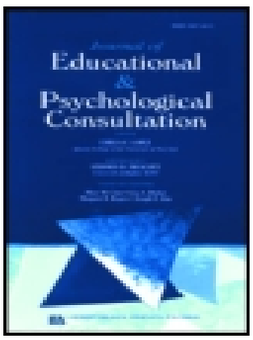

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Development and Examination of a Trainee-Led ECHO Autism Network for Rural Healthcare Providers

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ABSTRACT

Rural healthcare providers face numerous challenges in caring for autistic individuals. Some of the most common obstacles to optimal services include lack of specialized training and expertise, resources, and collaborators, as well as large physical distances between providers and those they serve, region-specific cultural factors, and others. Recent methodologies, such as Extensions for Community Healthcare Outcomes (ECHO), use videoconferencing technology to connect subject-matter experts with community providers to remediate disparities in 1) provider access to knowledge and consultation relevant to evidence-based practices (EBP) and, thereby, 2) patient access to quality care. Despite such advances, few projects have targeted rural communities in the same geographic area as network personnel. Additionally, to date, ECHO networks have been staffed with senior personnel, who have provided their experience and expertise to attendees. We, a multidisciplinary group of trainees and faculty, developed and piloted an ECHO Autism network for healthcare providers across the rural Western United States. In preparation for the launch of this network, trainees polled prospective participants regarding their disciplines and interests. Then, ECHO sessions were developed and implemented over several months. Finally, attendees provided feedback about their experiences. We report information regarding each of these phases and initial results of the post-session feedback to assist those who desire to develop a similar network in their area, and to provide preliminary examination (i.e., formative evaluation) of its benefit in view of the needs of rural providers caring for autistic individuals. We posit that our trainee-led model has unique value for cost-effectiveness and sustainability of implementation.

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Language use statement

In this paper, we have used identity-first terminology in line with the published preferences of the autistic community (e.g., Bottema-Beutel et al., 2021; Kenny et al., 2016). However, we acknowledge and respect the preference of others for person-first language.

The prevalence of autism spectrum disorder (ASD) has substantially increased in recent years (e.g., Maenner et al., 2020). Unfortunately, in many cases, the rate of ASD diagnosis seems to be outpacing current availability of interdisciplinary groups of professionals who have the competence and confidence to provide quality services (Corden et al., 2021; Sohl et al., 2017). Additionally, given the rapid publication rate of new research findings in the field of autism, and the co-occurring evolution of practices in this field (e.g., language use; see, for example, Bottema-Beutel et al., 2021), many professionals find it difficult to synthesize and apply new research to their clinical efforts. Combined, these factors regularly lead to an imbalance between availability of knowledge including that relevant to evidence-based practices (EBPs) and provider ability to integrate such knowledge into their practice, which is often most apparent in rural and other underserved areas (Antezana et al., 2017; Janvier et al., 2016; Sohl et al., 2017). Lag times are long between establishment of EBPs and routine integration into clinical practice (estimated at 17 years, for the half of EBPs that do attain widespread implementation; Bauer et al., 2015). This forecast is likely optimistic for rural practice, given reduced access to professional resources promoting EBPs, such as institutional subscriptions to published research and opportunities for curb-side consultation. Thus, an urgent need exists among various types of professionals for further training related to the clinical support of autistic individuals (Antezana et al., 2017; Janvier et al., 2016; Malik-Soni et al., 2021; Mazurek et al., 2017; Sohl et al., 2017).

Challenges in autism-related rural healthcare

Individuals and families, regardless of diagnosis, living in rural communities often feel the effects of limited resource access – such as, reduced early-screening and -intervention opportunities, more prevalent informal home-based rather than center-based preschools, and lower Kindergarten-readiness rates on average (Miller & Coley, 2019). Systematically different child-rearing practices, characterized by lower parental responsiveness to individual-child needs in interactions or different perceptions of health needs across rural communities, may also play a role in reduced services overall, including those for autistic individuals (Hale et al., 2016; Probst et al., 2016; Sheridan et al., 2014). While the developmental milieu of rural ecology involves more than healthcare proximity, parents' access to relevant and accurate

