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Expanding Access to HCV Treatment - Extension for Community Healthcare Outcomes (ECHO) Project: Disruptive Innovation in Specialty Care

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Abstract

The Extension for Community Healthcare Outcomes (ECHO) Model was developed by the University of New Mexico Health Sciences Center (UNMHSC) as a platform to deliver complex specialty medical care to underserved populations through an innovative educational model of team-based inter-disciplinary development. Using state-of-the-art telehealth technology, best practice protocols, and case based learning, ECHO trains and supports primary care providers to develop knowledge and self-efficacy on a variety of diseases. As a result, they can deliver best practice care for complex health conditions in communities where specialty care is unavailable.

ECHO was first developed for the management of hepatitis C virus (HCV), optimal management of which requires consultation with multi-disciplinary experts in medical specialties, mental health and substance abuse. Few practitioners, particularly in rural and underserved areas, have the knowledge to manage its emerging treatment options, side effects, drug toxicities and treatment-induced depression.

In addition data was obtained from observation of ECHO weekly clinics and database of ECHO clinic participation and patient presentations by clinical provider, evaluation of the ECHO program incorporates annual survey integrated into the ECHO annual meeting and routine surveys of community providers about workplace learning, personal and professional experiences, systems and environmental factors associated with professional practice, self-efficacy, facilitators and barriers to ECHO. The initial survey data show a significant improvement in provider knowledge, self-efficacy and professional satisfaction through participation in ECHO HCV clinics. Clinicians reported a moderate to major benefit from participation.

We conclude that ECHO expands access to best practice care for underserved populations, builds communities of practice to enhance professional development and satisfaction of primary care clinicians, and expands sustainable capacity for care by building local centers of excellence.

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Keywords

Telehealth; Hepatitis C; Rural Healthcare; Disease Management; Professional Satisfaction

Introduction: The need and significance of a disruptive innovation for specialty care delivery

(A disruptive innovation is one that has a serious impact on the status quo and changes the way people have been dealing with something, perhaps for decades).

The Extension for Community Healthcare Outcomes (ECHO) Model was developed by the University of New Mexico Health Sciences Center (UNMHSC) as a platform for academic medical centers to deliver complex specialty medical care to underserved populations. Using state-of-the-art multipoint telehealth technology and clinical management tools, ECHO trains and supports primary care providers to develop knowledge and self-efficacy on a variety of diseases not usually considered within their scope of practice. As a result, they can deliver best practice care for complex health conditions in Federally Qualified Health Centers (FQHC), other community-based sites, and prisons where specialty care is unavailable.

Patients who are uninsured, underinsured or living in areas with low socioeconomic status often have limited access to state-of-the-art specialty care. Persons with chronic diseases like hepatitis C may travel to larger cities and attempt to access academic medical centers (AMCs) when their conditions advance and require inpatient or tertiary care. However there are a number of social, cultural, linguistic and financial barriers that delay such utilization. In contrast, their primary care medical homes in FQHCs and with other local providers provide culturally appropriate and accessible care. Moreover, community-based providers can leverage their long term relationships to improve patient adherence and may be more aware of local resources than specialists living outside the community. The ECHO Model was developed as a platform to bridge this service gap, so that patients in rural and underserved areas have the “best of both worlds” individualized care provided by community practitioners and access to AMCs.

Lack of access to quality health care in both underserved urban and rural areas in the United States contributes to poor patient outcomes, particularly for patients with chronic, complex conditions (Crook and Peters, 2008). Primary care providers (PCPs) in medically underserved areas like rural New Mexico face challenges in providing quality care for patients with chronic conditions that would otherwise be managed by specialists. When these providers elect to provide care in the patient’s home community, they typically have limited access to specialists for consultation. Chronic disease management often requires ongoing consultation between the community provider and experts from multiple medical specialties to implement best practices (Whitcomb, 2005). PCPs in underserved areas frequently do not have this type of continuity and support with specialists (Smedley et al., 2002; Strong et al, 2005). As a result, they may be forced to refer patients to the closest academic medical center, which may be a several hours drive and unfamiliar to their patients.

