

ALPHA FOUNDATION FOR THE IMPROVEMENT OF MINE SAFETY AND HEALTH

Final Technical Report

1.0 Cover Page

Grant Number and Title: AFC719-14, Evaluating a Virtual 'Community of Practice' in Pneumoconiosis Mortality Hotspots in the United States

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1.0 Executive Summary (recommended length 1 pages): *The executive summary should provide a succinct and accurate description of the problem statement, the research approach, accomplishments and expected impact on mining health and safety. Since this executive summary may be released to the general public, budgetary information should not be included.*

Problem statement: The recent re-emergence of pneumoconiosis or mining dust-related lung diseases in miners requires innovative prevention and therapeutic strategies in the pneumoconiosis mortality hotspot regions in the U.S. Since most miners live in rural communities with a dearth of skilled expertise in mining-related diseases, the education and mentoring of professionals in rural areas involved in the care of miners is a logical first step, but this approach has not been evaluated.

Research Approach: The Miners' Wellness TeleECHO (Extension for Community Health Outcomes) Clinic at the University of New Mexico provides structured longitudinal tele-mentoring to rural clinical providers, respiratory therapists, benefits counselors, attorneys, and home health company professionals, creating a virtual 'Community of Practice'. This approach towards miners has, however, not been evaluated, constituting a critical gap in our knowledge. Our research objective was to evaluate outcomes related to our tele-mentoring intervention. Our central hypothesis was that participation in the tele-mentoring program improves professional participant and group characteristics.

Accomplishments:

Research Finding 1: Our study demonstrates the successful creation of a virtual multidisciplinary 'community of practice' in pneumoconiosis mortality hotspot rural regions of the U.S., with participants reporting multidisciplinary knowledge transfer. The community is regarded highly by participants regarding trust, willingness to help, and being closely knit.

Research Finding 2: Our study demonstrates the benefit of participating in a multidisciplinary telementoring intervention by improving participant self-efficacy in caring for miners with complex mining-related diseases.

Research Finding 3: Statements of expertise, and their acceptance and eschewal in this community of practice is a multidisciplinary process and its pattern indicates a high level of expertise sharing. This confirms the need for multidisciplinary input in the management of mining-related diseases.

Expected impact on mining health and safety.

As a consequence of the work performed, using our virtual community of practice model, we demonstrate that the participating multi-disciplinary professionals taking care of miners reported longitudinal increase in self-efficacy. We also demonstrated a very high level of collective efficacy, and sharing of expertise among our participants. We demonstrate effectiveness of our model using levels one through three of the Moore's expanded framework for Continuing Medical Education activities (Moore, Green et al. 2009). Our approach of "*moving knowledge and not patients*" will allow miners to receive high quality comprehensive inter-disciplinary care for complex diseases by professionals in rural communities. Our study finding represents a potential solution to a growing access to care gap for miners with pneumoconiosis. This provides the rationale for utilizing systems that are already in place for rapid scaling of the Miners' Wellness TeleECHO Program at other institutions nationally and globally. This will help address the healthcare challenge from the emerging epidemic of pneumoconiosis in the U.S.

2.0 Problem Statement and Objective: *The solicitation focus area should be identified and the problem statement summarized. Sufficient background information should be provided to justify why this approach is needed to advance the solution to this problem area. The specific aims and research objectives should be clearly documented.*

This grant application addresses an alternative focus area that is both understudied and a priority need among common miner health problems. The topical area is the innovative ‘community of practice’ approach to delivering care to miners in rural pneumoconiosis mortality hotspots. Since pneumoconiosis includes asthma and Chronic Obstructive Pulmonary Disease (COPD), this application partly addresses the Alpha Foundation targeted focus area ‘Examination of the Relationships between Mine Environment Exposures and the Development or Exacerbation of Asthma and COPD’ under ‘Injury and Disease Exposure and Risk Factors’.

Problem statement: The recent re-emergence of pneumoconiosis or mining dust-related lung diseases in miners requires innovative prevention and therapeutic strategies in the pneumoconiosis mortality hotspot regions in the U.S. Since most miners live in rural communities with a dearth of skilled expertise in mining-related diseases, the education and mentoring of professionals in rural areas involved in the care of miners is a logical first step, but this approach has not been evaluated.

Background: The Miners’ Wellness TeleECHO (Extension for Community Health Outcomes) Clinic at the University of New Mexico provides structured longitudinal tele-mentoring to rural clinical providers, respiratory therapists, benefits counselors, attorneys, and home health company professionals, creating a virtual ‘Community of Practice’. This approach towards miners has, however, not been evaluated, constituting a critical gap in our knowledge. There is a need to correct this gap in knowledge because without doing so, evidence-based rural interventions for providing complex interdisciplinary care for miners would likely remain beyond reach. The Miners’ Wellness TeleECHO Clinic’s long-term goal is to improve the quality of care delivered to miners in the pneumoconiosis mortality hotspot regions in the U.S. through structured longitudinal tele-mentoring of teams of rural professionals caring for miners, thereby creating a virtual community of practice.

Our research objective is to evaluate outcomes related to our tele-mentoring intervention. Our central hypothesis is that participation in the tele-mentoring program improves professional participant and group characteristics. We plan to test our central hypothesis and, thereby, accomplish our overall objective for this project by pursuing the following two specific aims:

Specific Aim 1: To examine the impact of teleECHO participation on professional participant characteristics, such as knowledge, self-efficacy, and professional isolation. Hypothesis 1A: TeleECHO participants report improvement in knowledge and self-efficacy and reduction in professional isolation at six- and twelve-months compared to baseline. Hypothesis 1B: TeleECHO participants have greater knowledge and self-efficacy, and lower professional isolation than non-participants at the twelve month study time point.

Specific Aim 2: To examine the impact of teleECHO participation on change in professional group characteristics, including collective efficacy, network distance, and sharing of expertise during sessions. Hypothesis 2: TeleECHO participation improves collective efficacy, decreases network distance, and identifies specific qualitative themes and patterns on sharing of expertise between participants.

3.0 Research Approach: *The strategy and study design used to solve the problem should be clearly described. The specific tasks that were used to address the research objectives are to be identified and described to a level of detail that would allow another researcher to understand the methodology and experimental design used to achieve the research objectives.*

Research Approach for Aim 1: In this nonrandomized intervention study, outcomes at six- and twelve-month evaluations for participants were compared to their baseline, to determine longitudinal change. In addition, twelve-month evaluation of outcomes were compared between participants and nonparticipants. The outcomes include self-reported knowledge, self-efficacy, and professional isolation, assessed using a single instrument with three domains, currently being created based on stakeholder input and the published literature.

Research Approach for Aim 2: In this prospective cohort study, outcomes at six- and twelve-month follow-up were compared to baseline, to determine longitudinal change. The outcomes included collective efficacy, network distance, and sharing of expertise during sessions.

Summary of Research Tasks Completed: A summary of study objectives, processes, outputs, and timeline for this project are provided in Table 1 below. The status column indicates that we have accomplished our sub-objectives over the study period.