information to support family functioning can be a key determinant in child development outcomes (Neumann et al., 2020). Primary-care providers, educators, county social workers, and rehabilitative therapists such as speech-language pathologists, audiologists, and occupational therapists are often first-line sources of information to support development, especially where more specialized care is limited (Sohl et al., 2017). However, even when motivated by these disparities to increase knowledge, rural practitioners may not have ready access to relevant information due to lack of local expertise, physical distance from metropolitan and/or university-based autism academic centers, and a limited local network of accessible providers with whom to consult. For instance, in the Western United States (U.S.), the states of Wyoming and Montana have an overall state average of 5.9 or 6.86 people per square mile, respectively (U.S. Census Bureau, 2020). Such sparse population spread could contribute to all of the aforementioned obstacles. Previous approaches to virtual provider training have shown that by leveraging technology, these gaps in resource availability resulting from geographical and other factors can be closed (e.g., Johnsson et al., 2016; Mazurek, 2020; Mazurek et al., 2017, 2019; Sohl et al., 2017).

The creation of multidisciplinary online networks that facilitate the exchange of knowledge and experience aligns with the ethical guidelines of diverse disciplines. For example, the Code of Conduct developed by the American Psychological Association (2017) advises psychologists to practice within the scope of their competency, seek consultation, and use up-to-date science to inform their decisions. Similar recommendations are echoed by the National Association of School Psychologists (National Association of School Psychologists (NASP), 2020). Additionally, the American Speech-Language-Hearing Association's (ASHA) Code of Ethics (American Speech-Language-Hearing Association, 2016) highlights the importance of interprofessional collaboration and making referrals when necessary. These standards are well supported by research on treatment effectiveness. Across disciplines, quality of implementation with respect to EBPs (e.g., fidelity to intervention content and structure, consistency across sessions) is associated with treatment outcomes including reduction of child behavior problems and other target symptoms (Azad et al., 2021b; Brookman-Frazee et al., 2019). Teleconsultation has been found a feasible and effective means for increasing within-discipline collaboration in schools, including expediting routine tasks such as development of student behavior intervention plans, without time-consuming face-to-face meetings (Sussman et al., 2021). In addition to effectiveness of teleconsultation in increasing the use of EBPs among rural school psychologists (Bice-Urbach & Kratochwill, 2016), Azad et al. (2021a) found teleconsultation to enhance fidelity to school-based intervention by increasing communication with parents. However, even with these guiding principles and videoconferencing methods in place, there are often obstacles (e.g., funding, program availability,

time, and relevance) that prevent practitioners from engaging in online professional development activities, particularly when cross-disciplinary consultation or training is needed (Bice-Urbach & Kratochwill, 2016; Malik-Soni et al., 2021).

Project ECHO® & The ECHO Model

Though often challenging to implement, increasing access to multidisciplinary expertise and a network of practice by utilizing widely available videoconferencing technology has a precedent. Project ECHO (Extension for Community Healthcare Outcomes) originated in New Mexico to address the health disparities and lack of access to healthcare and specialists related to hepatitis C, particularly in rural and underserved areas (Arora et al., 2007, 2011, 2010), but it is now also used to support healthcare and other professionals as they serve other populations, including autistic individuals. Implementing a Project ECHO typically includes a "hub" group of multidisciplinary specialists and subject matter experts who interact with interested healthcare providers in outlying areas (i.e., the "spokes" of the wheel) via teleconferencing technology, as well as e-mail, online presentations, telephone, and fax, as needed.

The hub team and spoke sites/individuals meet during regularly scheduled sessions over videoconferencing technology to discuss relevant and timely topics. The sessions include a short didactic lesson where subject matter experts from the hub team or larger community present (Fowler et al., 2018), followed by a case presentation from a spoke member about a relevant challenge of practice. The ECHO network community then works together to develop a set of potential best practices for the case presenter to consider and apply in their practice. ECHO emphasizes the importance of "all teach, all learn" and so discussions among the network community are not directed by the hub experts. Rather, spoke members are encouraged to share their own expertise and recommendations are guided by the hub team. Further, to ensure quality and effectiveness toward the goals of increased knowledge and self-efficacy among attendees, a core tenet of the ECHO model is continuous evaluation and feedback from spoke participants, in which all attendees are encouraged to provide evaluations of ECHO sessions and presenters after each session. Feedback is then discussed integrated into future session by ECHO hub teams.

