses, but

additional training helps providers take on that role. As a result, patients have a nearby touchpoint at an FQHC to access health care for mental illnesses.

The third story is from the Hepatitis C (HCV) series. Sara Miranda, a family nurse practitioner at PCC Community Wellness Center explained that after undergoing the ECHO trainings on HCV hers, six of her colleagues also completed the training. She shared that "amongst the seven of us across all PCC sites, we have successfully treated about one hundred patients, which I think is amazing for outpatient clinics to be able to offer that kind of service." Sarah also added that "the one hundred patients probably otherwise would not have gone on to successfully achieve a cure" (*Bonus Episode*, 2020). It is difficult to directly attribute patient outcomes to ECHO-Chicago's trainings, but this anecdotal evidence offers a starting point for understanding how the model influences patient outcomes.

Receiving Improved Specialty Care

By giving providers the necessary tools to treat and manage complex yet prevalent conditions, patients are ultimately able to receive improved care. Through the didactic presentations and case-based learning that is at the hallmark of the ECHO model, providers have an opportunity to develop a holistic understanding of how-to better care for patients, in a way that would otherwise only be accessible through specialist providers. As explained in the previous sections, ECHO-Chicago aims to help PCPs deliver more accessible specialty care services to patients along with their primary care services. Dr. Doriane Miller, co-lead for ECHO-Chicago's Serious Mental Illness series, explained that "the ability to have people cared for within the same setting in terms of screening, diagnosis and treatment, I think will help them to see a way in which they can have seamless care and that their providers, whether it be behavioral health or primary care, are all on the same page and all focused on their care in a way

that is patient centered" (*Serious Mental Illness*, 2019). There are two components to understand in order to trace how ECHO-Chicago helps patients receive improved specialty care. The first component is to understand the gaps in the needs of patients and the second component is to understand how ECHO-Chicago bridges those gaps.

Patients in Chicago, and many other underserved areas, face a variety of medical conditions. For example, Dr. Anna Volerman explained in the podcast episode on ECHO-Chicago's Complex Pediatric Asthma series,

> Pediatric asthma is quite prevalent on the South Side of Chicago affecting about 25 percent of children which are largely minority and low-income children and their families. That asthma tends to disproportionately affect them in terms of both prevalence but also morbidity, including things like emergency department visits hospitalizations missed school days (*Complex Pediatric Asthma*, 2020).

In the podcast episode on ECHO-Chicago's Women's Health series, the lead facilitator discussed her approach to developing the series' curriculum. Dr. Sandra Naaman shared that "not only do women have unique health needs such as contraception management, pregnancy, menopause, breast and gynecologic cancers, but even the same health issues that are common to both men and women affect women quite differently" (*Women's Health*, 2020). More specifically, Dr. Naaman notes that heart disease symptoms, urinary tract infections, sexually transmitted diseases, and mental health are among the most prevalent conditions that present themselves differently in women than in men and impact women and men differently (*Women's Health*, 2020). With this understanding, Dr. Naaman developed a curriculum that reflects "a comprehensive approach to women's care, one that extends beyond just the reproductive organs and hopefully arms the participants with the necessary clinical knowledge and state of the art guidelines to provide the best possible care to their patients" (*Women's Health*, 2020).

Throughout the podcast episodes, health care workers shared their own experiences with working with underserved populations. Dr. Stephanie Cox-Batson, for example, noted that "in community health, we have such a shortage of mental health providers and so many primary care providers become behavioral health and mental health providers, but not always with the level of comfort that they would like" (*ECHO-Chicago's Partnerships & COVID-19*, 2020). But the challenges of providing patients with adequate specialty care is a problem that extends beyond the realm of behavioral health. Laura Bauman, a participant in the Women's Health series, shared that many of the patients at her clinic are uninsured and "are often hesitant to seek health care in the first place. I strive to make sure that all of our patients, but especially those that identify as female, are comfortable during their appointment with their provider and are having all questions answered" (*Women's Health*, 2020). Dr. Magda Houlberg of Howard Brown Health explained that Howard Brown's extensive involvement with ECHO-Chicago's Hepatitis C was spurred in part by an interest in "the diagnosis and treatment of Hepatitis C" and Dr. Houlberg adds that "for [Howard Brown's] patient population, because we've been serving the LGBTQ population, there's a higher incidence of people living with HIV and Hep C," which increased their need to "build up some of the ability for us to treat hepatitis C in our community" (*Bonus Episode*, 2020). Providers at many safety-net hospitals and health centers face a unique set of challenges when caring for patients.

ECHO-Chicago helps providers adapt to their circumstances by teaching them actionable ways to make changes to their practices so that their patients can receive better specialty care. Marielle Ogle, a Project Coordinator for ECHO-Chicago, explained that

> We know that [the program participants] have gone to school for a very long time. They know, their stuff. There's always, you know, new things coming, you know, new updates, if you will, about, you know, what they're doing and medically what's best, but because

> it's coming from one of our subject matter experts, and it's being taught in these, you know, incremental kind of sizes for them to build their skills.

The Serious Mental Illness (SMI) series illustrates how ECHO-Chicago helps bring better specialty care services to traditionally underserved populations.

The SMI series' curriculum offers providers a new perspective on patients struggling with mental illnesses. The SMI series introduced a new concept of including patient voices. Director of Operations at ECHO-Chicago, Kanika Mittal, shared that

> We are also incorporating patient voices in our sessions, where we essentially invite a patient or a caregiver. And we request them to talk about their experience working with their doctor in a clinic, and talk about that experience, because sometimes we feel what happens on doctors' end, and is something different from what's happening on the patients end. And so, we want to make sure that we are able to connect the two together, and they can learn from each other.[11]

Karen Lee, Executive Director at ECHO-Chicago, added that the addition of the patient voice "brings up like little changes that providers can make, that [are traditionally] really not addressed in things like, you know, recommendations or, or best practices." To give an example of what these little changes look like, Karen explained that

> [Patients] go in [to the doctor's office], they fill out the papers, they hand them in, they go through the entire visit, and no one acknowledges the mental health questions that they answered on those forms. How does that make the patient feel? Even if it means everything's the same, everything's fine, there's no need to change medication, that acknowledgement still makes a difference. And that's a very small thing that providers can do. Because when they don't acknowledge it, what happens is it starts to degrade that trust between the patient and the provider. So, the next time the patient comes in, are they going to feel like they don't need to spend time answering these questions, or it doesn't matter how they answer these questions? And so, it changes how the patient views those things. And it's just this really small thing that a provider can do to change that.

[11] Disclosure: There is no relation between me and Kanika Mittal

The impetus behind many of the series, including the SMI series, is to show providers some of the best practices so that they can better deliver specialty care. The SMI series, specifically, illustrates how the unique opportunity for providers to learn from patients can help patients ultimately receive better specialty care.

A patient whose voice was featured in the series, noted that when "providers are able to ask consumer representatives questions, it helps them be more alert about the way that they're presenting things and the way that they're saying things to make patients more comfortable" (*Serious Mental Illness*, 2019). The patient also elaborated that including the patient voice

> Turns to the patient, and to a human being, who actually has information about what it is that they're going through and understands what it is that they're going through. It makes them a source of knowledge. And I think that that's very important. There may be stigma behind a certain way that something's being presented, or something is being said and it may make the patient feel uncomfortable (*Serious Mental Illness*, 2019).

During my interview with Kathryn West, she explained that patients

> Are able to provide such an important perspective and share insights that most providers wouldn't get to hear, because they're the types of meta conversations that there just isn't time and space for in most provider-patient relationships. Not because the desire isn't there, but just if you have 15 minutes to see your patient, there's no chance that you also have a chance to say how are you experiencing the, you know, your health care with us.

Brenda Jones, APRN, a participant in the SMI series explained that, in her experience, providers have a tendency to get caught up in the mechanics of treating patients with mental illnesses and that can lead to a loss of empathy in the provider-patient relationship (*Serious Mental Illness*, 2019). Melissa Duplantis, PsyD, another participant in the SMI series shared that the patient voice helped her clinic "change things in our health centers to serve [patients] better" (*Serious Mental Illness*, 2019). By giving providers a chance to reflect on their relationship with patients

in an educational setting, they have an opportunity to analyze the pain points of patients and devise actionable solutions to address them.