Table 1: Summary of Sub-objectives, Processes, Outputs, and Timeline in the Project

Sub-objectives (and Aims)	Processes	Outputs	Status
Develop database of 'existing' and 'new' spoke partners (Aims 1 and 2);	a. To create a database of existing ECHO clinic attendees; b. To create a database of potential new spoke partners	a. Database created with information on rurality, discipline and 'new' state	Completed
Perform telephone/email/F2F outreach to spoke partners to encourage participation (Aims 1 and 2);	a. To verify contact information; b. To contact spoke partners	a. Spoke partners verified and contacted	Completed
Conduct technology education for new spoke partners (Aims 1 and 2);	a. To create customized technology education plan b. To educate new spoke partners on clinic technology	a. Technology education plan created; b. Partners educated in the plan;	Completed
Analyze ECHO clinic participation and CME evaluation patterns (Aims 1 and 2);	a. To monitor and analyze participation pattern; b. To analyze CME evaluation patterns; c. To change curriculum, based on above patterns;	a. Participation patterns analyzed; b CME evaluation patterns finalized; c. Fine tune curriculum, based on above patterns;	Completed
To finalize outcome measures for Aim 1 (Aim 1);	a. To finalize items for knowledge, self-efficacy, satisfaction and professional isolation domains in a survey with input from all five stakeholder sets	a. Survey for Aim 1 finalized	Completed
To finalize outcome measures for Aim 2 (Aim 2);	a. To finalize items for collective efficacy survey; b. To finalize items for network distance survey; c. To pilot session transcript recording and qualitative analysis for themes for sharing expertise	a. Survey for collective efficacy finalized; b. Survey for network distance finalized; c. Strategy for sharing expertise finalized;	Completed
Develop REDCap-based methods for administering outcome instruments (Aims 1 and 2);	a. To finalize REDCap-based outcome instruments	a. Outcome instruments created in REDCap;	Completed
Submit and obtain IRB approval/s (Aims 1 and 2);	a. To submit IRB amendments; b. To submit periodic IRB progress report;	a. IRB amendment approval obtained; b. IRB progress report submitted.	Completed
Create data repository at hub site (Aims 1 and 2);	a. To create a repository for archiving didactics and outcome data;	a. Data repository created;	Completed
Collect data on outcome measures for Aim 1 (Aim 1)	a. To administer Aim 1 survey; b. To collect data on Aim 1; c. To store data in repository;	a. Aim 1 survey administered; b. Data on Aim 1 collected; c. Data stored in repository	Completed
Collect data on outcome measures for Aim 2 (Aim 2)	a. To administer Aim 2 surveys on collective efficacy and network distance; b. To collect random session video recording and transcripts for studying	a. Aim 2 surveys on collective efficacy and network distance administered; b. Data on sharing of expertise collected; c. Data stored in repository;	Completed

	sharing of expertise; c. To store data in repository;		
Data analysis (Aims 1 and 2)	a. To pilot/fine-tune and complete data analysis;	a. Data analysis completed for each of the three evaluation time points;	Completed
Interpretation of findings (Aims 1 and 2)	a. To interpret data findings;	a. Data findings interpreted for each of the three evaluation time points;	Completed
Dissemination of findings (aims 1 and 2)	a. To disseminate study findings to stakeholder groups; b. To submit interim reports to Alpha Foundation;	a. Disseminate findings; b. Submit interim and final reports to sponsor	Partially completed

4.0 Research Findings and Accomplishments: *The highlight of the report should be a detailed documentation and discussion of the research findings and accomplishments. The presentation of this material should be organized in a manner that clearly relates to the specific aims and research objectives for the project. Data and information developed from the project efforts should be presented with sufficient detail, analysis, and interpretation to support a clear and full understanding of the research conclusions derived from the project.*

Research Finding 1) Our study demonstrates the successful creation of a virtual multidisciplinary ‘community of practice’ in pneumoconiosis mortality hotspot rural regions of the U.S. (Figure 1), with participants reporting multidisciplinary knowledge transfer. The community is regarded highly by participants regarding trust, willingness to help, and being closely knit.

Over the one-year period from September 12, 2018 to September 18, 2019, 21 clinics were held over 26.5 hours, involving 154 unique attendees, with a total attendance of 514, averaging 24.9 attendees per clinic session. Fourteen attendees presented 21 unique patient cases, and 21 invited experts presented 21 didactics at these clinics during the timeframe. Geographical mapping indicates that attendees were predominantly located in pneumoconiosis mortality hotspots in the Appalachian and Rocky Mountain regions (Dwyer-Lindgren, Bertozzi-Villa et al. 2017) (Figure 1). Of the 129 CME surveys completed during this timeframe (survey response rate 24%), most participants rated the TeleECHO sessions as ‘very good’ to ‘excellent’ for survey items.

Table 1: Characteristics of Surveyed Participants (n=70)

Participant characteristics		N=70	(%)	
Duration of miner care (in years)	1	15	21.4)	
	2-5	22	(31.4)	
	6-10	13	(18.6)	
	11-15	6	(8.6)	
	16-20	3	(4.3)	
	>20	10	(14.3)	
Gender identity	Female	45	(64.3)	
Race	White	57	(81.4)	
Ethnicity	Non-Hispanic	63	(90.0)	
Age (in years)	≤ 50 years	36	(52.9)	
	≥ 51 years	32	(47.1)	
Proportion of rural miners served	≥ 61%	38	(55.1)	
	41-60%	13	(18.8)	
	≤ 40%	18	(26.1)	
Existing vs. new participants	Existing	30	(42.9)	
	New	40	(57.1)	
Clinical professional groups	Individual stakeholder groups	Clinician	20	(28.6)
		Respiratory therapist	12	(17.1)
		Home health company professional	14	(20.0)
Non-Clinical professional groups	Individual stakeholder groups	Lawyer/attorney	7	(10.0)
		Benefits counselor	8	(11.4)
		Other	9	(12.9)
Satisfaction in professional practice	Agree or strongly agree	61	(87.1)	
Lack of professional isolation	Agree or strongly agree	45	(64.4)	

Note 1: Clinical professional groups include the following stakeholder groups: clinician, respiratory therapist and home health professional. Non-Clinical professional groups include the following stakeholder groups: lawyer/attorney, benefits counselor, and other.

A convenience sample of 70 subjects (constituting 45% of the unique attendees) participated in a detailed survey. Most participants were white non-Hispanics, women, and 50 years or less in age (Table 1). Of all participants, 66% belonged to the clinical professional groups, including the clinician (29%), home health professional (20%), and respiratory therapist (17%) stakeholder groups; and 34% belonged to the non-clinical professional groups, including the lawyer/attorney (10%), benefits counselor (11%), and other (13%)

stakeholder groups. Most participants reported caring for miners from mostly rural communities for no more than 10 years. Despite a high level of job satisfaction, a significant minority of participants reported professional isolation.

Most participants correctly responded to nine of the ten knowledge questions relevant to the care of miners (Table 2). Participants demonstrated the lowest knowledge score on ‘legal’ pneumoconiosis, among the questioned knowledge areas. Participants in clinical professional groups were significantly more likely to correctly answer the question on guidelines for providing supplemental oxygen than those in nonclinical professional groups. As compared to fresh participants, existing participants were more likely to correctly answer questions on the type of workers eligible for miners’ compensation programs in the U.S., and the small opacity profusion threshold using the international classification of radiographs of pneumoconiosis (*i.e.*, B-reads). Although the total knowledge score was not significantly different between participants in the clinical versus nonclinical professional groups, existing participants demonstrated a trend towards a higher total score than fresh participants ($p=0.06$, Wilcoxon two-sample test).