Major components of the ECHO model – use of teleconsultation, didactic training by subject-matter experts, case presentation, and continuous formative evaluation – promote an active learning environment that allows members to strengthen their sense of confidence in their own abilities to use EBPs, through their relationships with like-minded peers (Arora et al., 2010; Bauer et al., 2015; Mazurek et al., 2017). In Mazurek et al. (2017); (2019) demonstrated links between ECHO Autism teleconsultation with improved

practitioner self-efficacy in caring for autistic individuals according to best practices (see also, Sussman et al., 2021).

While such benefits have been documented in ECHO networks in several geographical areas and for various different medical conditions, there is a need for autism-specific ECHO projects in which the hub resides within the same geographic region as the spokes, because of region-specific policy, cultural, and other location-based knowledge. Presently, across rural Idaho, Montana, North Dakota, Utah, and Wyoming (ranging from 10–20% rural to over 50%, depending on the state; U.S. Census Bureau, 2020), no network of rural practitioners exists. Thus, an ECHO network that serves these states would be particularly useful. The idea to initiate an ECHO network in the Western U.S. was inspired by the work of and consultations with Dr. Kristin Sohl, who created the first ECHO Autism network for providers in rural Missouri, which now serves a much larger area. The current study hypothesized that utilizing trainees and faculty from the regional Leadership Education in Neurodevelopmental and Related Disabilities (LEND) training program, with trainees representing experts in current research and EBPs across disciplines, would be a feasible approach to establishing an ECHO network to provide professional development to healthcare providers in this geographic region in better serving autistic individuals.

The LEND training program is a graduate-level training designed around interdisciplinary learning to improve the health of infants, children, and adolescents with disabilities (Association of University Centers on Disabilities (AUCD), 2011). One of these programs is the Utah Regional LEND (URLEND), recruiting trainees from Utah, Idaho, Montana, Wyoming and North Dakota in a diverse range of professional training programs including medicine, nursing, pharmacy, psychology, sociology, dentistry, audiology, speech-language pathology, physical and occupational therapies, nutrition, and social work. Program faculty include professionals and others with vested interests, spanning the above disciplines as well as health educators, public health specialists, autistic self-advocates, and parents/families.

One obstacle to initiating ECHO projects is finding willing and available professionals to serve as the hub team. Specifically, though often enthusiastic about the potential benefits of an ECHO network (Dearing et al., 2019), more experienced professionals often have heavy demands on their time. Senior trainees who have experience working with autistic individuals and their families have developed sufficient knowledge to contribute to ECHO networks and are often familiar with cutting edge clinical practices. Taking advantage of such knowledge and increased availability of such trainees, who are receiving LEND funding support, could be one route to overcome the type of barriers to optimal care and provider confidence cited above, while offering valuable experience to trainees.

Over a two-year period, trainees in the URLEND program designed and implemented the Project ECHO Autism for Rural Healthcare Providers within the catchment area of URLEND (Idaho, Montana, North Dakota, Utah, and Wyoming) to support rural healthcare providers in caring for autistic patients. This network was established and conducted by URLEND trainees with supervision and support from URLEND faculty with expertise in the evaluation and care of autistic children (authors PC, TG, CH), leveraging the existing trainee expertise, grant funding and time structure already in place through the LEND program.

Aim

The objective of this study is to report on the various stages of execution (development, pilot, and formative evaluation (here, "examination") – of the Project ECHO Autism for Rural Healthcare Providers–and test the feasibility of staffing an ECHO network with graduate clinicians (LEND trainees) and faculty mentors. We also aimed to elucidate the needs, comfort level, and interests of spoke participant providers in topics concerning caring for autistic patients/clients/students in primarily rural areas. We expected to see high satisfaction with and self-reported improvements in learning (pre- to post-session) from our attendees, based on previous effectiveness in these areas, using the ECHO model of teleconsultation. Finally, by carrying out an initial analysis of various features of the project and reporting the needs of rural healthcare providers, we provide recommendations for the feasibility and implementation of future ECHO Autism networks and discuss knowledge we gained about ASD itself and associated best practices.