New Mexico has a high proportion of residents who are poor (19.3 percent vs. 13.2 percent nationally) and uninsured (23.2 percent vs. 15.4 percent across the nation) (USDA Economic Research Services 2009). While more than one-third of residents live in rural or frontier areas, only 20 percent of the state’s physicians practice there. Due to severe shortages of specialty providers in rural areas, people with complex conditions such as

hepatitis C or rheumatoid arthritis often have to wait months to get treatment. ECHO was first piloted and evaluated for the treatment of hepatitis C virus (HCV) infections, to apply the inter-disciplinary expertise of specialty providers to this growing health crisis for which treatment options and best practices are constantly evolving (Ghany, 2009). Prior to Project ECHO, fewer than 1,600 New Mexico residents and no state prison inmates had received treatment for HCV and chronic liver disease, despite there being an estimated 34,000 persons living with HCV in the state.

Given the financial and systemic barriers to quality healthcare for rural and urban underserved patients with chronic disease, broader access to chronic disease care requires the use of new models. Project ECHO changes access to specialty care through a disruptive innovation that incorporates technology, co-managed patient care, supported and iterative practice, and chronic disease best practices to better address the challenge of providing quality care to patients with diverse chronic, complex conditions. In this paper, we describe the ECHO model and its application in HCV care New Mexico in detail and present data from initial surveys of the providers that have participated in the program.

Description of the ECHO model

The Extension for Community Healthcare Outcomes (ECHO) model was developed to improve access to complex chronic disease and specialty care in rural and frontier areas of New Mexico and in its prisons. ECHO is a disruptive innovation that allows access to the centralized wealth of subspecialist knowledge and skills found at UNMHSC, the state's only academic medical center (Arora et al., 2007a; Arora et al., 2007b; Arora et al., 2008). First piloted for the treatment of HCV in June 2003, ECHO applies the inter-disciplinary expertise of specialty providers to the growing public health problems of chronic, complex diseases. Through co-management of patients, rural PCPs learn about best practices and treatment for HCV from one to many, iterative case-based discussions that rely on telehealth technology to facilitate participation.

Few rural practitioners are prepared to deal with treatment side effects, drug toxicities, treatment-induced depression, and co-morbidities that include mental health issues and substance abuse common among hepatitis C patients. Optimal management of the complex condition of HCV requires consultation with highly trained specialists from multiple areas including gastroenterology, infectious disease, psychiatry, and addiction medicine. While such consultation is either cost-prohibitive or simply impossible to deliver in rural areas using traditional means, the innovative ECHO model provides this ongoing relationship in an easily accessible way.

ECHO operates regularly scheduled telehealth clinics that serve as "knowledge networks," bringing together expert inter-disciplinary specialists from UNMHSC and multiple community-based primary care providers in co-management of the primary care providers' patients (Figure 1). This is not "telemedicine" where the specialist assumes the care of the patient; instead, it is a guided practice model where the primary care provider retains responsibility for managing the patient, operating with increasing independence as their skills and self-efficacy grow. Collaborative partners in Project ECHO include providers from a variety of clinical sites including FQHCs in rural and underserved areas of the state, prisons, and the New Mexico Department of Health (NMDOH).

When a new partner site joins the network, ECHO staff conducts a 2-day orientation on the HCV treatment protocol, the technology, and the case-based presentation format they will use during weekly 2-hour telemedicine clinics. During these clinics, community partners collaborate with specialists through "learning loops" that follow the familiar case-based learning strategies from their post-graduate medical education. Learning loops are case-

based educational experiences in which community providers learn through three main routes:

1. Longitudinal co-management of patients with specialists offers case-based learning and an opportunity to develop both content knowledge and self-efficacy. The model supports guided feedback from specialists and iterative learning with the opportunity to discuss the patient multiple times during the course of the patient's care.
2. Learning from other community-based primary care providers in similar settings and with similar barriers is facilitated by the network's provider interaction and shared case management decision-making. Network providers are community providers who participate in ECHO together; through shared learning and increased expertise in HCV management and treatment, they also rely on each other for expertise and support and are developing a community of practice.
3. Content knowledge is supported through short didactic presentations keyed to specific issues that have arisen during the telehealth clinic. The presentations are given by the ECHO specialists during telehealth clinics.

Theoretical Basis of the ECHO Model

The ECHO model is based upon established educational theories about learning and behavior change including 1) Bandura's Social Cognitive Theory (1997), 2) Vygotsky's Situated Learning Theory and 3) Communities of Practice (Vygotsky, 1978; Lave and Wenger, 1991).