Table 2: Assessment of Self-reported Knowledge, from a Convenience Sample of 70 Participants

Participants demonstrating correct responses to the following questions:	All participants (N=70)	Participants in clinical professional groups (N=46)	Participants in non-clinical professional groups (N=24)	Fresh participants (N=40)	Existing participants (N=30)
	n (%)	n (%)	n (%)	n (%)	n (%)
Why is the assessment of oxygenation status with exercise encouraged during Department of Labor evaluation for coal miners?	67 (95.7%)	45 (97.8%)	22 (91.7%)	37 (92.5%)	30 (100%)
Which condition is commonly accepted as a consequential disease in miners?	54 (77.1%)	38 (82.6%)	16 (66.7%)	29 (72.5%)	25 (83.3%)
Silica exposure can cause the following lung diseases in miners except..	52 (74.3%)	33 (71.7%)	19 (79.2%)	28 (70.0%)	24 (80.0%)
What is DDF?	51 (72.9%)	33 (71.7%)	18 (75.0%)	26 (65.0%)	25 (83.3%)
Which one of the following combinations of worker type and compensation program is incorrect?	49 (70.0%)	30 (65.2%)	19 (79.2%)	22 (55.0%)	27 (90.0%)**
Which of the following statements is true regarding home based interventions in miners?	45 (64.3%)	28 (60.9%)	17 (70.8%)	27 (67.5%)	18 (60.0%)
Where small pneumoconiotic opacities exist in a B read classification for pneumoconiosis in a chest radiograph, at which profusion score threshold is there a concern of pneumoconiosis?	40 (57.1%)	24 (52.2%)	16 (66.7%)	18 (45.0%)	22 (73.3%)*
Which level of oxygenation is adequate for prescribing supplemental oxygen therapy, under the Medicare COPD guidelines?	40 (57.1%)	32 (69.6%)	8 (33.3%)**	23 (57.5%)	17 (56.7%)
Which one of the following spirometric patterns demonstrate airflow obstruction, using the GOLD criterion?	39 (55.7%)	27 (58.7%)	12 (50.0%)	24 (60.0%)	15 (50.0%)
Which disease in a coal miner is not considered legal pneumoconiosis?	10 (14.3%)	4 (8.7%)	6 (25.0%)	5 (12.5%)	5 (16.7%)
Total knowledge score	6.4 ± 1.8 (SD)	6.4 ± 1.8 (SD)	6.4 ± 2.0 (SD)	6.0 ± 2.0 (SD)	6.9 ± 1.5 (SD)

Note 1: * $p<0.05$; ** $p<0.01$ (using Fisher’s exact test for categorical variables and Wilcoxon two-sample test for continuous variables)

Note 2: Clinical professional groups include the following stakeholder groups: clinician, respiratory therapist and home health professional. Non-clinical professional groups include the following stakeholder groups: lawyer/attorney, benefits counselor, and other.

Key: DDF: Dust-related diffuse fibrosis; GOLD: Global Strategy for Obstructive Lung Disease; SD: Standard deviation

Although most participants reported high self-efficacy with respect to “soft” skills (such as empathy and sociocultural competency), and ability to refer appropriately to other experts, participants reported relatively lower self-efficacy with respect to diagnosing miners’ conditions, interpreting B-read reports, and determining eligibility for compensation under specific miners’ compensation programs (Table 3). As opposed to participants in non-clinical professional groups, those in clinical professional groups reported lower self-efficacy with respect to their ability to help miners navigate the compensation process and to serve as regional experts. On the other hand, participants in clinical professional groups reported greater self-efficacy with respect to managing and diagnosing health conditions. As compared to fresh participants, existing participants demonstrated significantly greater self-efficacy with respect to empathy and the ability to refer appropriately to other experts, collaborate with and educate other team members, and determine eligibility for compensation.

Table 3: Participants Rating Themselves as ‘Competent’, ‘Very Competent’ or ‘Expert’ on Self-efficacy Items (Corresponding to the Top Three Ratings on a Scale of 1-7), from a Convenience Sample of 70 Participants

Self-efficacy Items	All participants (N=70)	Participants in clinical versus non-clinical professional groups		Fresh versus Existing Participants	
		Clinical (N=46)	Non-clinical (N=24)	Fresh (N=40)	Existing (N=30)
	n (%)	n (%)	n (%)	n (%)	n (%)
Ability to demonstrate empathy towards miners with work related diseases	61 (87.1%)	39 (84.8%)	22 (91.7%)	31 (77.5%)	30 (100.0%)*
Ability to identify social, linguistic, cultural, economic, and educational barriers for care for miners	52 (74.3%)	34 (73.9%)	18 (75.0%)	26 (65.0%)	26.0 (86.7%)
Ability to refer patients with diseases to appropriate experts, in absence of relevant expertise	49 (70.0%)	33 (71.7%)	16 (66.7%)	23 (57.5%)	26 (86.7%)*
Ability to collect information required under the miners' compensation programs	45 (64.3%)	28 (60.9%)	17 (70.8%)	22 (55.0%)	23 (76.7%)
Ability to collaborate with and educate other team members about miners' diseases	44 (62.9%)	29 (63.0%)	15 (62.5%)	20 (50.0%)	24 (80.0%)*
Ability to assess the quality of the pulmonary function test	39 (57.7%)	29 (63.0%)	10 (41.7%)	21 (52.5%)	18 (60.0%)
Ability to advocate for your patient/client to help them navigate the compensation process	39 (55.7%)	23 (50.0%)	16 (66.7%)*	19 (47.5%)	20 (66.7%)
Ability to interpret pulmonary function test results	39 (55.7%)	28 (60.9%)	11 (45.8%)	20 (50.0%)	19 (63.3%)
Ability to interpret arterial blood gas test results	38 (54.3%)	29 (63.0%)	9 (37.5%)	19 (47.5%)	19 (63.3%)
Ability to serve as the miners' expert in your community/region	37 (52.9%)	23 (50.0%)	14 (58.3%)*	17 (42.5%)	20 (66.7%)
Ability to help manage common health conditions in miners	32 (45.7%)	26 (56.5%)	6 (25.0%)**	16 (40.0%)	16 (53.3%)
Ability to determine eligibility for compensation under specific miners' compensation programs	30 (42.9%)	16 (34.8%)	14 (58.3%)	11 (27.5%)	19 (63.3%)**
Ability to interpret B-read reports of chest radiographs	25 (35.7%)	14 (30.4%)	11 (45.8%)	11 (27.5%)	14 (46.7%)
Ability to diagnose common health conditions in miners	27 (38.6)	22 (47.8%)	5 (20.8%)*	13 (32.5%)	14 (46.7%)

Note 1: *p<0.05; **p<0.01 (using Fisher’s exact test for categorical variables)

Note 2: Clinical professional groups include the following stakeholder groups: clinician, respiratory therapist and home health professional. Non-clinical professional groups include the following stakeholder groups: lawyer/attorney, benefits counselor, and other.

Participants rated the ‘community of practice’ highly with respect to its willingness to help overall (93%) and for improving patient care (91%), respect (91%), finding and sharing resources (89%), fostering members’ ability to care for miners (87%), being closely knit (87%), and trust (86%). The learning community was rated lower with respect to supporting each other in times of stress (66%), intervening if a fellow participant was arriving at a wrong conclusion (73%), or figuring out what choices to make when the clinic faced decisions

(77%; Table 4). There were no significant differences with respect to any of the individual collective efficacy items among participants in the clinical versus nonclinical professional groups, and fresh versus existing participants.