Method

Staff and support

The design, implementation, and preliminary evaluation of the ECHO network were performed by the trainees and faculty in the URLEND-Autism Enhanced (AE) program. Trainees in this second, specialized year of the training program have significant experience with autism via their respective graduate training programs and the first year of the URLEND program, making them well-suited to support the delivery of the ECHO. Trainees in the current group had professional backgrounds in psychology, speech-language pathology, occupational therapy, nursing, special education, behavioral analysis, and audiology. Mentors were three URLEND-AE program faculty members (authors TG, PC, and CH) whose backgrounds include School Psychology, Pediatrics, and Healthcare Ethics and Public Health, respectively. Trainees and mentors spent weekly and regularly scheduled

URLEND-AE time discussing design, distribution, and analysis of the pre-network survey, selection of the didactic topics and presenters, solicitation and selection of the cases and their presenters, preparing didactic presentations, discussing post-session feedback, collaborating on the current manuscript, and making plans for future network activities. Trainees served as didactic presenters and the hub team during ECHO sessions, with faculty members present to oversee and contribute to these efforts. Furthermore, technical and administrative support in broadcasting and recording the sessions was obtained from the Wyoming Institute for Disabilities (WIND; University of Wyoming), an organization that is a URLEND member institution and has significant expertise regarding the ECHO model as the ECHO Superhub for Education. Specifically, WIND offered technical support (e.g., video conference hosting), transcription services, personnel to compile and distribute session notes and case feedback, evaluation implementation, publicity, and in-session video conferencing support.

Phase 1: pre-ECHO needs assessment and recruitment

Phase 1 respondents

Phase 1 of the study included conducting a needs assessment survey prior to the initiation of the ECHO network and to support the development of the curriculum and aid in the recruitment of spoke participants. Survey respondents within the rural catchment area of URLEND were recruited by convenience sampling and distribution of a survey via online postings, newsletters, organization-based e-mail lists, among other methods, to gauge general and topical interest. Respondents who completed the interest survey for the network (N = 106) included healthcare providers (professionals and trainees) across all URLEND states (North Dakota, n = 1; Montana, n = 22; Idaho, n = 16; Utah, n = 45; Wyoming, n = 19) as well as a few other regional states (Arizona, n = 1; Colorado, n = 1; Nevada, n = 1; South Dakota, n = 1; Washington, n = 2), and came from a wide variety of disciplines (see, Table 1). All survey respondents were invited to participate in the network.

Phase 1 procedures

Potential respondents were invited via e-mail to complete an interest survey about participation in Project ECHO Autism for Rural Healthcare Providers. Survey items included basic demographic information, what (if any) continuing education credits prospective participants would be interested in obtaining, their discipline/area, degree of familiarity with the ECHO model, familiarity and comfort working with autistic individuals, and ranking of proposed topics to be covered in the ECHO sessions. As a part of the survey, respondents were asked to indicate any areas of expertise (e.g., within their discipline) and if they would be willing to share this expertise with the

Table 1. Pre-network survey respondents' professional disciplines.

Discipline	n
Occupational Therapy	27
Education	17
Psychology	16
Healthcare	15
Speech and Language	14
Family Member	6
Audiology	2
Pediatric Dentistry	2
"Other*"	1 (each of various disciplines); 19 total

*"Other" included: various behavioral and early intervention specialists, care coordinators, a dentist, nutrition specialists, geneticist, assistive technology specialists, public health and social workers, vision specialist, nonprofit executive director, and a nursing care coordination specialist.

network. Online survey data were collected and managed using REDCap electronic data capture tools (Harris et al., 2009). All individuals on the list of potential respondents, along with any additional contacts provided by actual respondents, were invited to participate in Project ECHO Autism for Rural Healthcare Providers. Given the feedback collected, three pilot sessions on topics of interest to respondents were held in February, March, and April of year 1.