The self-efficacy data sheds color on the degree to which ECHO-Chicago's programming helps provide improved to specialty health care services. In this analysis I focused on looking at a subset of the survey questions that focused on how confident primary care providers felt screening for certain conditions (and identifying candidates for screening) and prescribing the appropriate treatments. As discussed in my literature review, screening and prescribing practices can have a serious impact on patient outcomes. Additionally, I included a question in each survey that asks how comfortable the participant would be with assisting their colleagues in treating other patients with similar conditions. This question also ties into the idea of increasing access to specialty care services because it illustrates the extent to which additional patients could also receive improved care from the colleagues of ECHO-Chicago trained providers.

For the analysis of screening and prescription related questions I looked at survey data from the Women's Health, Serious Mental Illness, Hepatitis C, and Complex Pediatric Asthma series because screenings and prescriptions are particularly significant to these patient populations. The analysis presented in **Table 3** indicates that across all four of these series there is a statistically significant increase (approximately 12% to 20% increase in confidence using the difference in self-efficacy values) in the ability of participants to provide specialty care services such as screenings and prescriptions. The very low p-values associated with the t-tests, especially when compared to an $\alpha = 0.05$ significance level, indicate that there is a considerable impact of the series. As a result of providers becoming more confident in identifying and treating patients, especially in communities where specialty care may be otherwise inaccessible, patient outcomes could be considerably improved. A further analysis of patient outcomes through looking at health

records data at the clinics of participating providers would shed more light on this question and what the direct impact of ECHO trainings on patients is. The qualitative and quantitative analysis yields evidence that ECHO's trainings help primary care providers improve the specialty care that is delivered to underserved communities.

Table 2 *Paired t-tests for select series*

Series Name	Subset of Questions	t-statistic	Degrees of Freedom	Difference in Self-Efficacy[12]	p-value
Women's Health: A Multidisciplinary Approach to Complex Care	Ability to elicit an appropriate family history to help identify women at high risk for a possible hereditary cancer syndrome Ability to manage the general follow-up care for women with a history of breast cancer, such as mammograms and bone mineral density testing Ability to order and understand cardiac stress test results Ability to discuss the use of selective estrogen receptor modulators to reduce a women's risk for breast cancer Serve as consultant within my clinic community for Risk-based Women's Healthcare questions/issues	11.03	43	1.24	4.11×10^{-14}
Serious Mental Illness	Ability to diagnose mental health disorders using DSM-V criteria Ability to select appropriate medications for patients with SMI Appropriate use of antipsychotics Ability to serve as a consultant in my clinic for mental health issues and questions	9.46	74	0.98	2.29×10^{-14}
Hepatitis C	Ability to identify patients who should be screened for hepatitis C	20.59	275	1.43	$< 2 \times 10^{-16}$

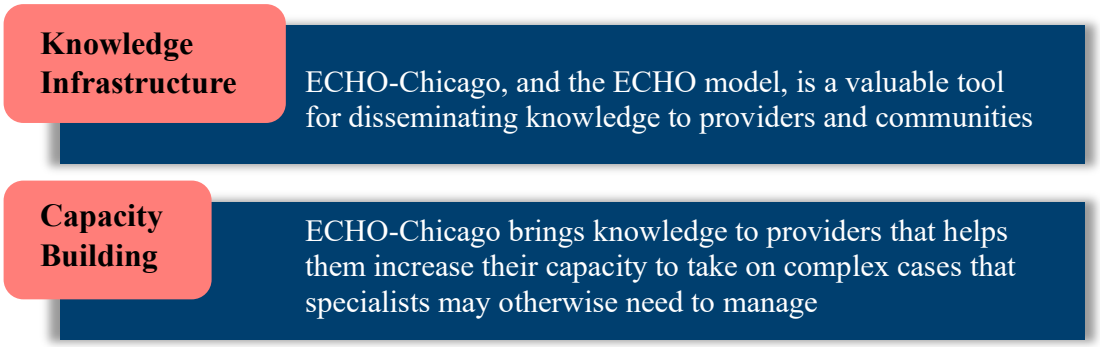
[12] The difference used here is the mean of the differences between the answers to the self-efficacy questions on the post-series survey and the pre-series survey.

	Ability to identify suitable candidates for treatment for hepatitis C Ability to assess and manage psychiatric co-morbidities in patients with hepatitis C Ability to assess and manage substance abuse co-morbidities in patients with hepatitis C Serve as consultant within my clinic and in locality for hepatitis C questions/issues				
Complex Pediatric Asthma	Ability to diagnose asthma in children Ability to select the most appropriate medication(s) for each asthma patient Ability to choose appropriate inhalation device for the patient (e.g., aerosol, HFA, dry powder twisthaler or dry powder diskus) Ability to serve as a consultant within my clinic for asthma questions and issues	7.53	65	0.83	0.000000000197

Nonetheless, it is important to acknowledge that the evidence presented is largely anecdotal and self-reported. A future area for research to better understand the impact of ECHO-Chicago's programming on patient care is to look at electronic health record data of the participating providers' patients before and after completing a series. A barrier to doing this kind of data-driven analysis is the high cost of accessing the data and the time and effort needed to conduct the analysis. The evidence generated from such an analysis, however, would be incredibly valuable to best measure the impact of ECHO-Chicago. In the SMI series, however, a big component of the series is really understanding the patient experience and how to connect with patients to ultimately foster more trust. ECHO-Chicago's curriculum allows for time and space to learn about and reflect on some of the less apparent components of practicing medicine.

Ultimately, that opportunity to reflect on ways that patient care can be delivered best has the potential to translate into real changes that impacts patient care.

The Impact on the Healthcare System



Infrastructure: ECHO as a Versatile Tool for Learning & Teaching

Throughout my interviews and analysis, one theme that rapidly emerged was how ECHO-Chicago has impacted the way health care is delivered, especially in the safety-net health system. In the face of the COVID-19 pandemic, ECHO's capacity for impact has become all the more apparent. During my interview with Patrick Gower, a Project Coordinator with ECHO-Chicago, he shared the importance of sharing medical knowledge with community physicians and other providers because "ultimately that knowledge can save someone's life who can't go to a specialist right away." Over the past year, the COVID-19 pandemic has upended the healthcare system, but programs like ECHO-Chicago have made a concerted effort to support health care workers.

Dr. Daniel Johnson, Director of ECHO-Chicago, explained that ECHO-Chicago "decided very early on that COVID-19 would have to be a part of [their programming], since so many of those series do impact the care of patients who would be affected by COVID-19, such as the hypertension series, the diabetes series, the series on obesity, and even the pediatric series" (*COVID-19 Sessions*, 2020). Dr. Johnson added that the COVID-19 crisis was characterized by a

rapidly evolving knowledge base which meant that the ECHO platform was well suited to "move that knowledge as rapidly as possible out to the community" because "it was the communities of underserved patients in particular that were being impacted by covid more so than others" (*COVID-19 Sessions*, 2020). Finally, he added that ECHO-Chicago and ECHO projects around the world were able to roll out COVID-19 programming to community providers in a span of days and weeks, rather than months and years (*COVID-19 Sessions*, 2020). ECHO-Chicago, specifically, created COVID-19 series for pediatric populations, adult populations, nursing homes, and even for educators in schools. The participant responses to these series tells a story of how salient the ECHO platform is in supporting the health care system.

ECHO-Chicago's model is an effective way to deliver information. Dr. Kate Thompson, a Geriatrician at the University of Chicago and a Project Director for the Share Network, commented that

> ECHO is a great model for information sharing in something rapidly evolving like this pandemic, because not only does it sort of give people who are on the front lines access to the latest and greatest from the experts who are doing the research, are doing the clinical care in infectious diseases and in geriatrics, but it also just offers them the ability to share what's working and what's not within their own practices, really quickly, with a lot of other people who are trying to figure out as well (*COVID-19 Sessions*, 2020).