Table 4: Participants Agreeing or Strongly Agreeing with Individual Collective Efficacy Items

Collective efficacy item	All participants (N=70) n (%)	Participants in clinical versus non-clinical professional groups		Fresh versus Existing Participants	
		Clinical (N=46) n (%)	Non-clinical (N=24) n (%)	Fresh (N=40) n (%)	Existing (N=30) n (%)
People in this learning community are willing to help other members	65 (92.9%)	45 (97.8%)	20 (83.3%)	38 (95.0%)	27 (90.0%)
People in this learning community help each other to improve patient care	64 (91.4%)	44 (95.7%)	20 (83.3%)	36 (90.0%)	28 (93.3%)
People in this learning community build respect for each other's particular interests	64 (91.4%)	43 (93.5%)	21 (87.5%)	37 (92.5%)	27 (90.0%)
People in this learning community find and share resources with each other	62 (88.6%)	41 (89.1%)	21 (87.5%)	38 (95.0%)	24 (80.0%)
This is a close-knit learning community	61 (87.1%)	43 (93.5%)	18 (75.0%)	35 (87.5%)	26 (86.7%)
This learning community fosters all members' ability to care for miners	61 (87.1%)	40 (87.0%)	21 (87.5%)	36 (90.0%)	25 (83.3%)
People in this learning community generally get along with each other	61 (87.1%)	40 (87.0%)	21 (87.5%)	35 (87.5%)	26 (86.7%)
People in this learning community can be trusted	60 (85.7%)	40 (87.0%)	20 (83.3%)	35 (87.5%)	25 (83.3%)
People in this learning community are able to manage conflicts of interests	58 (82.9%)	41 (89.1%)	17 (70.8%)	32 (80.0%)	26 (86.7%)
People in this learning community figure out what choices to make when the clinic faces decisions	54 (77.1%)	37 (80.4%)	17 (70.8%)	30 (75.0%)	24 (80.0%)
Members in this learning community would intervene if a fellow member was arriving at a wrong conclusion	51 (72.9%)	37 (80.4%)	14 (58.3%)	27 (67.5%)	24 (80.0%)
People in this learning community support each other in times of stress	46 (65.7%)	30 (65.2%)	16 (66.7%)	26 (65.0%)	20 (66.7%)

Note 1: None of the comparisons were statistically significantly different (using Fisher's exact test for categorical variables).

Note 2: Clinical professional groups include the following stakeholder groups: clinician, respiratory therapist and home health professional. Non-clinic

Results examining patterns of knowledge transfer within the 'community of practice' are presented in Table 5. Across all participants, respondents reported having a mean number of 4.33 knowledge sources, with existing participants reporting a significantly higher mean number of knowledge sources than fresh participants. Among all participants, respondents reported on average that nearly half (0.47) of their knowledge sources were from outside of their professional group. Participants in the non-clinical professional groups reported a significantly higher mean proportion of knowledge sources from outside of their professional group, than participants in the clinical professional groups. Finally, among the entire sample, the mean proportion of knowledge sources outside of one's stakeholder group was 0.51. Existing participants reported a significantly higher mean proportion of knowledge ties from outside of their stakeholder group than fresh participants.

Table 5: ‘Community of Practice’ Network Analysis of Knowledge Transfer for Either Individual Stakeholder Groups or Collections of Stakeholder Groups.

	Participants in clinical versus non-clinical professional groups						Fresh versus Existing Participants			
	All Participants		Clinical		Non-clinical		Fresh		Existing	
	Mean	(SE)	Mean	(SE)	Mean	(SE)	Mean	(SE)	Mean	(SE)
Number of knowledge sources (N=70)	4.33	(0.36)	3.97	(0.48)	4.63	(0.52)	3.60	(0.44)	5.30*	(0.56)
Proportion of knowledge sources outside of professional group (N=68) ¹	0.47	(0.04)	0.24	(0.04)	0.68**	(0.04)	0.48	(0.06)	0.47	(0.05)
Proportion of knowledge sources outside of stakeholder group (n=60) ²	0.51	(0.05)	0.45	(0.06)	0.59	(0.07)	0.41	(0.06)	0.63*	(0.06)

Note 1: P-value for mean difference: *p<0.05; **p<0.01, two-tailed test.

Note 2: Clinical professional groups include the following stakeholder groups: clinician, respiratory therapist and home health professional. Non-clinical professional groups include the following stakeholder groups: lawyer/attorney, benefits counselor, and other.

¹Respondents not reporting any knowledge ties (N=2) are excluded.

²Respondents not reporting knowledge ties and/or from outside of their individual stakeholder groups (N=10) are excluded.

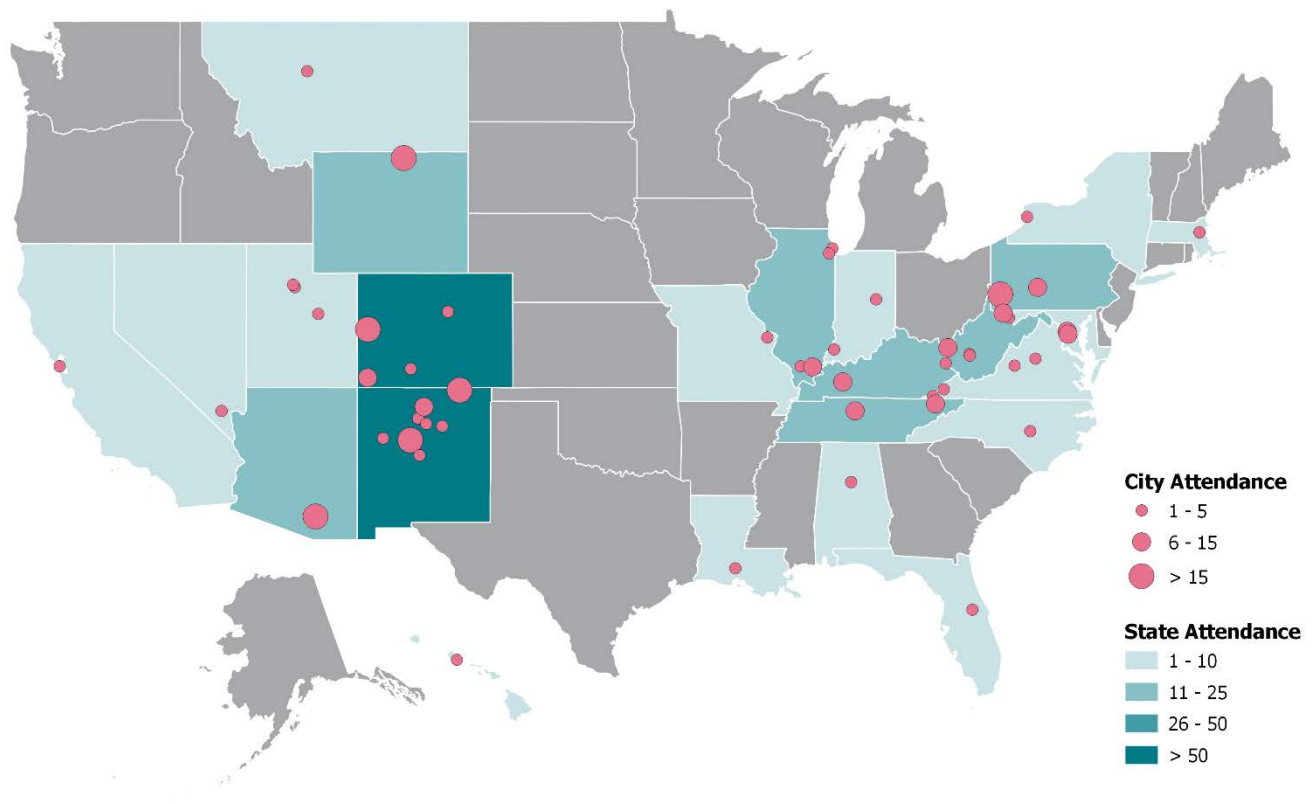


Figure 1: Pictorial participation pattern indicates that the program participants are located in the pneumoconiosis mortality hotspot regions in rural Appalachia and Mountain West, confirming the appropriateness of the program’s geographical reach

Research Finding 2: This study demonstrates the benefit of participating in a multidisciplinary telementoring intervention by improving participant self-efficacy in caring for miners with complex mining-related diseases.

A total of 47 participants were available for analyses. As shown in Table 6, most respondents reported caring for miners for 10 years or less (55.3%), and caring for at least a 40% proportion of miners living in rural areas (59.6%). 53.2% of subjects were existing participants. Clinical professional groups constituted the largest group of subjects (74.4%), with the largest subgroup being clinicians. Despite a high level of reported professional satisfaction, a significant minority described professional isolation.