Phase 2: ECHO Implementation

Phase 2 participants

Phase 2 involved implementing the ECHO network for a full year. Each session was attended by the hub team of URLEND-AE trainees (n = 8), faculty mentors (n = 3), and "spoke" participant rural healthcare providers. Most hub team trainee members were enrolled in discipline-specific PhD programs. The individuals who participated in the ECHO sessions (hereafter "participants" or "attendees") were highly varied in their disciplines and differed from session to session. Many of these individuals were also Phase 1 survey respondents, while others were not. A listing of hub and spoke individual disciplines/backgrounds is contained within Table 2.

Phase 2 procedures

ECHO sessions began in the 2020–2021 academic year. Each 90-minute session included both a didactic and case presentation component. Didactic presenters came from the hub team, including URLEND trainees, parents of autistic children, and invited health professionals specializing in topics of interest. A list of didactic topics can be found in Table 3. Topics were derived from the pre-network survey results compiled during Phase 1 – that is, determined to be the most relevant to survey respondents. Didactic materials were made available to all attendees following the session.

Table 2. Hub and spoke individual disciplines.

Hub Disciplines	Spoke Disciplines
Mentors	- Case management
- School psychology/psychology	- Pediatrics
- Pediatrics with expertise in autism	- Occupational therapy
- Health Education	- Speech-language pathology
Trainees	- Board-certified behavior analysis (BCBA)
- Special education	- Clinical psychology
- Psychology	- School psychology
- Board-certified behavior analysis (BCBA)	- Special education
- Speech-language pathology	- Emergency medical services
- Occupational therapy	- Parent/Caregiver/Family member
- Audiology	

Table 3. Interests of pre-network survey respondents, ranked by total endorsements.

Topic	Number of Respondents Interested (Total respondents = 106)
Behavior strategies for working with individuals with ASD	74 (69.8%)
Psychiatric/Behavioral Health Co-occurring Conditions (e.g., Anxiety, ADHD, Aggression)	71 (66.9%)
Coordination of Care Across Disciplines (e.g., Role of: SLP, OT, Physical Therapy/PT, Pedatrics/Medical Doctor, Psychology, Nursing, Social Work, Educators)	71 (66.9%)
Family Education and Support (e.g., Parent Mental Health)	69 (65.1%)
Evidence-based interventions for ASD (e.g., ABA, Cognitive-Behavioral Therapy/ CBT, ST, OT)	67 (63.2%)
Parent Behavioral Management (e.g., Feeding, Toileting, Sleep)	63 (59.4%)
Family Perspective	57 (53.8%)
Medical Co-occurring Conditions (e.g., Epilepsy, Sleep Disorders, GI Disorders)	57 (53.8%)
Transition to Adulthood (e.g., Guardianships, Healthcare, Education)	52 (49.1%)
Early Identification of ASD	52 (49.1%)
Working with Schools (e.g., IEP, 504 plans, advocacy)	48 (45.3%)
Community Resources (e.g., Social Media, Online Resources, Education)	47 (44.3%)
Medication and ASD	46 (43.4%)
Safety and ASD (e.g., Wandering)	41 (38.7%)
ASD Cultural Competency	39 (36.8%)
Complementary and Alternative Medicine (e.g., Supplements, Mindfulness)	35 (33.0%)
Testing and Diagnosis	33 (31.1%)
General Overview of ASD	16 (15.1%)
Additional Topics entered by respondents (e.g., sexuality, adult screening/ assessment and intervention, sensory processing, access to services for autism in underserved populations, early diagnosis and intervention, financial resources and support for family members, issues surrounding public education, and nutrition and feeding)	1 (each of numerous assorted topics; 0.9%)

ADOS: Autism Diagnostic Observation Schedule; ABA: Applied Behavior Analysis; DIR: Developmental Individual-difference Relationship-based; FAPE: Free and Appropriate Education; IDEA: Individuals with Disabilities Education Act