Dr. Thompson also added that participants had so many questions about "best practices, how to advise patients and family members both on how to stay safe or what to do if they're sick, and how to keep health care workers in primary care practices and in skilled nursing facility safe" (*COVID-19 Sessions*, 2020). Executive Director of the Illinois Chapter of the American Academy of Pediatrics, Jennie Pinkwater, explained that pediatricians "are drowning in information" and that participating in ECHO's pediatric series has been a good opportunity for participants to "share their experience in terms of transitioning their practice to telehealth or

different issues that they're facing" (*COVID-19 Sessions*, 2020). In the midst of a global health crisis, the ECHO-Chicago platform has been leveraged to disseminate information to frontline health care workers.

To put the value of ECHO's trainings in perspective, Shelly Fisher, a series facilitator, reflected on her ECHO experience and shared that

> There's about a 17-year gap between research evidence being disseminated and us actually incorporating it into practice. Whereas [the COVID-19 pandemic] is causing us to take moment by moment findings and push it out and assure that it's getting out to every nook and cranny and actually implemented and that I've never seen in my career before. And I think that that's really hopeful for methods for the future (*ECHO-Chicago and the AHRQ Nursing Home Project, Part 2*, 2021).

While the pandemic has added a new dimension of complexity to the discussion of healthcare systems, ECHO-Chicago has demonstrated that it can be a powerful tool for tackling a variety of other health care challenges by providing the infrastructure for teaching and learning.

Karen Lee, Executive Director at ECHO-Chicago, informed me that they developed an opioid use disorder series for providers to prescribe medication assisted treatment because the city came to them saying that there were a lot of providers "going through [the city's] training to get waivers [to prescribe medication assisted treatment]" but were not seeing providers utilize the treatment. Karen then elaborated that this particular series really helped participants go beyond the mechanics of the treatment and think about how to actually implement its use in their practice. ECHO-Chicago has extended the ECHO model to work with a variety of stakeholders, beyond health care workers. Kanika Mittal pointed out that "the whole goal of ECHO is to provide best practices and this medical education piece using a case-based learning model is applicable in so many different ways." In practice, ECHO-Chicago has done this by incorporating a variety of stakeholders into their series as voices but also developing series that

are not directed towards health care workers. For example, Kanika also shared that ECHO-Chicago recently organized a series for judges to learn about opioid use disorder.

Another example of incorporating other stakeholders is the Complex Pediatric Asthma series. In the Complex Pediatric Asthma series, caregivers (e.g., parents) were invited to be a part of the sessions. A parent of an asthmatic child shared that prior to their daughter having asthma

> I never got the chance to look into that—you know what're the causes, what inhalers, and all of that, so by her having [asthma] and me being [a part of ECHO-Chicago] I've gotten so much more information—each time we meet I learn something new. And by me being a preschool teacher I in turn take that back to my parents that don't know (*Complex Pediatric Asthma*, 2020).

The parent's point about sharing her knowledge with other parents, echoes another comment that came up in one of the podcasts. Dr. Stephen Schrantz, an infectious disease specialist at the University of Chicago, mused that

> The idea of [ECHO] is that we are producing a voice that then is echoed through the primary care providers that is echoed then to the to the patients, and then they echo it to their family and friends. And that's the way you disseminate the right information and combat misinformation or even disinformation that occurs on other platforms, such as social media (*ECHO-Chicago's Partnerships & COVID-19*, 2020).

As noted earlier in the paper, pediatric asthma, for example, has a dramatic impact on communities in Chicago. When parents are better informed of the symptoms and next steps in the care of asthmatic children, they can in turn help educate other parents, thereby creating an educational multiplier effect . The infrastructure that ECHO-Chicago has built up over the last decade has positioned the organization well to tackle health disparities.

It is difficult to measure the direct impact that such an intervention has on patients. Nonetheless, the self-efficacy increase that was demonstrated by the surveys is compelling

evidence that participants are learning in the ECHO-sessions, consequently increasing their self-confidence. Additionally, during the AHRQ ECHO National Nursing Home COVID Action Network session that I observed, a poll was conducted via Zoom that asked, "how much will information from this session help you improve your facility's COVID-19 related practices?" The poll's results showed that 43% of respondents answered, "a lot" and 53% answered "some."[13] Though the degree varied, the consensus was that the information was valuable and would impact their practices in some capacity. A larger scale analysis that focuses on studying several clinics and facilities that have had historically high participation in ECHO-Chicago's programming would likely provide more concrete evidence as the impact of the learnings on patients. The story of ECHO-Chicago started with an aim of teaching and as Patrick Gower noted in our interview, "the sky is the limit" in terms of what the ECHO model can achieve moving forward.

Providers: Increasing Capacity & Reducing Burdens

The final theme that emerged from my analysis was that ECHO-Chicago's programming helps primary care providers build their capacity to treat patients with complex conditions which helps reduce the burden on specialists and patients. As Karen Lee, the Executive Director at ECHO-Chicago, pointed out that a question at the core of the ECHO model is that "can we use the ECHO model, to train up primary care providers, so that they have the skills to be able to provide an additional layer of care before they need to get to specialty care?" If that additional layer is built up, then an implication is that the barrier of wait times would be reduced when trying to access specialty care for underserved communities and then providers could focus their

[13] The AHRQ ECHO National Nursing Home COVID Action Network session that I observed had over 50 participants

scarce time on the most challenging patients. More importantly, however, the consequence of that additional layer of care is that patients are able to get the help and treatment they need at a local FQHC.

ECHO-Chicago has especially been able to demonstrate its ability to build capacity through their Hepatitis C series. ECHO-Chicago developed two series to provide education on Hepatitis C. The first series is called 'Hepatitis C' and is designed to expand primary care capacity for HCV screening and care at community health centers, especially those in underserved neighborhoods. The second series is called 'Hepatitis C Case Management & Clinic Capacity Building' and it is designed to build on the first series through strengthening existing HCV programming and creating individualized HCV workflows for their clinics.

These series were a part of HepCCATT, an initiative to expand and improve hepatitis C testing and care funded by the CDC in 2014 (*HepCCATT*, 2019).[14] Dr. Andrew Aronsohn, the lead facilitator for the Hepatitis C ECHO-Chicago project, explained that HepCCATT is "a full scale implementation of all kinds of services needed on the patient level, and also city level, in order to get more people diagnosed and cured of Hep C" (*HepCCATT*, 2019). Over the years, ECHO-Chicago has trained hundreds of participants on providing HCV care.

Lauren Huss, a family nurse practitioner from ACCESS Community Health Network, said that her participation in ECHO-Chicago's Hepatitis C programming helped her and her clinic "create more of a wraparound service program in order to help support the treatment of hepatitis C patients" (*HepCCATT*, 2019). That "wraparound service program" includes linking patients to providers who have completed the ECHO-Chicago series, getting transportation to

[14] More information about HepCATT can be found here: https://hepccatt.org/

and from visits, helping patients get prior authorization process for insurance verification, ensuring that the FibroScan or additional imaging referrals are made, and appointments are kept (*HepCCATT*, 2019). Dr. Aronsohn also reiterated Lauren's first point by noting that he was seeing instances where, "one person would obtain the [ECHO-Chicago Hepatitis C] training and then they would become the local expert within that FQHC" and that created a sort of "internal referral" process (*HepCCATT*, 2019). There is merit in using ECHO's model to help providers grow their capacity to manage patients, whether the condition is Hepatitis C or something else entirely. But what does this mean for patients?

When PCPs are trained to be able to manage conditions that are otherwise typically managed by specialists, there is an increase in care available and that means more patients can get treated. ACCESS Community Health Network Chief Medical Officer, Dr. Jairo Mejia, put the program's impact in perspective by describing the change in the number of patients that were treated for Hepatitis C at ACCESS Community Health Network. Dr. Mejia shared that in 2016, one treatment for Hepatitis C was completed in the entire organization and in 2018, that number had increased to over 100 patients (*HepCCATT*, 2019). Dr. Aronsohn offered more context to this number adding that "over 350 people now who have taken our course who are individually treating patients themselves, and to think about the number of lives now that they have touched and lives that they have saved, it's really remarkable" (*HepCCATT*, 2019). While ACCESS Community Health Network may not be representative of every location that participates in ECHO-Chicago's series, there is compelling evidence that there is a sort of multiplier effect in this idea of building capacity. ECHO-Chicago's HCV programming has demonstrated how the ECHO model can help build the capacity of PCPs which can then, in turn, reduce the burden on specialists so that care can be adequately allocated to those who need it.