Social Cognitive Theory identifies influential factors that predispose individuals to believe in their ability to take actions and engage in behavior that will produce desired results. Social Cognitive Theory argues that three factors influence the likelihood of an individual to change his or her behavior. First, the individual must believe that the benefits of performing the new behavior will outweigh its costs. Second, the individual must have confidence in his or her ability to perform the specific behavior in a variety of circumstances, also known as self-efficacy. Third, there must be reinforcement of positive behavior changes from persons who are seen as important (Bandura 1986, Bandura 1997).

The ECHO Model of learning incorporates each of these three components, with a particular emphasis on enhancing provider self-efficacy. Community providers learn the cost and benefits of delivering best practice care in contrast to their prior practices by seeing the impact on their patients. This is reinforced through clinics in which providers collaborate on patient management with inter-disciplinary specialists, who are seen as trusted experts. Most importantly, community providers develop self-efficacy as they assume increasing role in delivering best practice care, with the expert specialists gradually transitioning to a smaller consultative role to ensure patient safety and support provider confidence on an ongoing basis.

ECHO's training components such as learning loops and co-management of patients during telehealth clinics are also based on *situated learning theory*, which notes that learning requires social interaction and collaboration. Situated learning theory evolved from the work of Vygotsky (1978) who defined teaching and instruction as a process of assisting learners in knowledge construction and organization for optimal assimilation and access. Therefore, teaching requires providing learners with the opportunity to 1) extend their current skills and knowledge, 2) model the idealized version of the task, 3) engage learners' interest, 4) simplify tasks so they are manageable, and 5) motivate learners to pursue the task.

Lave and Wenger (1991) extend Vygotsky's work in their *community of practice theory*. In ECHO's one-to-many "knowledge network", the learning process evolves more profoundly and continuous participation in a community of learners who are "in practice" building technical knowledge and skill associated with the care of patients with complex diseases.

Situated learning and community of practice are supported by collaborative learning, coaching and mentoring with those more expert than oneself but also with one's peers. Each of these approaches is accomplished in ECHO through iterative practice, feedback, modeling, successive approximation and mentoring and consultation with inter-disciplinary experts and peers. Recent reports on best practices in physician professional development from the Institute of Medicine, Carnegie Foundation, and Macy Foundation support educational approaches in ECHO (Cooke et al., 2009; Hager et al., 2007; Institute of Medicine, 2009).

Expansion of ECHO and Sources of Funding

Project ECHO has expanded beyond hepatitis C and now covers 12 additional disease areas: 1) asthma and pulmonary disease, 2) child, adolescent, and family psychiatry, 3) chronic pain and headache, 4) diabetes/cardiovascular risk reduction, 5) high-risk pregnancy, 6) HIV/AIDS, 7) integrated addictions and psychiatry (IAP), 8) medical ethics, 9) occupational medicine, 10) pediatric obesity, 11) psychotherapy and 12) rheumatology. There are 255 partner teams participating in ECHO clinics for these diverse areas, as some health providers are involved in multiple ECHO disease areas (Figure 2). More than 10,000 patient consultations have occurred to date across these 13 telehealth clinics.

Project ECHO was awarded a 3-year grant totaling $1.45 million from the Agency for Healthcare Research and Quality (AHRQ) in 2004 for the HCV pilot. An additional AHRQ grant for $1.5 million under the Minority Research Infrastructure Support Program (M-RISP) was awarded in 2007, supporting pilot research for four additional health conditions. ECHO received an award of $5 million from the Robert Wood Johnson Foundation in 2008 to replicate this model in 6 other disease areas and at a second Academic Health Center at the University of Washington. In 2009 ECHO received $1.2 million AHRQ grant to enhance its web based disease management tool. ECHO also receives over $1 million per year from the New Mexico Legislature, based on its ability to make best-practice care for hepatitis C available statewide.

Participant Survey

Project ECHO employs several methods for evaluation of its programs, including (1) Observation of ECHO weekly clinics; (2) Monitoring of database of ECHO clinic participation and patient presentations by clinical provider; (3) Annual survey integrated into the ECHO annual meeting; (4) Routine surveys of community providers about workplace learning, personal and professional experiences, systems and environmental factors associated with professional practice, self-efficacy, facilitators and barriers to ECHO.

Data included in this paper reported in Tables 2-7 is based on two different types of surveys. A survey from the ECHO Annual Meeting is one type of data reported. The data was collected primarily at the conclusion of the meeting and is reported in Tables 2-4. Respondents who attended the Annual Meeting either completed the survey at the end of the meeting, or were asked to return it in a pre-addressed stamped envelope. The ECHO community providers who did not attend the Annual Meeting were sent the survey by mail the following week. Participants who did not respond were sent a reminder two weeks after the first mailing and encouraged to complete the survey.