Using the retrospective pre-post-test method, with both pre-test and post-test data obtained at 12-month study time point, subjects reported significant improvements in nine of 14 items ($p < 0.05$, positive average change scores), and a significant decline in one of 14 items (with respect to their ability to interpret pulmonary function test results, $p < 0.001$, negative average change scores), since their start dates in the program (Table 7). Subjects also reported significant improvement with respect to their scores for all three domains of clinical skills ($p < 0.001$), medicolegal skills ($p = 0.04$), and soft skills ($p = 0.01$), and for the 14-item total score ($p = 0.002$). As compared to fresh participants, existing participants demonstrated significantly greater improvement in their self-reported ability to diagnose health conditions (*i.e.*, clinical skill item 1; estimate 0.78, 95% C.I. 0.29, 1.26, $p = 0.003$), and clinical skills domain score (estimate 0.33, 95% C.I. 0.06, 0.59, $p = 0.02$). As compared to non-clinical professional groups, clinical professional groups demonstrated significantly greater improvement in their self-reported ability to assess the quality of the pulmonary function test (*i.e.*, clinical skill item 4; estimate 0.56, 95% C.I. 0.08, 1.04, $p = 0.03$, Table 8).

In the alternate analysis of 37 subjects, using the traditional pre-post-test method, with pre-test and post-test data obtained at 0 and 12 month study time points respectively, a significant improvement in three of 14 items ($p < 0.05$) and a decline in one item (with respect to their ability to interpret pulmonary function test results, $p = 0.04$) was noted over the 12-month study time frame (Table 7). Subjects showed no significant improvement in any of the three domain scores or their total score over this time frame. As compared to non-clinical professional groups, clinical professional groups demonstrated significantly greater improvement in their self-reported ability to determine eligibility for compensation (*i.e.*, medicolegal skill item 1, estimate 1.67, 95% C.I. 0.25, 3.08, $p = 0.03$), to advocate for the patient/client to help them navigate the compensation process (*i.e.*, medicolegal skill item 2, estimate 1.23, 95% C.I. 0.06, 2.40, $p = 0.045$), medicolegal skill domain score (estimate 1.35, 95% C.I. 0.29, 2.41, $p = 0.02$), and total score (estimate 0.62, 95% C.I. 0.06, 1.18, $p = 0.04$).

Table 6: Characteristics of Surveyed Participants at 12 months Study Time Point (n=47)

Participant characteristics		N	(%)	
Duration of miner care (in years)	1	7	(14.9)	
	2-5	11	(23.4)	
	6-10	8	(17.0)	
	11-15	3	(6.4)	
	16-20	2	(4.3)	
	21+	6	(12.8)	
	Not reported	10	(21.3)	
Gender identity	Male	13	(27.7)	
	Female	24	(51.1)	
	Not reported	10	(21.3)	
Race	White	32	(68.1)	
	Asian	2	(4.3)	
	Two or more races	2	(4.3)	
	Some other race	1	(2.1)	
	Not reported	10	(21.3)	
Ethnicity	Hispanic	4	(8.5)	
	Non-Hispanic	31	(66.0)	
	Not reported	12	(25.4)	
Age (in years)	≤30 years	3	(6.4)	
	31-40 years	8	(17.0)	
	41-50 years	6	(12.8)	
	51-60 years	9	(19.1)	
	>60 years	9	(19.1)	
	Not reported	10	(21.3)	
Proportion of rural miners served	81-100%	10	(21.3)	
	61-80%	10	(21.3)	
	41-60%	8	(17.0)	
	21-40%	2	(4.3)	
	0-20%	7	(14.9)	
	Not reported	10	(21.3)	
Existing vs. fresh participants	Fresh	22	(46.8)	
	Existing	25	(53.2)	
Clinical professional groups	Individual stakeholder groups	Clinician	17	(36.2)
		Respiratory therapist	9	(19.1)
		Home health professional	9	(19.1)
Non-Clinical professional groups	Individual stakeholder groups	Lawyer/attorney	2	(4.3)
		Benefits counselor	6	(12.8)
		Other	4	(8.5)
Satisfaction in professional practice	Strongly agree to Agree	44	(93.6)	
	Neutral to Strongly Disagree	3	(6.4)	
Lack of professional isolation	Strongly agree to Agree	34	(72.3)	
	Neutral to Strongly Disagree	13	(27.7)	

Note 1: Clinical professional groups include the following stakeholder groups: clinician, respiratory therapist and home health professional. Non-Clinical professional groups include the following stakeholder groups: lawyer/attorney, benefits counselor, and other.

Table 7: Change in self-efficacy items, separately calculated since the subject start date in the program (using the retrospective pre-post-test method with both pre-test and post-test data obtained at 12 month study time point), and over a 12 month study time frame (using the traditional pre-post-test method with pre- and post-test data obtained at 0 and 12 month study time points respectively)

	Score at 12 month study endpoint		Change in score since the subject start date in the program, using the retrospective pre-post-test method			Change in score since the study start date using the traditional pre-post-test method		
	N	Mean \pm SD of 12 month score	N	Mean \pm SD change in score	P-value	N	Mean change in score SD of change	P-value
All subjects								
CLINICAL SKILLS								
Ability to diagnose common health conditions in miners	47	4.66 \pm 1.87	43	0.47 \pm 0.91	0.002	30	0.47 \pm 1.07	0.02
Ability to help manage common health conditions in miners	47	4.87 \pm 1.74	44	0.61 \pm 1.04	<0.001	34	0.56 \pm 1.13	0.01
Ability to interpret pulmonary function test results	46	4.20 \pm 1.98	45	-0.38 \pm 0.72	<0.001	36	-0.31 \pm 0.86	0.04
Ability to assess the quality of the pulmonary function test	47	4.51 \pm 2.08	46	0.41 \pm 0.78	<0.001	36	0.14 \pm 1.02	0.42
Ability to interpret arterial blood gas test results	47	4.55 \pm 2.01	46	0.22 \pm 0.63	0.02	37	0.03 \pm 0.90	0.86
Ability to interpret B-read reports of chest radiographs	47	3.62 \pm 1.84	47	0.30 \pm 1.02	0.05	36	0.33 \pm 1.59	0.22
Average 6-item clinical skills domain score	47	4.40 \pm 1.62	47	0.27 \pm 0.50	<0.001	37	0.20 \pm 0.68	0.08
MEDICOLEGAL SKILLS								
Ability to determine eligibility for compensation under specific miners' compensation programs	46	4.43 \pm 1.70	44	0.39 \pm 1.24	0.045	35	0.63 \pm 1.63	0.03
Ability to advocate for your patient/client to help them navigate the compensation process	46	4.61 \pm 1.67	45	0.40 \pm 1.30	0.046	33	0.24 \pm 1.32	0.30
Ability to collect information required under the miners' compensation programs	46	4.52 \pm 1.67	44	0.30 \pm 1.30	0.14	36	-0.14 \pm 1.53	0.59
Average 3-item medicolegal skills domain score	47	4.52 \pm 1.59	47	0.37 \pm 1.17	0.04	36	0.24 \pm 1.33	0.29
SOFT SKILLS								
Ability to demonstrate empathy towards miners with work related diseases	47	5.53 \pm 1.28	45	0.16 \pm 1.11	0.35	37	-0.35 \pm 1.18	0.08
Ability to identify social, linguistic, cultural, economic, and educational barriers for care for miners	47	4.89 \pm 1.20	47	0.43 \pm 1.04	0.01	36	-0.44 \pm 1.50	0.08
Ability to serve as the miners' expert in your community/region	47	4.55 \pm 1.77	46	0.48 \pm 1.30	0.02	34	0.38 \pm 1.44	0.13
Ability to collaborate with and educate other team members about miners' diseases	47	4.87 \pm 1.56	47	0.45 \pm 1.08	0.01	37	0.30 \pm 1.41	0.21
Ability to refer patients with diseases to appropriate experts, when you do not possess the relevant expertise	47	4.87 \pm 1.45	47	0.23 \pm 1.25	0.21	35	-0.20 \pm 1.37	0.39
Average 5-item soft skills domain score	47	4.94 \pm 1.25	47	0.34 \pm 0.89	0.01	37	-0.07 \pm 0.96	0.67
Average 14-item total score	47	4.62 \pm 1.32	47	0.31 \pm 0.64	0.002	37	0.10 \pm 0.73	0.40