Policy Implications

ECHO-Chicago has demonstrated, both qualitatively and quantitatively, its capacity for impacting the way health care is delivered. The impact, however, was not immediate—ECHO-Chicago has seen tremendous growth over the last ten years since the hub was started by Dr. Daniel Johnson. As the ECHO model has gained, and continues to gain, traction across the United States and globally, there are three major lessons that new, and growing, ECHO hubs can learn from ECHO-Chicago.

Lesson 1: Coalition Building

The first lesson that ECHO-Chicago underscores is the importance of collaboration. ECHO-Chicago's ability to build coalitions with its stakeholders has been integral in their ability to scale up and drive impact. Two important stakeholders are local health organizations, such as FQHCs, and health experts, such as the facilitators from the University of Chicago and other national healthcare organizations. The impact of building coalitions for ECHO hubs is apparent through an analysis of ECHO-Chicago's success. Most importantly, building relationships with local health organizations and collaborating with health experts increases the participant and partner base while improving the programming.

ECHO-Chicago has been able to build relationships with local clinics and health care organizations, such as ACCESS Community Health Network, Howard Brown Health Centers, the Southside Healthcare Collaborative, and so many other community-based organizations. During my interview with Isa Rodriguez, we spoke about the importance of recruiting, and she explained that she maintains relationships with leaders at the different centers and "that's usually [ECHO-Chicago's] way in, talking to leadership, and then leadership funnels it down," and that

turns into participants "[telling] their friends and their friends will join and then they'll tell another three friends, and colleagues, from across the city." For example, the Howard Brown Health Centers conducted an effort to have as many providers as possible participate in the ECHO Hepatitis C series. As a result, their capacity to treat Hepatitis C patients increased dramatically. Working directly with these organizations creates a two-fold network effect by growing the participant base through recommendations from colleagues and, as a result, amplifying the trickle-down effect that increasing the capacity of primary care providers has on other providers, patients, and broader healthcare systems.

One of the challenges is that reaching some of the necessary partners, including the providers (the participants) themselves, can prove to be difficult. With primary care providers overextended at many FQHCs, there is a major time constraint, and committing to extracurricular trainings may not be feasible. A mitigating solution that ECHO-Chicago has employed is working directly with the leadership at clinics and health care organizations to funnel information to the providers and providing a set schedule of all of the sessions in advance so that providers and clinics can plan.

ECHO-Chicago collaborates very closely with a variety of health experts. These health experts are often affiliated with University of Chicago Medicine, but the whole team of facilitators have a range of occupations and affiliations. Some of the series' facilitators are from other health care organizations such as the SHARE Network, Project Hope, and the Institute for Healthcare Improvement. The breadth of experience that the facilitators bring is a key demonstration of the value add of ECHO-Chicago. During my observational sessions of ECHO-Chicago's trainings, I had a chance to see the importance of the expertise firsthand. For example, in the AHRQ ECHO National Nursing Home COVID Action Network session the facilitators

were very knowledgeable about Quality Improvement in health care settings and as a result was able to provide targeted and actionable advice to the participants about the best practices for managing COVID-19 cases and outbreaks in nursing homes. The facilitators designed interactive activities that challenged the participants as evidenced by the participants' questions and answers that were prompted by the activities. Furthermore, podcast interviews with facilitators, such as Dr. Sandra Naaman of the Women's Health series, revealed how much their clinical experience informs the curriculums they design. In addition to the facilitators, ECHO-Chicago worked with city health experts in Chicago to deliver a series that helped providers better learn how to incorporate medication assisted treatment for opioid use disorder. By working with a broad coalition, ECHO-Chicago is able to strengthen its programming and that enhances its ability to affect change in the communities it works with.

The major recommendation for new and growing ECHO hubs trying to grow their participant and partner base is to focus on building coalitions. The major path to building these coalitions is to develop pipelines for partnerships with relevant stakeholders such as clinics, health care organizations, and other experts. Developing effective pipelines demands active outreach, as Isa Rodriguez shared. Reaching the leadership of clinics can be accomplished through professional networks and referrals. Building relationships with partners can drive growth dramatically and as a result is a high impact initiative and should be a near-term priority. However, outreach is not a simple task and as result likely requires dedicated personnel meaning that it is a costly endeavor from a labor and time standpoint. Nonetheless, this recommendation is very feasible for growing ECHO hubs.

In tandem with outreach, it is crucial to be able to provide succinct, yet educational, information about ECHO. ECHO-Chicago's website, for example, is well poised to answer any

questions potential partners may have. They provide a wealth of impact metrics, calendars of upcoming sessions, testimonials from partners, and more. However, compiling and presenting this data is a costly endeavor. Data collection and analysis can be an expensive and time-consuming process, as I will discuss in more detail in the next section, and as a result it may not be very feasible for new and growing ECHO hubs to prioritize providing as much data as ECHO-Chicago is able to provide today. As a result, providing comprehensive and accessible data may be better categorized as a long-term project while nascent ECHO hubs grow their programming. ECHO-Chicago has demonstrated immense skill in fostering relationships and building effective coalitions with partners in Chicago and beyond and there are many transferrable lessons for other ECHO hubs.

Lesson 2: Driving with Data

The second important lesson that I took away from ECHO-Chicago was the importance of being data-driven. The most robust data source ECHO-Chicago has is its participants. At the beginning and at the conclusion of each series, participants are asked to fill out surveys that ask a range of questions—even beyond the self-efficacy questions that the analysis of this paper focused on. ECHO-Chicago's database includes Over the course of the last decade, ECHO-Chicago has been able to accumulate a substantial evidence base. In addition to the surveys, several of the program staff noted that they also received a lot of anecdotal feedback from participants about what in the series was helping and what pain points remained for them. The podcasts used in my analysis were also created by ECHO-Chicago's team and Kathryn West shared that the purpose of sharing all this data and information was to "expand the reach and to be able to share with more people what we're doing, and also to really highlight and elevate the voices of the people who are making the work we do possible."

While collecting data from participants is valuable, there is a degree of bias in the data because it is self-reported and those who are interviewed are self-selected. ECHO-Chicago's Research Manager, Sandra Tilmon, shared that an avenue of research she has pursued is looking at electronic health records (EHR) data. Sandra explained to me that with her analysis of EHR data, she is "actually showing that our clinicians, after participating in that the relevant ECHO [series], change their prescribing practices, or change their assessment practices for kids with asthma, or, for instance, shortening the time [with the disease] for someone with Hep C." As noted in the results discussion, there is a considerable time and financial barrier that often hinders that kind of research, but the degree to which it can be completed is incredibly valuable.

Collecting data is crucial for three reasons. The first reason is that it is a valuable reporting tool for gaining additional funding, as Patrick Gower pointed out to me. Another reason that collecting and sharing ECHO-Chicago's data is that it more clearly depicts the impact of the programming and the scale of what they do. The data helps tell the narrative of the impact ECHO-Chicago has had on Chicago, and the surrounding areas, and makes a compelling case for the ECHO model, more broadly. The final reason that this data is valuable is that the feedback and data help inform the programming. Understanding whether including the patient voice was valuable to the serious mental illness series was crucial and knowledge of its success in that series encourages the addition of patient voices, and other voices, in different series as well.

Impact measurement is becoming increasingly important. For new and growing ECHO hubs that are building up their measurement capacities, there are three major initiatives to help accomplish that. The initiatives I have identified are implementing pre-series and post-series surveys, regularly scheduled communications, and publicly available dashboards of data. Implementing pre-series and post-series surveys are common impact measurement tools utilized

by ECHO hubs across the world. A basic survey would be easy to develop and deploy to participants and as a result, I believe it is a very feasible, low cost, and high impact initiative that can be accomplished in the near-term. ECHO-Chicago's surveys are very comprehensive. For example, they ask self-efficacy questions, knowledge-based questions, and also collect detailed demographic information about participants. Building robust surveys like ECHO-Chicago is likely a more time and labor-intensive undertaking and that would be a long-term initiative.