Case presentations were offered either by hub team members or ECHO attendees. To offer the opportunity for attendees to present cases for which they might have needed assistance/suggestions, prior to each session, we solicited interested participants. Case content was not necessarily coordinated with didactic topics, though there was often incidental overlap which led to interesting talking points. Prior to each case presentation, families were informed of all procedures and purposes of the presentation and then were asked to sign a consent form providing permission to present their case. All presentation materials were also de-identified and, in some cases, we changed

certain aspects of the presented information (e.g., assigned sex of the child), if it was not essential to the understanding of the case, to further foil identification of the subject of the case before each presentation. During case presentations, a set of template slides were presented that profiled each case – i.e., demographic information, diagnosis/es, co-ocurring conditions, current and past services received and outcomes of these supports, any additional information caregivers and clinicians considered pertinent, and specific questions for the network regarding suggestions about future supports. Then, the entire network of attendees was encouraged to ask questions and offer suggestions about future clinical action. If the number of attendees exceeded approximately 30 participants, virtual breakout rooms were used for this discussion. Following small-group (4–6 people) conversations about the case, a spokesperson from each group was invited to share what they had discussed to debrief with all in attendance. All discussion points, whether verbally expressed or recorded in the chat screen, were compiled into a report, reviewed by the hub team, and given to the presenter following each session. The intent of these reports was to provide the presenting clinician with all suggestions, corresponding best-practices, and community resources that had been offered during the discussion portion of the presentation. Additionally, following each session, hub team members held debriefing meetings to discuss their impressions, lessons learned, and make plans to help case presenters. All sessions were held using Zoom videoconferencing software (Zoom Video Communications, Inc.).

Following each ECHO session, a post-session survey was sent to attendees. This survey comprised questions or statements such as, "Overall, I was satisfied with today's session," "Today's session contributed to my understanding of working with people with autism," "What I have learned today will improve my home/family life and/or professional practice," "Today's topic was useful to me," "Confidence in using something from today's session," and "How often will you use something you learned from today's session?" Responses were rated on Likert scales corresponding to each item (i.e., 1–5, 1–6, 1–7, depending on the question). The number of survey respondents for each session varied from 11–34 (M = 18.00; S.D. = 8.35), with total participants invariably exceeding post-session survey responses.

Analysis

Descriptive analysis of pre-network survey responses (Phase 1) included tallying the number of responses and calculating percentages for each question on the survey. For questions related to topics of interest, we carried out an overall ranking, to determine which topics we would likely use in ECHO sessions throughout 2020–2021. For post-session surveys in Phase 2, we also performed descriptive analyses. Additionally, Wilcoxon Rank Sum tests were

used to examine the difference between pre- and post-session knowledge level. Responses to the post-session surveys were averaged and plotted to gain insight about attendees' preferences and feelings about the various dimensions of inquiry across sessions. Statistical analyses were carried out using the SPSS statistical package (IBM Corp. Released, 2020).

Results

Phase 1 results: pre-network survey and needs analysis

Aggregated data in response to the pre-network survey questions, such as, "Are you interested in learning more about the network that would meet beginning in the spring of 2020?" showed that participants were very interested in learning more about the URLEND ECHO Autism network (n = 105, 99%). A slight majority indicated that they were not familiar with the ECHO model (n = 60, 57%). In another question, on a scale from not comfortable/familiar at all to very comfortable/familiar, the majority of participants indicated high levels of comfort – either very comfortable/familiar (44.4%) or comfortable/familiar (41.5%) – while fewer indicated lower levels of comfort/familiarity (14.1%). Additionally, 79 (75.2%) reported an interest in CEUs, eight indicated CME, and seven specified "other" which included CEs for psychologists, contact hours, counseling renewal units, program credit, and Utah Physical Therapy Association Approved CEUs. Furthermore, 35 (33.0%) individuals also stated that they had areas of expertise that they would be willing to share with the network, which were highly varied. Finally, respondent-ranked topics of interest, ranging from most to least endorsed, as well as a list of additional topics entered by respondents, are presented in Table 3.