Table 8: Subgroup analysis of change in self-efficacy items since the subject start date in the program (using the Retrospective pre-post-test method with both pre-test and post-test data obtained at 12 month study time point)

Change in (item, domain or total) score	Fresh Participants			Existing Participants			Clinical Professional Groups			Non-Clinical Professional Groups		
	N	Mean \pm SD	P-value	N	Mean SD	P-value	N	Mean SD	P-value	N	Mean SD	P-value
CLINICAL SKILLS												
Ability to diagnose common health conditions in miners	20	0.05 \pm 0.69	0.75	23	0.83 \pm 0.94	<0.001	33	0.52 \pm 0.94	0.004	10	0.30 \pm 0.82	0.28
Ability to help manage common health conditions in miners	22	0.32 \pm 0.72	0.05	22	0.91 \pm 1.23	0.002	34	0.65 \pm 1.01	<0.001	10	0.50 \pm 1.18	0.21
Ability to interpret pulmonary function test results	22	-0.32 \pm 0.78	0.07	23	-0.43 \pm 0.66	0.01	33	-0.48 \pm 0.76	<0.001	12	-0.08 \pm 0.51	0.59
Ability to assess the quality of the pulmonary function test	22	0.41 \pm 0.67	0.01	24	0.42 \pm 0.88	0.03	34	0.56 \pm 0.79	<0.001	12	0.00 \pm 0.60	>0.99
Ability to interpret arterial blood gas test results	22	0.09 \pm 0.68	0.54	24	0.33 \pm 0.56	0.01	34	0.29 \pm 0.72	0.02	12	0.00 \pm 0.00	>0.99
Ability to interpret B-read reports of chest radiographs	22	0.00 \pm 1.02	>0.99	25	0.56 \pm 0.96	0.01	35	0.31 \pm 1.08	0.09	12	0.25 \pm 0.87	0.34
Average 6-item clinical skills domain score	22	0.09 \pm 0.33	0.20	25	0.42 \pm 0.57	0.001	35	0.31 \pm 0.53	0.002	12	0.13 \pm 0.35	0.22
MEDICOLEGAL SKILLS												
Ability to determine eligibility for compensation under specific miners' compensation programs	21	0.14 \pm 1.11	0.56	23	0.61 \pm 1.34	0.04	33	0.36 \pm 1.27	0.11	11	0.45 \pm 1.21	0.24
Ability to advocate for your patient/client to help them navigate the compensation process	21	0.24 \pm 1.04	0.31	24	0.54 \pm 1.50	0.09	33	0.36 \pm 1.39	0.14	12	0.50 \pm 1.09	0.14
Ability to collect information required under the miners' compensation programs	21	0.33 \pm 1.24	0.23	23	0.26 \pm 1.39	0.38	32	0.28 \pm 1.40	0.26	12	0.33 \pm 1.07	0.31
Average 3-item medicolegal skills domain score	22	0.23 \pm 1.05	0.32	25	0.49 \pm 1.27	0.06	35	0.35 \pm 1.22	0.1	12	0.42 \pm 1.06	0.20
SOFT SKILLS												
Ability to demonstrate empathy towards miners with work related diseases	21	0.19 \pm 0.51	0.10	24	0.13 \pm 1.45	0.68	34	0.15 \pm 1.16	0.46	11	0.18 \pm 0.98	0.55
Ability to identify social, linguistic, cultural, economic, and educational barriers for care for miners	22	0.41 \pm 0.85	0.04	25	0.44 \pm 1.19	0.08	35	0.31 \pm 1.05	0.09	12	0.75 \pm 0.97	0.02
Ability to serve as the miners' expert in your community/region	22	0.50 \pm 1.01	0.03	24	0.46 \pm 1.53	0.16	34	0.41 \pm 1.44	0.1	12	0.67 \pm 0.78	0.01
Ability to collaborate with and educate other team members about miners' diseases	22	0.41 \pm 1.05	0.08	25	0.48 \pm 1.12	0.04	35	0.43 \pm 1.20	0.04	12	0.50 \pm 0.67	0.03
Ability to refer patients with diseases to appropriate experts, when you do not possess the relevant expertise	22	-0.05 \pm 0.90	0.82	25	0.48 \pm 1.48	0.12	35	0.11 \pm 1.35	0.62	12	0.58 \pm 0.90	0.046
Average 5-item soft skills domain score	22	0.29 \pm 0.67	0.05	25	0.38 \pm 1.07	0.09	35	0.27 \pm 0.98	0.11	12	0.53 \pm 0.55	0.01
Average 14-item total score	22	0.19 \pm 0.56	0.12	25	0.41 \pm 0.70	0.01	35	0.30 \pm 0.69	0.01	12	0.34 \pm 0.51	0.04

Table 9: Subgroup analysis of change in self-efficacy items over a 12 month study time frame (using the traditional pre-post-test data method with pre- and post-test data obtained at 0 and 12 month study time points respectively)