Next, regularly scheduled communications, such as a quarterly newsletter, would be an effective method of updating potential partners and participants about programming. These newsletters can include testimonials from participants, information about new and developing series, and profiles of facilitators. Developing a quarterly newsletter is a potentially high impact action that can be feasibly done at a low cost and it should, therefore, be a near-term priority for ECHO hubs to create. Over time, with increased sophistication, the frequency of the newsletters could increase. Finally, I would recommend making a public dashboard of all of the data and information collected. The transparency that a public dashboard instills is valuable for recruiting participants, donors, and other partners. Collecting, analyzing, and visualizing data, however, is a laborious undertaking and requires great skill and therefore this should be viewed as a long-term goal to work towards.

Lesson 3: Adapting & Innovating

The final lesson that stood out to me after learning about ECHO-Chicago was the importance of adapting to the needs of their stakeholders, and ultimately innovating to push their boundaries. To discuss the value of innovation in the ECHO model, I will draw on some of the examples of ECHO-Chicago's modifications and creativity that I discussed in the results section.

In the Complex Pediatric Asthma and Serious Mental Illness series, ECHO-Chicago began including patients' and caregivers' voices in the curriculum by having them share their experiences with pediatric asthma and mental illnesses. According to the ECHO-Chicago staff I spoke to, these were generally well received by the participants. The patients and caregivers added a new layer to the discussions happening in each session. Health care inextricably links health care workers, patients, and caregivers. Acknowledging that inseparable connection through the incorporation of everyone's perspectives in a learning environment is a unique feature of the ECHO model.

The final component to this discussion is the potential for other applications of the ECHO model. At its core, the ECHO model aims to educate people at the frontlines of underserved communities and, as a result of a network effect, the learnings then echo to impact communities, more broadly. ECHO-Chicago explored applying the ECHO model to non-providers through a series on opioid use disorder for judges, a series on COVID-19 for school administrators, and their Trauma & the Workforce: Strategies to Enhance Resilience series. Further evidence is likely needed to fully understand the impact of the ECHO model in other contexts, but its demonstrated value in the medical field leaves me optimistic.

Designing and implementing the kind of innovative programming that ECHO-Chicago has over the years is not a near-term focus for new and growing ECHO hubs. Instead, these are long-term initiatives. This kind of programming demands time, bandwidth, funding, and infrastructure. As a result, adding new voices to the series and expanding the reach of the ECHO model beyond health care providers are not feasible today, but should be long-term ambitions. As ECHO hubs solidify their behavioral health programming, they can look towards adding patient voices to the discussions. Additionally, as they improve their pediatrics, even geriatrics,

oriented series, adding in caregiver voices could be a valuable addition. ECHO is a versatile platform and its didactic lessons along with case-based learning model can be valuable in a variety of settings for people beyond health care workers.

Through an analysis of survey, observational, and qualitative interview data, there is considerable evidence that ECHO-Chicago has been able to impact providers, patients, and healthcare systems through providing a unique educational opportunity for primary care providers. The program's offerings have grown considerably since ECHO-Chicago's inception in 2010. As the ECHO model grows through new hubs around the world, there is a lot to be learned about the scaling process. Growth is an important component to understand of the ECHO model because, ultimately, that drives the ability of the program to improve health care delivery on large scale. **Figure 1** illustrates some key initiatives for early-stage ECHO hubs that I identified through my study of ECHO-Chicago and summarizes important considerations for their implementation.

Figure 1 *A summary of the discussed initiatives and their feasibility considerations for nascent ECHO hubs* (KEY: Green dots indicate high feasibility and impact, Yellow dots indicate mid to low feasibility and impact, the dollar signs depict relative cost expectation including labor and time)

	Initiative	Feasibility	Cost	Priority	Impact
Coalition Building	Building pipelines with relevant partners	🟢	$$	Near-term	🟢
	Providing accessible information	🟡	$$	Long-term	🟢
Driving with Data	Pre-series and post-series surveys	🟢	$$	Near-term	🟢
	Newsletters & other regular communications	🟢	$	Near-term	🟡
	Public data dashboard	🟡	$$$	Long-term	🟢
Adapting & Innovating	Introducing additional layers to the curricula	🟡	$$	Long-term	N/A
	Expanding programming initiatives	🟡	$$$	Long-term	N/A

Conclusions

Project ECHO has developed a unique educational model that aims to make specialty care services more accessible to underserved communities. By connecting primary care providers and other health care workers to renowned experts, and to each other, through a case-based curriculum, ECHO-Chicago is able to influence the way health care is delivered. Ultimately, the benefit can be seen on health care workers, patients, and broader health care systems. Over the last decade, ECHO-Chicago has grown its programming and left a considerable footprint on the communities it works with. From their ongoing efforts with Hepatitis C to their recent programming targeted towards helping manage the COVID-19 pandemic, ECHO-Chicago has been able to utilize the ECHO model to demonstrate its value in reducing health care disparities.

Further analysis is certainly necessary to fully grasp the impact of ECHO-Chicago, and other ECHO hubs for that matter. The data presented in this paper largely relies on the subjective interpretations of various stakeholders and, therefore, the next major avenue of study should be concrete quantitative data. Two quantitative analyses that may be beneficial would come from economic data and additional electronic health records data. An economic analysis would entail looking at the cost impact on patients as well as Medicare and Medicaid. Since safety net hospitals provide lower cost services to patients, there are likely savings for patients. Additionally, according to a study of Senate provisions from the HELP and Finance Committees, expanding health insurance coverage and investing in community health centers can generate $369 billion in total medical savings (Ku et al., 2009). A more comprehensive analysis of looking at health centers that have participated in ECHO trainings and whether that has translated into increased patient care capacity could provide valuable information that could guide ECHO funding as well. Finally, looking at clinic-specific health records data, as ECHO-Chicago has done and continues to do, will provide more information about the impact of the training on patient outcomes. Connecting specific providers to their patients' outcomes would provide more information on patient impact. A challenge with conducting both these analyses is that analyzing the data is labor and time intensive, making it a costly undertaking. Nonetheless, the results would be valuable and as a result should be explored by researchers.

Understanding the ECHO model holistically, and its accomplishments through a case study of ECHO-Chicago hubs, is vital to the discussion of the future of ECHO initiatives everywhere. Today there are over 400 ECHO hubs across the world and there have been over two million learning hours—the momentum in the ECHO movement is palpable (*Project ECHO*,

n.d.).[15] ECHO-Chicago is one of many hubs that have made a positive impact in medically underserved communities through building coalitions, being data-driven, and through deploying creative solutions and approaches for their programming. The success of ECHO hubs are, however, heavily influenced by the resources available to them and the enthusiasm from the program organizers and partners. Cultivating financial, structural, and organizational support is a lengthy process but ECHO-Chicago's impact on its community shows the importance of building that support. The lessons that can be learned from ECHO-Chicago are quintessential for other hubs as they look towards growing and driving impact.