A second type of survey was sent to HCR providers after they had participated in ECHO HCV telehealth clinics for six months and included items that asked respondents to rate their learning associated with their participation in ECHO, benefits, barriers and technology associated with ECHO. Again participants who did not respond were sent a reminder two weeks after the first mailing and encouraged to complete the survey. Data reported from the "Six Months Participation Survey" are in Tables 5-7. Approval for the study was obtained from the institutional ethics board, including informed consent from each participant.

Response rates to these surveys vary and are as follows: Table 2 - 94%, Table 3 - 89%, Table 4 - 76%, Table 5 - 64%, Table 6 - 71% and Table 7 - 61%. Table 2 reports data from a 2006 survey of ECHO providers who co-manage HCV patients. The responses were uniformly positive in their assessment of the ECHO model including benefit to the practice and patients, expanded access to specialists, and the provider's professional enhancement. In Table 3, ECHO providers report increased competence in each of the nine abilities, rating themselves as having little knowledge or skill in HCV at the time they joined ECHO HCV clinics to being competent or very competent after participation in ECHO for approximately 12 months or longer. The effect size for each item is large and is the overall effect size for the mean comparison of the nine items (Cohen, 1988). Providers also responded positively to the expectations in the ECHO model that they be able to serve as local consultants about HCV questions and issues to other providers. Individual responses on the survey demonstrate their increased self-efficacy.

Table 4 reports the responses of HCV community providers to a 2008 ECHO Annual Meeting survey. Survey items clustered into topics such as transfer of knowledge from the ECHO telemedicine clinic to their clinical activities; support in their clinical environment for their involvement in ECHO; patient safety and quality of care supported by ECHO; and their preferred teaching practices associated with the ECHO model. Providers endorsed a large degree of transfers of knowledge from ECHO clinics to benefit the care of other patients with similar diseases (not presented in ECHO) and to clinical staff at rural sites. Clinicians also expressed confidence in the support they received from ECHO specialists and their own ability to identify and address patient safety issues.

HCV clinicians from partner sites completed a survey after six months of participation in ECHO HCV clinics. Tables 5, 6 and 7 report providers' assessment of their knowledge and skills in patient screening, management, and treatment (Table 5); benefits associated with regular participation in ECHO HCV clinics (Table 6); and sources of learning in these clinics (Table 7). Items in each table are rated on a four point scale. As shown after six months of participation in ECHO HCV co-managed clinics providers reported a moderate to high degree of learning in how to: screen patients for HCV, treat behavioral health and substance abuse issues, identify patients eligible for treatment, interpret lab values, initiate pharmacological treatment and manage side effects. Most providers felt that case base learning was a reliable/essential source of learning and that it enhanced their knowledge about HCV and was a major benefit to them. The anchors used for each rating are described in each table.

Overall, these survey data lend strong support to the ECHO model of care for HCV patients. They also point out areas that may be improved in the future. There are some limitations in the surveys and they include the potential of self selection bias of respondents; only those who participate in ECHO are surveyed, and they may differ in their response from the general population of primary care practitioners who serve the underserved population, our target audience. Although the response rate to the survey was high, these are inherent limitations in self-reported survey data. Finally, the number of ECHO HCV providers (which reflects the population in HCV ECHO) is small.

Implications and Potential for Replication

Project ECHO has the potential to be a significant disruptive innovation in three major areas: 1) access to specialty health care, 2) expanded delivery of evidence-based best practice care, and 3) a new paradigm for team-based interdisciplinary professional development. It contributes to these three areas by using its model of case-based, iterative learning in an environment employing technology to support inter-disciplinary community providers in provision of quality care for patients with chronic, complex diseases.

ECHO provides attention to other needs of community providers as well. Providers develop confidence in their ability to provide safe and effective care, value being part of a community of practitioners dedicated to improved care for complex patients, and appreciate being valued by their peers. They receive professional satisfaction and acknowledgement through their close collaboration with respected experts at an AMC. Ongoing learning and development contributes to a feeling of professional satisfaction that can promote retention in rural and underserved communities that otherwise offer limited opportunities for professional engagement.