Change in item	Fresh Participants			Existing Participants			Clinical Professional Groups			Non-Clinical Professional Groups		
	N	Mean \pm SD	P-value	N	Mean \pm SD	P-value	N	Mean \pm SD	P-value	N	Mean \pm SD	P-value
CLINICAL SKILLS												
Ability to diagnose common health conditions in miners	13	0.23 \pm 1.24	0.51	17	0.65 \pm 0.93	0.01	27	0.44 \pm 1.12	0.05	3	0.67 \pm 0.58	0.18
Ability to help manage common health conditions in miners	17	0.53 \pm 1.18	0.08	17	0.59 \pm 1.12	0.046	29	0.69 \pm 1.07	0.002	5	-0.20 \pm 1.30	0.75
Ability to interpret pulmonary function test results	17	-0.41 \pm 0.94	0.09	19	-0.21 \pm 0.79	0.26	29	-0.31 \pm 0.93	0.08	7	-0.29 \pm 0.49	0.17
Ability to assess the quality of the pulmonary function test	17	0.12 \pm 1.05	0.65	19	0.16 \pm 1.01	0.51	29	0.14 \pm 0.99	0.46	7	0.14 \pm 1.21	0.77
Ability to interpret arterial blood gas test results	17	0.00 \pm 0.87	>0.99	20	0.05 \pm 0.94	0.82	30	0.13 \pm 0.90	0.42	7	-0.43 \pm 0.79	0.20
Ability to interpret B-read reports of chest radiographs	16	-0.06 \pm 1.77	0.89	20	0.65 \pm 1.39	0.05	29	0.48 \pm 1.70	0.14	7	-0.29 \pm 0.76	0.36
Average 6-item clinical skills domain score	17	0.07 \pm 0.63	0.65	20	0.31 \pm 0.71	0.07	30	0.28 \pm 0.69	0.03	7	-0.16 \pm 0.55	0.48
MEDICOLEGAL SKILLS												
Ability to determine eligibility for compensation under specific miners' compensation programs	15	0.93 \pm 1.39	0.02	20	0.40 \pm 1.79	0.33	30	0.87 \pm 1.36	0.002	5	-0.80 \pm 2.49	0.51
Ability to advocate for your patient/client to help them navigate the compensation process	15	0.47 \pm 1.46	0.24	18	0.06 \pm 1.21	0.85	28	0.43 \pm 1.26	0.08	5	-0.80 \pm 1.30	0.24
Ability to collect information required under the miners' compensation programs	16	0.00 \pm 1.55	>0.99	20	-0.25 \pm 1.55	0.48	30	0.07 \pm 1.34	0.79	6	-1.17 \pm 2.14	0.24
Average 3-item medicolegal skills domain score	16	0.45 \pm 1.29	0.19	20	0.07 \pm 1.36	0.83	30	0.46 \pm 1.12	0.03	6	-0.89 \pm 1.80	0.28
SOFT SKILLS												
Ability to demonstrate empathy towards miners with work related diseases	17	-0.06 \pm 1.34	0.86	20	-0.60 \pm 0.99	0.01	30	-0.20 \pm 0.92	0.25	7	-1.00 \pm 1.91	0.22
Ability to identify social, linguistic, cultural, economic, and educational barriers for care for miners	17	-0.59 \pm 1.73	0.18	19	-0.32 \pm 1.29	0.30	30	-0.27 \pm 1.41	0.31	6	-1.33 \pm 1.75	0.12
Ability to serve as the miners' expert in your community/region	16	0.75 \pm 1.53	0.07	18	0.06 \pm 1.30	0.86	29	0.55 \pm 1.38	0.040	5	-0.60 \pm 1.52	0.43
Ability to collaborate with and educate other team members about miners' diseases	17	0.41 \pm 1.23	0.19	20	0.20 \pm 1.58	0.58	30	0.27 \pm 1.34	0.28	7	0.43 \pm 1.81	0.56
Ability to refer patients with diseases to appropriate experts, when you do not possess the relevant expertise	16	-0.44 \pm 1.59	0.29	19	0.00 \pm 1.15	>0.99	30	-0.20 \pm 1.45	0.46	5	-0.20 \pm 0.84	0.62
Average 5-item soft skills domain score	17	0.00 \pm 1.14	0.99	20	-0.12 \pm 0.80	0.51	30	0.02 \pm 0.89	0.89	7	-0.45 \pm 1.22	0.36

Research Finding 3: Statements of expertise, and their acceptance and eschewal in this community of practice is a multidisciplinary process and its pattern indicates a high level of expertise sharing. This confirms the need for multidisciplinary input in the management of mining-related diseases.

A key feature of our virtual community of practice is ‘expertise sharing’ between various disciplines during the discussion component of the sessions. This is qualitatively measured using ‘statements of expertise’ (*i.e.*, statements that define the problem and/or specify solutions to the problem). Instances where statements of expertise are eschewed or embraced/accepted by others in the community of practice were analyzed, over the 21 clinics over the 12 months study period. All stakeholder groups offer statements of expertise, confirming the multidisciplinary nature of the discussion in the community of practice. An average of 32 statements of

expertise during the discussion component of each session indicates a high level of expertise contribution. All stakeholder groups also participate in the acceptance and eschewal processes, except for benefits counselors who did not eschew any statement of expertise. The multidisciplinary acceptance and eschewal process is key to the sharing of expertise in the complex management of mining-related diseases. Clinical provider group offer disproportionately greater number of statements of expertise whereas benefits counselor offer disproportionately lower number of statements of expertise. Most statements of expertise are accepted, indicating that those offering expertise are accepted to be content experts by the community of practice. The facilitator plays a disproportionately important role in accepting these statements of expertise. Although clinical providers and the facilitator offer the greatest number of eschewals, all stakeholder groups except benefits counselors participate in the eschewal process.

Table 10: Pattern of expertise sharing across stakeholder groups in the multidisciplinary community of practice, using NVivo, a qualitative analysis software

Stakeholder group	Attorney	Benefits Counselor	Clinical Provider	Home Health Professional	Other	Respiratory Therapist	Facilitator	Row total
Statements of Expertise	94 (13.9%)	8 (1.2%)	328 (48.5%)	36 (5.3%)	67 (9.9%)	55 (8.1%)	88 (13.0%)	676 (100%)
Acceptance	15 (3.6%)	15 (3.6%)	83 (20%)	22 (5.3%)	11 (2.7%)	9 (2.2%)	260 (62.7%)	415 (100%)
Eschewals	10 (12.3%)	0 (0.0%)	27 (33.3%)	8 (9.9%)	9 (11.1%)	5 (6.2%)	22 (27.2%)	81 (100%)

Accomplishments: Our program was recognized by the American Thoracic Society as a 2019 innovation in fellowships education.

5.0 Publication Record and Dissemination Efforts: *In addition to summarizing the accomplishments, a complete record of presentation, publications (including those in process) and deliverables shall be provided. (Note: Only a (bibliography) listing of the reports is required. Do not provide copies of the publications.) In addition to this record, a dissemination plan shall be provided for any enabling technology, design guideline or tool that requires further distribution to enhance the Foundation's safety and health agenda as a result of this project.*

Our stakeholder partners are helping us disseminate products related to study findings. We have identified partner organizations for dissemination, to ensure meaningful and direct connection with end-users. Examples of such partner organizations are the United Mine Workers Association (UMWA) and the National Coalition of Black Lung and Respiratory Disease Clinics. Our dissemination efforts include our Network website 'TheAmericanMiner.org'; Instagram account 'americanminerofficial'; twitter account '@americanminerm'; and Facebook page 'facebook.com/newmexicomining' as well as our Miners' Wellness Tele-ECHO Clinic website (<http://echo.unm.edu/miners-wellness/>). Our stakeholder partners also participate in traditional dissemination efforts, such as authoring manuscripts and presenting study findings at professional/scientific conferences and lay gatherings to reach new and different audiences. Our partners have identified opportunities to present and share information about the study to move away from traditional models of dissemination and to think more creatively about how to get information into the hands of those who need it. An example of non-traditional model of dissemination is a video presentation to miners and policymakers on Project ECHO at the National Miners' Day Celebration, Raton, NM, December 2018. We have formed a Mining Advisory Council across Miners' Colfax Medical Center, University of New Mexico Health Sciences Center, and New Mexico College of Technology and Mining to oversee the dissemination process.

The following abstracts, manuscripts, presentations are examples of traditional dissemination efforts (Moore, Atkins et al. 2019). In addition, our program was recognized by the American Thoracic Society as a 2019 innovation in fellowships education.

Scientific abstracts

Sood, A; Assad, N; Le Seur, K; Walker, J; Wissore, B; Salveson, S; Soller, B; Rochelle, R; Murillo, S; Kalishman, S; Pollard, C; Jarrell, WC. Use of Novel Technology to Help Fellows Fight an 'Old' Exposure. Abstract for innovations in fellowship education, presented at the 2019 American Thoracic Society International Conference, Dallas, TX.

Sood, A; Assad, N; Jarrell, CW; Kalishman, S; Le Suer, K; Murillo, S; Myers, O; Rochelle, R; Salveson, S; Soller, B; Walker, J; Wissore, B; Pollard, C. Evaluating a Virtual 'Community of Practice' Approach in Pneumoconiosis Mortality Hotspots, scientific abstract presented at the March 2019 META ECHO 2019 Conference, Albuquerque, New Mexico.