[15] More details can be found on the Project ECHO dashboard at https://hsc.unm.edu/echo/data-marketplace/interactive-dashboards/movement-overview.html

Appendix

Appendix A: Podcasts Analyzed

Podcast Name	Interviewees	Description
Serious Mental Illness: Patient & Provider Reflections	Drs. Doriane Miller & Daniel Yohanna, past participants, and other members of the ECHO SMI team.	This episode is about the Serious Mental Illness (SMI) series, started in 2018, which was the first to feature a patient voice segment.
HepCCATT: Stories & Successes	Dr. Andrew Aronsohn (University of Chicago Medicine); ACCESS Community Health Network Chief Medical Officer Dr. Jairo Mejia; and Lauren Huss, FNP-C	This episode discusses the Hepatitis C intervention that ECHO-Chicago has been a part of in Chicago.
Complex Pediatric Asthma: Voices and Impact	Lead Facilitator of the series, Dr. Anna Volerman; two community advisory board members; ECHO-Chicago Director, Dr. Daniel Johnson; Research Manager, Sandra Tilmon, MPH	This episode discusses the Complex Pediatric Asthma series and why pediatric asthma is especially important to address on the South Side of Chicago.
ECHO-Chicago's Urban Impact, Part 1	ECHO-Chicago Director, Dr. Daniel Johnson	This episode helps listeners learn more about the start of ECHO-Chicago and how it addresses the challenges of urban medicine.
ECHO-Chicago's Urban Impact, Part 2	Partners from Esperanza Health Center, Howard Brown Health Center, PCC Community Wellness, and Chicago Family Health	This episode asks partners about their experience with our ECHO programming throughout the years.
Women's Health: An Ever-evolving Field	University of Chicago Medicine's Dr. Sandra Naaman, Facilitator; a former participant	This episode explores how Dr. Naaman has reshaped the Women's Health: A Multidisciplinary Approach to Complex Care series to address the changing world of women's healthcare and the experience of a participant.
COVID-19 Sessions: ECHO-Chicago's Pandemic Response	ECHO-Chicago Director, Dr. Daniel Johnson; ECHO-Chicago facilitator, Dr. Kate Thompson (the SHARE Network); Executive Director of the Illinois Chapter of the American Academy of Pediatrics, Jennie Pinkwater	This episode shares how ECHO-Chicago and ECHO programs globally have responded to the COVID-19 pandemic.
ECHO-Chicago's Partnerships & COVID-19	Dr. Stephanie Cox-Batson (Near North Health Services Corporation); Dr. Jay Chauhan (Chicago Medical Society); Facilitator, Dr. Stephen Schrantz (University of Chicago)	This episode focuses on some of the partnerships that have made ECHO-Chicago's COVID-19 series possible.

ECHO-Chicago & the AHRQ Nursing Home Project, Part 1	Drs. Jen Pisano and Stacie Levine (University of Chicago); Sue Schory and Celeste Pearson (Project Hope)	This episode looks at the AHRQ Nursing Home Project ECHO series and its interdisciplinary focus.
ECHO-Chicago & the AHRQ Nursing Home Project, Part 2	Facilitator, Shelly Fischer (Project Hope); Facilitator, Risa Hayes (Institute for Healthcare Improvement)	This episode examines the focus on the quality improvement and staff well-being focus of the AHRQ Nursing Home Project ECHO series.

Appendix B: Interview Questions

1) *Introductions*
    a. Verbal Consent
    b. Purpose of the Study
2) *Can you tell me about your role at ECHO-Chicago?*
    a. Can you tell me about the different series you've coordinated?
3) *What metrics does ECHO-Chicago use to evaluate "impact"?*
    a. On a similar note, do you have any anecdotal or quantitative data that reflects the "impact" (on the participants and even the patients, if possible) that any of your series have had?
    b. Is there a gap in your ability to measure impact?
    c. What strategies do you employ in order to isolate the impact of ECHO-Chicago specifically?
    d. What do you believe the ideal metrics would be? Are there barriers to using these metrics?
    e. How does access to "impact" oriented data affect the operations of ECHO-Chicago?
    f. Has data been used to make changes to the programming?
4) *Participant Response*
    a. What has the feedback been from participants for your series?
    b. Does the feedback vary across the different series?
    c. Have you seen participants mention changes in their clinical practice?
    d. Do participants come back to attend series in the future?
    e. Network effect - do participants recommend ECHO-Chicago to their colleagues?
5) *Future*
    a. Are there any challenges that you/ECHO-Chicago is facing?
    b. Are there goals that you have for ECHO-Chicago in the next 3-5 years?
6) *How has ECHO-Chicago evolved during your tenure with the organization?*
    a. Growth
    b. Direction/Mission
    c. Strategies

Appendix C: Interview Memos with the ECHO-Chicago Team

Name: Isa Rodriguez, BA	**Role:** Associate Director of Outreach	**Date:** January 15th, 2021

Isa Rodriguez studied Healthcare Management at DePaul University and prior to joining ECHO-Chicago, she worked at The Joint Commission which accredits and certifies tens of thousands of health care organizations and programs. Isa shared that she grew up in an underserved community in Chicago and community health was a natural career choice for her.

- Measuring Impact: ECHO-Chicago utilizes REDCap pre and post series surveys. These surveys ask a lot of general information, their self-efficacy, as well as how much they know about the subject matters sometimes about like, their own personal feelings about the subject matter. ECHO-Chicago's analysis of this survey data has typically seen an increase in self-efficacy.
- Gaps in Measuring Impact: Isa shared that, in a 'perfect world,' they would be able to access Medicaid data and actually measure the difference of how people are obtaining care to see more clearly what the impact of ECHO trainings on patient outcomes is.
- Participant Response: Feedback is important to the team and they try to incorporate as much of the feedback into their programming. Isa also shared, using the Hepatitis C series as an example, that many participants will often stay in contact with the series facilitators and come back for advice on managing certain patient cases. The ECHO-Chicago series traditionally focus on helping providers manage a variety of chronic conditions and as a result the participants will stay involved with ECHO over time.
- Recruiting Participants: Isa is constantly in touch with the leadership at FQHCs and works on building and maintaining relationships with them. ECHO-Chicago also relies heavily on peer referrals to recruit participants. Isa noted that people don't really know what ECHO is until they get in and participate in a series, so the peer referral process is helpful because there is more trust when the information comes from other providers.
- Participant Demographics: Most of the participants are MD/DO's, Nurse Practitioners, Nurses. With ECHO, they are finding that nurse practitioners are really interested in ECHO because they can gain so much knowledge that they do not gain in school. They can quickly begin treating patients for these illnesses which they were not able to before.
- Challenges: There's always a challenge of funding, because they are always looking for steady funding. Additionally, due to COVID, providers across the board have less capacity for additional trainings so there's been a challenge of people not being able to commit which has made some of the series smaller.

Name: Kanika Mittal, MS	**Role:** Director of Operations	**Date:** January 20th, 2021

Kanika Mittal grew up in India and pursued an undergraduate degree in engineering. She then came to the US to pursue a Master of Science in Chemical Engineering from Northwestern University. Kanika worked on several public health projects before coming to ECHO-Chicago.

- Evolution of ECHO-Chicago: They started with a topic which was very adult patient focused and over the course of years, they have expanded some of the pediatric focused topics as well as behavioral and mental health related topics as well. The ECHO team has years and years of experience running this, when this pandemic hit us, the team was quickly able to expand and provide education on best practices related to like COVID prevention and management. They've innovated and begun to include patient voices in their curriculum.
- Goals of ECHO-Chicago: They aim to create this community of learning and it's a safe learning environment because providers are essentially coming in and telling you what they don't know something that they want to work on and improve for to provide the best care for their patients.

- Case Presentations: These are real time cases that they ask for from participants (usually primary care providers) and the participants are asked to bring their most complex cases. The goal is to present the case and the challenges and then it's not just the subject matter experts that are giving their recommendations, it's opened up to the group, because the issue might be something that other providers might have seen in their clinical settings. Everyone is learning from each other.

Name: Karen Lee, MS	**Role:** Executive Director	**Date:** January 20th, 2021

Karen Lee studied HiPSS at the University of Chicago as an undergrad and then pursued a Master's in Health and Social Behavior from the Harvard School of Public Health. Prior to joining ECHO-Chicago, Karen worked with numerous public health programs.

- Beginnings of ECHO-Chicago: Karen shared with me the origins of ECHO-Chicago and the impetus for starting the ECHO program in Chicago. In Chicago, as she pointed out, there are major challenges with accessing health care for some populations. There are issues of accessing transportation, insurance, and wait times, just to name a few.
- Dr. Johnson (the Director of ECHO-Chicago) would say about 20 to 30% of the of the patients that he sees really could be seen by a primary care doctor and be managed by a primary care doctor. If ECHO-Chicago can get more patients seen by primary care managed by primary care, then that frees up the time that the specialty care providers to focus in on the really the most complex patients, so then maybe the wait times won't be as long.
- ECHO-Chicago's Focus on Teaching Best Practices: Karen shared how including the 'patient voice' brings up like little changes that providers can make, and those are things that are really not addressed in recommendations otherwise.
- Gaps in Measuring Impact: They would love to be able to look at more patient outcomes data, but that is difficult to access. While evaluating their Hepatitis C series, they were able to look at patient level data. Looking at patient outcomes data can help answer questions like were more screenings conducted? Were there more diagnoses? Were more people treated? Nonetheless, it's still very difficult to attribute change to a specific educational intervention.
- Running a 'Clinical Trial' to Study ECHO-Chicago: Karen brought up the idea of conducting an experiment where some providers would not get trained, and some providers would get trained. This is not necessarily practical because ECHO is typically appealing to a specific type of provider—i.e., providers that are dedicated enough to get additional training—so 'assigning' providers to take the trainings would not necessarily be effective because they would not have the same intrinsic motivation.
- Community: ECHO-Chicago aims to create a sense of community as well as a learning community.