The project also demonstrates that technology and inter-disciplinary collaboration can be used to leverage scarce health care resources. Many telemedicine projects link specialists with remotely located patients. ECHO inverts that process and uses technology to build knowledge and skills among remotely located providers who in turn care for patients with chronic disease within their home communities.

Communication between primary care providers and AMC specialists is often suboptimal. Primary care providers may not receive feedback about patients they have referred, and specialists may not know the history of patients when they begin care. ECHO can streamline and enhance such care coordination, with primary and specialty care providers working together to care for patients using the ECHO model.

Hepatitis C was an ideal condition for which to pilot the ECHO model because it is a complex disease that requires experts from multiple specialties, mental health experts and substance abuse professionals to achieve optimum management. Few primary care practitioners, particularly in rural and underserved areas, have the broad knowledge to manage emerging drugs and treatment options, treatment side effects, drug toxicities, treatment-induced depression, and substance abuse issues are common among hepatitis C patients.

As a result of the success of the ECHO model for hepatitis C, there has been significant demand to treat other complex and chronic diseases. ECHO has now expanded to provide telehealth clinics for 13 distinct disease “arms” for challenging and common health issues as broadly divergent as substance use disorders, mental health disorders, cardiac risk reduction (including diabetes, hypertension, hyperlipidemia, obesity, smoking cessation, nutrition and exercise physiology), prevention of teenage suicide, rheumatology and childhood obesity.

While ECHO was developed and piloted in New Mexico where the primary barriers to care are socioeconomic and geographic, it is now being replicated in urban areas and outside of the United States. These efforts will help determine the broader applicability of the model. In addition to the hepatitis C program in New Mexico, a similar HCV program is being replicated for rural residents of Washington State in cooperation with the University of Washington with funding from the Robert Wood Johnson Foundation. India is launching an ECHO effort to respond to disproportionately high rates of HIV/AIDS. These efforts will be studied to investigate whether ECHO is as effective in poor, urban areas or international communities where there are shortages of health care providers.

To expand this model of care delivery, AMCs will need financial incentives. Today, academic health centers focus on research, training, and tertiary care. Federal and state governments could provide funds to promote an additional mission for AMCs to help and build capacity among primary care providers to treat complex, chronic conditions. This incentive would allow models such as ECHO to expand access to best practice care for underserved populations, build communities of practice to enhance professional development and satisfaction of primary care clinicians, and expand sustainable capacity for care by building local centers of excellence.

In summary, ECHO enhances chronic disease management in a number of ways, not just through its innovative use of new technology. In New Mexico and other underserved areas, there are multiple, common, chronic, and complex diseases for which there are too few specialists. Examples include rheumatoid arthritis, hepatitis C, and chronic pain. Collaboration among specialty and primary care providers is an inexpensive way to increase the capacity to provide complex, chronic care even in communities not considered geographically remote. ECHO links these collaborative teams with existing community clinicians and gives them the expertise and confidence to be able to treat these diseases.

In addition to patient care, the technology used in ECHO has demonstrated its utility in educating clinicians through co-managed care of rural and underserved patients throughout the state. The geographic isolation of many communities in New Mexico precludes ongoing on-site professional education or consultation. While there are a variety of educational programs and media available at this time, most online venues do not involve face-to-face interactions with colleagues and do not address their professional isolation. In contrast to typical “telemedicine” services where specialists directly see patients using similar technology, ECHO uses technology to link these specialists with community-based clinicians. Therefore, it empowers and educates these providers through iterative, co-managed case based care to become equivalent to academic specialists in the quality of patient care they provide, a disruptive and innovative healthcare outcome. ECHO focuses on the needs of community providers and underserved patients in supporting best practice care for complex patients, while meeting the larger societal needs within the state to better address expensive chronic diseases growing at unsustainable rates.

Conclusion

In this paper, we demonstrate that using the ECHO model, HCV care delivered by primary care providers in rural areas and prisons can be as safe and effective as that provided by specialists at an AMC. Community providers become progressively more independent over time while remaining well-informed about best evidence, protocol changes and the latest research findings through the clinics and their didactic sessions. As community providers and academic specialists adapt the model to an increasingly broad and diverse range of chronic health issues, ECHO has significant potential for replication and expansion.