A. Sood, N. A. Assad, W. C. Jarrell, S. Kalishman, K. R. LeSuer, S. Murillo, O. Myers, R. Rochelle, H. A. Rishel Brakey, S. Salveson, B. Soller, J. Walker, B. Wissore, C. Pollard. A Virtual 'Community Of Practice' Approach Represents An Educational Innovation In Managing Pneumoconiosis In Rural United States. Scientific abstract submitted for presentation at the 2020 American Thoracic Society International Conference, Philadelphia, PA.

Published manuscript:

Moore P, Atkins GT, Cramb S, et al. COPD and Rural Health: A Dialogue on the National Action Plan. *J Rural Health*. 2019; 35(4):424-428.

Submitted manuscripts for peer review:

Akshay Sood; Nour Assad, M.D; William Cotton Jarrell; Summers Kalishman; Kyla Le Suer; Stephen Murillo; Orrin Myers; Rachelle Rochelle; Sarah Salveson; Brian Soller; Jolene Walker; Bruce Wissore; Charles Pollard. A Virtual 'Community of Practice' Approach by Rural Stakeholders in Managing Pneumoconiosis in the United States. Original research manuscript currently under peer review to Rural and Remote Health in December 2019.

Manuscripts in preparation:

Akshay Sood, Charles Pollard, Summers Kalishman, Heidi Rishel Brakey, Orrin Myers. A qualitative analysis of expertise sharing patterns during telementoring of multidisciplinary professional groups in the care of miners. Original research manuscript being submitted for peer review to Occupational and Environmental Medicine in March 2020.

Akshay Sood, Charles Pollard, Summers Kalishman, Brian Soller, Orrin Myers. Knowledge network patterns during telementoring of multidisciplinary professional groups in the care of miners. Original research manuscript being submitted for peer review May 2020.

Akshay Sood, Charles Pollard, Kyla Le Suer, Kevin Vlahovich, Jolene Walker. Caring for miners during the coronavirus disease-2019 (COVID-19) pandemic. Commentary being submitted to the Journal of Rural Health in March 2020.

Presentations:

'Project ECHO: A Live demonstration of Case-Based Tele-learning' presentation at the National Coalition of Black Lung and Respiratory Disease Clinics 2018 Conference, Chicago, IL, September 2018.

The Story of a Rural Community Combating Black Lung, presentation at Peabody Americas Black Lung Seminar, St. Louis, December 2018.

The Story of a Rural Community Combating Black Lung, presentation at National Miners' Day Celebration, Raton, December 2018.

Paying Too High a Price! The Lung Health Cost of Mining in New Mexico, presentation at the Department of Internal Medicine Grand Rounds, November 2018.

Project ECHO: A Live Presentation, 2019 National Coalition of Black Lung and Respiratory Disease Clinics Conference, Gatlinburg, Tennessee, September 2019.

Sunrise Seminar SS304 - PROJECT ECHO: Extending past medical practices for idiopathic pulmonary fibrosis to underserved communities, presented at the ATS 2019 International Conference, Dallas, TX

Southwest Mining Health Center: Interdisciplinary Collaboration for Miners' Health and Safety, accepted for presentation at the HRS A Radiation Exposure Screening and Education Program meeting, Online meeting, April 2020

6.0 Conclusions and Impact Assessment: *The report must provide concise and clear conclusions derived and supported by the research findings. A key goal of the Foundation's agenda for funding these research efforts is to produce practical outputs that have a measureable impact on mining health and safety. In this context, the report should also draw conclusions regarding how and to what degree the project accomplishments advanced the science, solved the problem that was the topic of the research grant and/or can guide practical applications that are likely to improve mining safety and health.*

As a consequence of the work performed, using our virtual community of practice model, we demonstrate that the participating multi-disciplinary professionals taking care of miners reported longitudinal increase in self-efficacy. We also demonstrated a very high level of, collective efficacy, and sharing of expertise among our participants. We demonstrate effectiveness of our model using levels one through three of the Moore's expanded framework for Continuing Medical Education activities (Moore, Green et al. 2009). Our approach of "moving knowledge and not patients" will allow miners to receive high quality comprehensive inter-disciplinary care for complex diseases by professionals in rural communities. Our study finding represents a potential solution to a growing access to care gap for miners with pneumoconiosis. This provides the rationale for utilizing systems that are already in place for rapid scaling of the Miners' Wellness TeleECHO Program at other institutions nationally and globally. This will help address the healthcare challenge from the emerging epidemic of pneumoconiosis in the U.S.

7.0 Recommendations for Future Work: *Recommendations for future work shall be summarized.*

We demonstrate effectiveness of our model using levels one through three of the Moore's expanded framework for Continuing Medical Education activities (Moore, Green et al. 2009). This preliminary data, sets the foundation for (i) obtaining Moore Level 4 outcomes on participant competency, and longitudinal change in knowledge networks of participants; (ii) studying the impact of expansion and augmentation strategies related to the existing tele-mentoring intervention, focusing on rural providers and trainees. This data is needed before we can study the impact of the intervention on patient-level outcomes. We propose the following recommendations for future work, for which we would like to request consideration for additional funding by the alpha Foundation.

Evaluation aim 1: To examine the impact of the expanded and augmented teleECHO program on general and specific competencies, and knowledge networks, among those involved in providing care and treatment to miners with pneumoconiosis.

- 1) Hypothesis 1A: TeleECHO participants demonstrate improvement in general and specific competencies involved in the care of miners at twelve-months compared to baseline (i.e., time of enrollment in the study).
- 2) Hypothesis 1B: TeleECHO participants demonstrate greater competency than non-participants at time of enrollment in the study.
- 3) Hypothesis 1C: TeleECHO participants report different knowledge network characteristics than non-participants at time of enrollment in the study.

We will also analyze the frequency of participation to determine a dose-response relationship among participants. Subgroup analysis for hypothesis 1A will examine differences in outcomes between 'new' and 'existing' participants, with a greater change anticipated in 'new' as compared to 'existing' participants.

Evaluation aim 2: To develop and examine the impact of incentives, and expansion of dissemination strategies, on teleECHO participation frequencies of target groups of rural providers and trainees.

- 1) Hypothesis 1A: Monetary and/or non-monetary incentive strategies aimed at existing rural providers and trainee participants increases their TeleECHO participation.
- 2) Hypothesis 1B: Regional and national expansion of dissemination strategies aimed at rural providers and trainees increase their proportional participation in the program.

8.0 References: *List all relevant references cited in the Final Report that support the research effort.*

Dwyer-Lindgren, L., A. Bertozzi-Villa, R. W. Stubbs, C. Morozoff, S. Shirude, M. Naghavi, A. H. Mokdad and C. J. L. Murray (2017). "Trends and Patterns of Differences in Chronic Respiratory Disease Mortality Among US Counties, 1980-2014." JAMA **318**(12): 1136-1149.

Moore, D. E., Jr., J. S. Green and H. A. Gallis (2009). "Achieving desired results and improved outcomes: integrating planning and assessment throughout learning activities." J Contin Educ Health Prof **29**(1): 1-15.

Moore, P., G. T. Atkins, S. Cramb, J. B. Croft, L. Davis, R. J. Dolor, D. Doyle, M. Elehwany, C. James, A. Knudson, J. Linnell, D. Mannino, J. M. Rommes, A. Sood, E. Stockton, D. N. Weissman, M. Witte, E. Wyatt, W. C. Yarbrough, B. P. Yawn, L. Johnson, T. Morris, J. P. Kiley, N. J. Ammary-Risch and A. Punturieri (2019). "COPD and Rural Health: A Dialogue on the National Action Plan." J Rural Health **35**(4): 424-428.

9.0 Appendices: *Include any material that cannot be conveniently or logically included in the body of the report that is relevant to support the effort or outcome of the project accomplishments or conclusions. For example, data sets that support the research approach and the record of accomplishments can be provided in the Appendix.*

None