Name: Sandra Tilmon, MPH	**Role:** Research Manager	**Date:** January 25th, 2021

Sandra Tilmon is an epidemiologist by training and received a Master of Public Health. Sandra has worked on a variety of data analysis projects over the course of her career and has always been motivated by health disparities.

- Health Disparities: ECHO is deeply committed to at risk populations, federally qualified health centers, free and charitable clinics, and other safety net health providers. They want to take the burden off of the least resourced people.
- Data Management and Analysis: Sandra works on analyzing and managing all the pre-series and post-series surveys. The analysis that she runs on the self-efficacy data is also paired t-tests. Self-efficacy is measured on a seven-point scales. We discussed Moore's Evaluation Levels. The challenge is that the self-efficacy is self-reported, so Sandra is also working with EHR data to show

that participating providers are actually changing their clinical practices. The surveys have also started including knowledge-based questions so they can measure 'learning' more concretely.

- Gaps in Data Analysis: Accessing data is extremely costly from a monetary, time, and labor standpoint. Many clinics also don't have great data management infrastructures and that makes it even more difficult to get the necessary data.
- Organizational: ECHO-Chicago has a very robust set of processes and has been able to accomplish a lot over the last decade. Pre-pandemic one of Sandra's goals was to do a large-scale "refurbishment" of the pre and post surveys.
- Sandra and I also discussed other potential research questions:
    - What makes a participant/leader of a health center more or less inclined to participate in ECHO's programming?
    - Looking at self-efficacy by demographics
    - An economic analysis of health centers and ECHO-Chicago

Name: Kathryn West, AM & LSW	**Role:** Transformation Impact Manager	**Date:** February 10th, 2021

Kathryn West is a licensed social worker and went to the University of Chicago's School of Social Service Administration for her Master of Arts in social work. Kathryn shared her passion for Narrative Medicine and explained that her interest lies in where the relationship between patients and providers is, what patients are sharing, how patients tell the stories of their experience, and how that informs the patient-provider relationship and ultimately the impact on healthcare policy, systems, and organizational culture.

- Experience with ECHO-Chicago: Kathryn shared her appreciation of the fact that ECHO-Chicago is research driven because it opens up room for creativity and innovation while generating positive impact. It's important to ECHO-Chicago that their programming has a positive impact because the time of the providers is very scarce and valuable.
- Podcasts: She wanted to start the podcasts (and posting these blogs) because people who reach out can get information about what ECHO-Chicago does, ECHO-Chicago has their public dashboard page where people can see some high-level impact metrics, funders are getting reports, partners are getting information. BUT the general providers who are participating or people who are involved in the community, but may not be getting those regular reports, wouldn't necessarily be able to see what an enormous impact ECHO is having, or a provider/funder who is focused on one specific area might not see the whole range of topics that ECHO is covering.
- Patient Voice: Patients are able to provide such an important perspective and share insights that most providers wouldn't get to hear, because they're the types of kind of meta conversations that there just isn't time and space for in most provider-patient relationships.
- Feedback: In one of the pandemic series that she is working, Kathryn shared that somebody reached out to tell her that the ECHO-Chicago series was keeping him "sane"
- Impact of Prescriptions: In the SMI series they measure providers' comfort prescribing anti-psychotics. It is important to see that comfort level increase because the wait for somebody to see a psychiatrist can be six months long or more, especially if it's somebody who's uninsured or under insured. There is also a dearth of psychiatrists in general, so there's a huge need for more people to be able to prescribe and to feel comfortable doing so. For patients who need anti-psychotics, to be able to get them from a community provider might mean that they have six months more treatment, or six months to start getting testing to see what types of anti-psychotics will work for them. That could make a large difference versus having to wait all that time, especially if there's a lot of impairment because of the illness.
- Potential Challenges: Pre-pandemic Zoom was a sort of novelty but during COVID and post-COVID the appeal might be diminished. However, they have not seen that impact current participation and don't seem very concerned about this.

Name: Marielle Ogle, MS	**Role:** Project Coordinator	**Date:** February 12th, 2021

Marielle Ogle studied advertising during her undergraduate degree and pursued a Master of Management from the University of Illinois at Urbana-Champaign. She started off her career doing marketing work in the healthcare setting and has since worked at the Service Employees' International Union (SEIU) Healthcare, managing a pilot program for specialized training surrounding diabetes, dementia and hypertension, and a holistic women's fertility care center. She has been at ECHO-Chicago for 1.5 years.

- Role at ECHO-Chicago: Marielle coordinates 3 series, works on s the marketing/communications piece as well. Coordinating the series involves speaking with the facilitation team and going through the registration and outreach process to make sure that we're recruiting the right community-based-providers to do our training.
- Women's Health Series: In the early stages, Marielle shared that it was a smaller cohort, about 10 to 15 women, who joined and there was a lot of connecting on the level of shared knowledge. Since those earlier days, the number of men have steadily increased which was a positive change she saw. The most recent cohort was about 1/3 male. This is a positive trend because it means that providers generally want to learn more about women's health. Marielle also shared that this specific series has a lot more medical information (rather than practice-based recommendations).
- Content of the Series: The content typically depends on the audience. A question that guides the programming is: What can you give this audience and this cohort, that they can use to make the lives better (improved quality of care, quality of life) for this population dealing with this condition or this disease?
- How can ECHO-Chicago make sure that people walk away with something, like a nugget of information, that really helps that community-based-organization treat their patients better and get to the root cause of the disease and illness?
- Symphony Partnership: One of the series that Marielle coordinates is geriatrics for skilled nursing facilities. This series is a little different because it focuses on one organization called Symphony. Symphony has different facilities around the city and so these trainings with ECHO also served to connect their providers who otherwise might not have met. The interesting piece here is that they all worked under one organization, so they got to learn how to implement the information in their facilities. And because it's the same organization that they all have the same protocols and practices.
- Potential Challenges for ECHO models: Internet access in some communities is not great (in the US and even more in other parts of the world) and this can be a barrier to access ECHO programming.

Name: Patrick Gower, MPA	**Role:** Project Coordinator	**Date:** February 25th, 2021

Patrick Gower earned a Master of Public Affairs from Indiana University and a Bachelor of Arts in International Studies from the University of Kentucky.

- Role: Patrick has worked on coordinating series on Childhood Obesity, Hypertension, Trauma in the Workforce, and others. He also helps out with recruiting efforts and communicating what the ECHO model is and the expectations of being in a series to potential participants. Patrick also works with Sandra on the data management component of the organization. Some of the data heavy questions he has worked on exploring include how facilitators can use the self-efficacy data to inform their curricula.
- Data: The self-efficacy data is self-reported so it's important to understand that there is some bias when understanding the results. The effect however is generally positive of ECHO-Chicago's programming. Patrick has gotten a lot of positive feedback and has found that people are generally honest about their experiences.
- Seeing Impact: Patrick shared that he tries to categorize the specific changes he sees participants making. For example: prescribing, less specialist referrals, screenings, etc. The impact has a lot to do

with the content of the series and the easiest way to see the impact manifest is through the confidence of the participants (self-efficacy).
- Future & Applications of the ECHO Model: Patrick shared that the idea of teaching people 'best practices' has a lot of applications. At the center of the ECHO model is really this idea of Re-engaging people's minds in learning ways that they can do X, Y, or Z better.