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Figure 1.
ECHO HCV "knowledge network" depicting one-to-many relationship in telehealth clinics between expert inter-disciplinary specialists and multiple community-based primary care providers in patient co-management

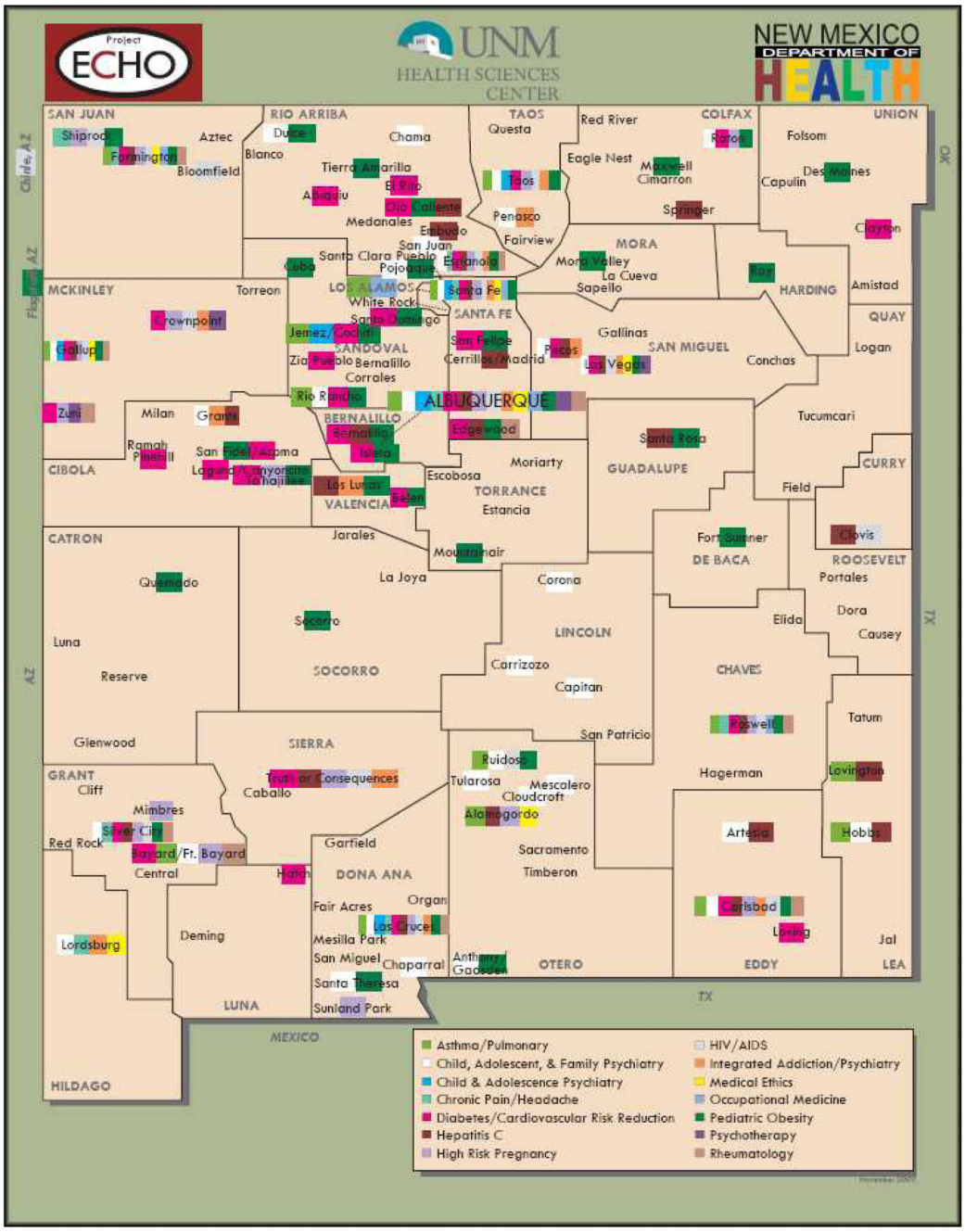

Figure 2. Map of Project ECHO Clinical Treatment Sites in New Mexico

Table 1

Key Accomplishments of ECHO

A total of 415 HCV “knowledge network” telehealth clinics have been held.
The ECHO HCV telehealth clinic has 21 participating agencies across New Mexico that have become HCV Centers of Excellence (a site that accepts referrals for HCV treatment from other clinicians in the community). They include FQHCs, NMDOH offices, Indian Health Service facilities, seven prison sites, and private practice physicians who serve low-income communities.
There have been over 5,000 patient consultations for hepatitis C via the telehealth clinics, with community providers presenting patient cases to receive expert support and co-management. This number includes clinical evaluations and screenings to determine and promote patient readiness, with periodic review of cases that are not treatment-ready to ensure appropriate linkage to other services.
Most consultations serve patients from ethnic/racial minority groups (69% of patients from rural health centers and prisons).
Over 8,500 hours of Continuing Medical Education (CME) and Nursing Continuing Education Units (CEUs) have been issued to community-based primary care providers at no cost to the individual. Project staff have provided over 500 hours of training at rural sites, including staff and provider training as well as Grand Round presentations.