Appendix C: Observational Session Memos

Series Name: Opioid Use Disorder in the Emergency Department	**Observation Date:** January 20th, 2021

- The subject: Opioid Use Disorder in the ED - Legal Issues and Communication Skills
- A discussion on HIPAA with respect to patients with drug use; discussion on AMA cases
- The role of de-escalation and the importance of de-stigmatizing substance use disorder through language and interactions with patients
- Practitioners sharing their experiences with the use of police/security in cases of violent drug-users (I would not share any details beyond this statement)
- Case presentation: The environment that was fostered was very collaborative, the willingness of participants to share their lived experiences (along with approaches, medical knowledge) and the consequences of decisions they may have made (i.e., treatments, use of security in the ER)

Series Name: AHRQ ECHO National Nursing Home COVID Action Network	**Observation Date:** January 28th, 2021

- Number of participants ~ 53
- Quick Coherence Technique (Meditation)
- Epidemiology & Vaccine Updates
    - A discussion of new COVID variants and their transmissibility
    - Vaccine rollout and ideas for assisting in education/debunking myths
    - Required IPC measures (masking, face shield, etc.)
- Challenges in Nursing Homes: Multi-occupancy rooms, shared bathrooms make it difficult to control outbreaks. Since these are the homes of residents, prioritizing quality of life is crucial. Achieving the balance has put a lot of stress of staff.
- Question Posed: How has the access to PPE changed, what does it look like today?
- Question Posed: What are the turnaround times you are seeing with COVID test results?
- Managing telehealth has been difficult and adds a burden for staff
- Treatments available for mild COVID-19 cases (a bit more technical but depending on the demographic of participants the information might be basic)
- Optimizing medication management during the COVID-19 pandemic; considerations regarding when to hospitalize patients
- Monoclonal antibodies treatment
- Interdisciplinary communication strategies and tools → Question Posed: What standardized tools or strategies do you use for interdisciplinary communication?
- Case presentation: How one nursing home handled the initial COVID-19 outbreak in March/April of 2020; the presenter used a PDSA framework
- Overall: I found that everyone was incredibly encouraging, from the facilitators to the other participants. There was a high level of engagement and the participants actively participated when

questions were posed to the group and when they had questions. The chat function was very effectively utilized, and this was made more apparent because of the size of the group.

Series Name: Hepatitis C	**Observation Date:** January 20th, 2021

• Number of participants ~23
• This was the first session in this entire series
• The facilitator provided all of his contact information and encouraged participants to reach out if anybody ever had patient questions
• All the participants introduced themselves (gave their professional backgrounds and everyone shared their experience treating HCV patients—experience ranged from no HCV patients to several patients)
• Participants shared what their goal for the series was: Many indicated that wanted to become more "confident" treating HCV patients
• The facilitator shared that he wanted the series to be interactive and wanted to foster a "back and forth exchange"
• In Illinois you might get declined for filling patients' prescriptions for HCV therapies by Medicaid without specialist consults, but ECHO is able to step in and serve as the consult in many cases
• The session included a primer of HCV to 'level-set'
  ○ Discussed the care cascade
  ○ Potential pitfalls of risk-based screening
  ○ HCV treatments and medications
• Case presentation: A doctor provided a patient case and it ended up fostering a discussion between the facilitator and the provider; there was a discussion of treatment options	

Appendix D: Survey Overviews

Table 4 *Overview of pre-series and post-series survey data analyzed in this paper*

Series Name	Abbreviated Description (from ECHO-Chicago's Website)[16]
Pediatric Attention Deficit Hyperactivity Disorder	Our curriculum touches on everything from behavioral interventions to medication prescription and management, alternative medical options for treatment, and the impact of ADHD on sleep. Though we focus on pediatric ADHD, we also spend a session focusing on ADHD in adults.
Adolescent Health	By improving the adolescent-friendliness of your health center and improving the quality of care provided to adolescents, we can close many gaps they experience in care and improve their overall health and well-being. Through this series, ECHO-Chicago will train community-based primary care providers to provide better care to adolescents living in Chicago, and surrounding areas
Behavioral Health Integration - Systems Collaborative Care	Collaborative care is a type of integrated health care that treats common mental health conditions in primary care. This series aims to enhance access to mental

[16] https://www.echo-chicago.org/topics/

	health care for patients and lead to an improved patient experience through a coordinated effort between primary care providers and behavioral health providers.
Behavioral Health Integration - Common Psych Issues in Primary Care	In addition to delving into symptom identification and diagnosis, our curriculum looks at Motivational Interviewing and other non-pharmacological approaches to treatment as well as medication prescription and management so that more of this first line care can be provided in the primary care setting. This series is focused on the skillset a primary care provider would need, but we also encourage participation from other collaborating healthcare providers, such as social workers and case managers.
Childhood Adversity & Trauma: Strategies for Promoting Health	Through this series, ECHO-Chicago will train community-based primary care providers to assess and address ACEs and implement trauma-informed practices to improve overall well-being of adolescents living in Chicago through ECHO-Chicago's innovative workforce development model for expanding primary care capacity in under-served communities.
Complex Pediatric Asthma: Beyond the Guidelines	Our Complex Pediatric Asthma series curriculum is designed to expand primary care capacity in diagnosing and managing complex asthma for Chicago's most vulnerable children and to increase best practices for pediatric asthma management in the community.
Complex Diabetes: Managing Medical and Social Issues	This series aims to provide PCPs with practical knowledge and skills that will help them implement and sustain evidence-based practices and navigate the complexities of diabetes care and management for both type 1 and type 2, including information and skills about delivering comprehensive diabetes care in resource-constrained communities, and integrating medical and social care delivery in healthcare settings.
Geriatrics	The ECHO-Chicago Geriatrics curriculum improves health outcomes for older adults by creating a robust, engaged network of interdisciplinary care providers who share resources and education to improve health for older adults. Our discussion and case-based learning center on issues of assessment and screening, polypharmacy and medication reconciliation, fall risk assessment, and advanced care planning and end-of-life issues.
Geriatrics for Skilled Nursing Facilities (SNFs)	This curriculum was tailored to address the specific concerns of nursing staff members and aims to answer clinical questions while also providing a forum to discuss the various patient care roles within the SNFs.
Hepatitis C	The ECHO-Chicago curriculum in Hepatitis C (HCV) is designed to expand primary care capacity for HCV screening and evidenced-based care at community health centers, especially those in underserved neighborhoods. ECHO-Chicago training provides primary care providers with the knowledge to identify persons at risk for HCV and conduct risk assessments, test, diagnose, counsel, stage, monitor and treat persons with HCV.
Resistant Hypertension	The ECHO-Chicago Resistant Hypertension curriculum addresses state of the art care, including proper techniques for obtaining accurate BP readings, medication management, important dietary changes, and patient adherence to treatment. The newest hypertension guidelines are also discussed.
Childhood Obesity and Comorbidities	We will discuss the recommendations for primary care providers put forth by the American Medical Association (AMA) which were divided into subcategories that include: reviewing lifestyle habits, family history, physical examination, and

	laboratory testing. We will also learn about environmental causes of obesity as well as co-morbidities.
Opioid Use Disorder	This ECHO-Chicago series will equip primary care providers with the knowledge to provide care to patients and communities suffering from addiction. Our Opioid Use Disorder curriculum is designed to focus on case discussions, problem solving, peer support, and mentorship for beginning MAT prescribers. We welcome all community-based healthcare providers, behavioral health specialists and social workers join his series and learn how to manage complex opioid related cases.
Women's Health: A Multidisciplinary Approach to Complex Care	With a range of topics from behavioral healthcare and the use of Motivational Interviewing to screening and genetic risk factors for cervical and breast cancer, our curriculum moves through a variety of issues which are pressing to our providers and the female patients they serve. This series was designed with the goal of providing training and support to community providers in using a risk-based approach to breast, bone, heart, and gynecological health.
Serious Mental Illness	This series will engage community-based primary care providers in advanced training that builds skills to screen, diagnose, and manage SMI; we cover a variety of topics from behavioral management to community partnerships, Motivational Interviewing, and other brief intervention models. Our ECHO-Chicago SMI curriculum aims to build capacity at the primary care level to help providers become more competent and comfortable delivering care to patients living with SMI and reducing the burden on specialty mental health care and is appropriate for all primary care providers.

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