Table 2
Annual Survey of Clinicians Participating in ECHO HCV Clinic, 2006

N=17 Rating Scale: from 1 to 5 with 1=Not at All to 5= To a Large Degree	Mean Score (Range 1-5)
ECHO has diminished my professional isolation.	4.3
My participation in ECHO has enhanced my professional satisfaction.	4.8
Collaboration among agencies in ECHO is a benefit to my clinic.	4.9
ECHO has expanded access to HCV treatment for patients in our community.	4.9
In general access to specialist expertise and consultation is a major area of need for me and my clinic.	4.9
Access to HCV specialist expertise and consultation is a major area of need for me and my clinic.	4.9

Table 3

Community Clinician Assessment of Self-Efficacy in HCV Patient Care (ECHO Annual Survey – 2006 and 2007)

N=25	Prior to Participation MEAN (SD)	After 1-year of Participation MEAD (SD)	Paired Difference MEAN (SD)	P-Value	Effect size for the Change †
Ability to identify patients who should be screened for HCV.	4.2 (1.3)	6.4 (0.6)	2.2 (1.2)	<0.0001	1.8
Ability to identify suitable candidates for treatment for HCV.	2.8 (1.2)	5.6 (0.8)	2.8 (1.2)	<0.0001	2.4
Ability to assess severity of liver disease in patients with HCV.	3.2 (1.2)	5.5 (0.9)	2.3 (1.1)	<0.0001	2.1
Ability to treat HCV patients and manage side effects.	2.0 (1.1)	5.2 (0.8)	3.2 (1.2)	<0.0001	2.6
Ability to educate clinic staff about HCV patients.	2.8 (1.1)	5.8 (0.9)	3.1 (1.3)	<0.0001	2.5
Ability to educate and motivate HCV patients.	3.0 (1.1)	5.7 (0.6)	2.7 (1.1)	<0.0001	2.4
Ability to assess and manage psychiatric co-morbidities in patients with HCV.	2.6 (1.2)	5.1 (1.0)	2.4 (1.3)	<0.0001	1.9
Ability to assess and manage substance abuse co-morbidities in patients with HCV.	2.6 (1.1)	4.7 (1.1)	2.1 (1.1)	<0.0001	1.9
Ability to serve as a consultant within my clinic and in locality for HCV questions/issues.	2.4 (1.2)	5.6 (0.9)	3.3 (1.2)	<0.0001	2.8
Overall Competence (average of 9 items above)	2.8‡ (0.9)	5.5‡ (0.6)	2.7 (0.9)	<0.0001	2.9

*Provider Self-Efficacy - Twenty-five clinicians participating in the ECHO HCV clinics rated theirknowledge, skills, or competence in HCV prior to and after approximately one year of participation. Providers ratedthemselves, both retrospectively and currently, on a 7-point scale (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”.)

†Effect size is the standard mean difference between paired post-participation and pre-participation ratings. It is calculated by using the average paired difference between post-participation and pre-participation ratings as the numerator and the standard deviation of the paired differences as the denominator. A classification of effect size offered by Cohen is: 0.2 = small, 0.5 = medium and 0.8 = large (Cohen, 1988).

[≠]Cronbach's alpha for the 9 BEFORE ratings = 0.92 and Cronbach's alpha for the 9 TODAY ratings = 0.86 indicating a high degree of consistency in the ratings on the 9 items.

Table 4
Annual Survey of Clinicians Participating in ECHO HCV Clinic (2008)

N=23 **Rating Scale Anchors:** **1=Not at All** **5=To a Large Degree**	
Transfer of Knowledge from ECHO Clinic to Clinical Care	**Mean (Standard Deviation)**
I am able to apply knowledge learned in ECHO clinics to patients with similar diseases in my clinic.	4.7 (0.5)
I am able to share knowledge with clinical staff about specific diseases discussed in the ECHO clinics I attend.	4.4 (0.7)
Local Clinical Environment	
Clinicians and staff at my clinic are supportive of my involvement in ECHO.	4.3 (0.8)
Patients and their families support our involvement with ECHO	3.9 (0.9)
Participating and learning about a complex chronic disease through ECHO is an effective way for our clinic to enhance its expertise.	4.7 (0.6)
Local health care professionals consult with us as local experts in specific diseases because of our ECHO participation.	3.6 (1.1)
Patient Safety/Quality of Care	
I am confident as a provider that ECHO addresses patient safety issues promptly and effectively for each of the ECHO clinics in which I participate.	4.8 (0.5)
I am confident about my knowledge and skills to address patient safety issues associated with the patients I present in ECHO clinics.	4.0 (0.8)
ECHO specialists help me identify potential patient safety/quality of care issues.	4.7 (0.5)
Teaching Best Practices	
I am confident/comfortable presenting patient cases during ECHO clinics.	3.6 (1.4)
I listen and learn from providers who present their patient cases during ECHO clinics.	3.8 (1.2)
Didactic sessions during ECHO clinics are an effective way for me to learn screening, treatment, and management of patients.	4.2 (1.0)
Site visits by ECHO staff are an effective way for clinical staff to learn ECHO disease specific screening, management and treatment protocols.	4.2 (1.0)
Multiple site visits at my clinic by ECHO staff would be more effective way to learn ECHO protocol and procedures.	3.4 (1.0)

Table 5

Assessment by Clinical Providers of Degree of Learning in HCV Clinical Content Areas After Six Months Participation in ECHO HCV Co-Managed Clinics

Degree of Learning (N=38) **Rating Scale:** **1=No Learning** **2=Limited Degree** **3=Moderate Degree** **4=High Degree**	**1**	**2**	**3**	**4**
Screening patients for HCV.	5%	8%	32%	55%
Identification of patients eligible for HCV treatment.	0%	3%	26%	71%
Interpretation of laboratory values associated with HCV.	0%	3%	39%	58%
HCV treatment protocol by genotype.	3%	8%	26%	63%
Pharmacological management.	0%	11%	34%	55%
Management of side effects associated with treatment for HCV.	0%	24%	21%	55%
Management of HCV patients who are not eligible for treatment.	3%	16%	47%	34%
Management of non-HCV patients with other GI problems/syndromes. NA=4	12%	32%	44%	12%
Screening HCV patients for behavioral health/substance abuse issues. NA=1	3%	16%	32%	49%
Treatment of behavioral health/substance abuse issues in HCV patients. NA=1	0%	16%	46%	38%
Communication with patient and families about HCV.	3%	11%	42%	45%

Table 6

Assessment by Clinical Providers of Benefits associated with ECHO Participation After Six Months Participation in HCV Co-Managed Clinics

Benefits (N=52) **Rating Scale:** **1=Not a Benefit** **2=Minor Benefit** **3=Moderate Benefit** **4=Major Benefit**	**1**	**2**	**3**	**4**
Enhanced knowledge about management and treatment of HCV patients.		2%	8%	90%
Being well-informed about symptoms of HCV patients in treatment.		4%	15%	81%
Achieving competence in caring for HCV patients.		2%	8%	90%
Self-efficacy: Belief in my ability to manage and treat HCV patients.		6%	13%	81%
Access to expertise in behavioral/mental health resources (in caring for HCV patients). NA=1		6%	14%	80%
Access to expertise in pharmacology (in caring for HCV patients).		6%	23%	71%
Enhanced skills in communication with HCV patients and their families. NA=1	2%	16%	35%	47%
Collegial discussions with peers about HCV patients.		8%	11%	81%

Table 7

Assessment by Clinical Providers of Sources of Learning in ECHO HCV Clinics After Six Months Participation in HCV Co-Managed Clinics

Sources (N=36) **Rating Scale:** **1=Not a Source of Learning** **2=Occasional Source of Learning** **3=Good, Reliable Source of Learning** **4=Essential Source of Learning**	**1**	**2**	**3**	**4**
Learning from colleagues and specialists from other disciplines who participate in the HCV telemedicine clinic.	0%	14%	42%	44%
Learning by returning to topics of discussion several times in the HCV telemedicine clinic. NA=1	6%	18%	35%	41%
Case-based learning as the focus for discussion and learning in HCV telemedicine clinic. NA=1	0%	11%	26%	63%