Phase 2 results: session descriptions and synthesis of outcomes

Summarized descriptions of ECHO Sessions

In 2020, we delivered ECHO sessions in February, March, and April that focused, respectively, on: (1) *Early Identification of autism spectrum disorder* (n = 19), (2) *Interaction of Medical and School Systems* (n = 12), and (3) *Behavior Strategies for Working with Individuals with ASD* (n = 30). Across all three sessions, more than 90% of post-session respondents reported that the session contributed to their understanding of working with autistic individuals. In every session, attendees indicated a positive change in knowledge. Wilcoxon Rank Sum testing between pre- and post-session knowledge level revealed a significant favorable change in knowledge overall ($Z = -3.07$; $p = .002$). The percentage of participants who reported being overall satisfied with the sessions ranged from 87% to 100%. A summary of each session's participants, survey respondents, didactic topic, average

Table 4. Summary of Session Characteristics and Feedback.

Month (2020–2021)	Number of Participants	Number of Survey Respondents	Didactic Topic	Average Change in Knowledge (%)*	Planning to Share Session Info (%)
February	31	19	Early identification of ASD	10%	95%
March	27	12	Interaction of medical and school systems	16%	92%
April	61	30	Behavior strategies for working with individuals with ASD	8%	90%
August	27	11	Psychiatric/Behavioral Health Co-Occurring Conditions	18%	91%
September	32	17	Family Perspective	10%	88%
October	69	34	Behavior Strategies for working with individuals with ASD	10%	94%
November	27	12	Coordination of Care Across Disciplines	14%	100%
December	39	16	Evidence-based Interventions for ASD	12%	75%
January	26	14	Co-Occurring Medical Conditions	16%	100%
February	29	14	Parent behavioral management	20%	100%
March	21	8	Family education and support: mental health and resilience	10%	88%
April	19	5	Transition to adulthood	12%	100%
Mean	**34.00**	**15.91**		**13%**	**93%**
S.D.	**15.44**	**8.83**		**4%**	**7%**

*Change in knowledge percentages were calculated by dividing the pre-session by the post-session participant-reported knowledge scores

change in knowledge (i.e, pre-session score divided by the post-session scores), and percent planning to share info from the session is presented in Table 4.

We held nine additional sessions during the 2020–2021 academic year. The topics for these sessions were as follows (presented with number of attendees): 1) *Psychiatric/Behavioral Health Co-occurring Conditions (e.g., ADHD, anxiety, aggression;* n = 27); 2) *The Family Perspective* (n = 32); 3) *Behavior Management Strategies* (n = 69); 4) *Coordination of Care Across Disciplines* (n = 27); 5) *Evidence-Based Interventions for ASD* (n = 39); 6) *Medical Co-occurring Conditions (esp. Hearing Loss, Gastrointestinal Issues, and Sleep Disorders;* (n = 26); 7) *Parent Behavioral Management* (n = 29); 8) *Family Education and Support: Mental Health and Resilience* (n = 21); 9) *Transition to Adulthood* (n = 19). Topics were derived from pre-ECHO survey responses (Phase 1). Each session was presented by a hub team member or invited speaker with expertise in the topic area. The vast majority of post-session survey respondents indicated that they were satisfied with the session, that their knowledge had increased, and that they would share the information they learned. Additionally, each session

included a case presentation by a hub team member or professional from the network.

Synthesis of session characteristics and outcomes

Percentage of participants that attended at least one ECHO session during the 2020–2021 academic year from each of the states in the URLEND area (and Texas) are reflected in Figure 1. Most participants were from Wyoming (36%), Utah (30%), and Montana (26%). Other states, such as Texas (4%), Idaho (3%), and North Dakota (1%) were represented more modestly in the sample geographic makeup.

Figure 2 shows the top several disciplines/roles of the participants that attended at least one session during the 2020–2021 academic year. The role with the most respondents was "Case Manager," while the fewest number of participants were "Early Intervention Specialists." Other roles included: "Student" (15), "Specialist" (13), "Other" (8), "Director" (8), "SLP" (7), "Professor" (7), and "Coordinator" (6). Thus, participants composed a varied group of allied healthcare providers and academics that differed in some ways from the pre-network survey respondents.

Overall, respondents were satisfied with our team's ECHO sessions. That is, most attendees (>95%) either "strongly agreed" or "agreed" that they were satisfied with the session they attended. Benefit was assessed by looking at survey questions concerning increases in knowledge and likelihood of using and sharing session information. On all such survey items, most respondents indicated that the sessions "contributed to [their] understanding of working with people with autism," "improved their home/family life or professional

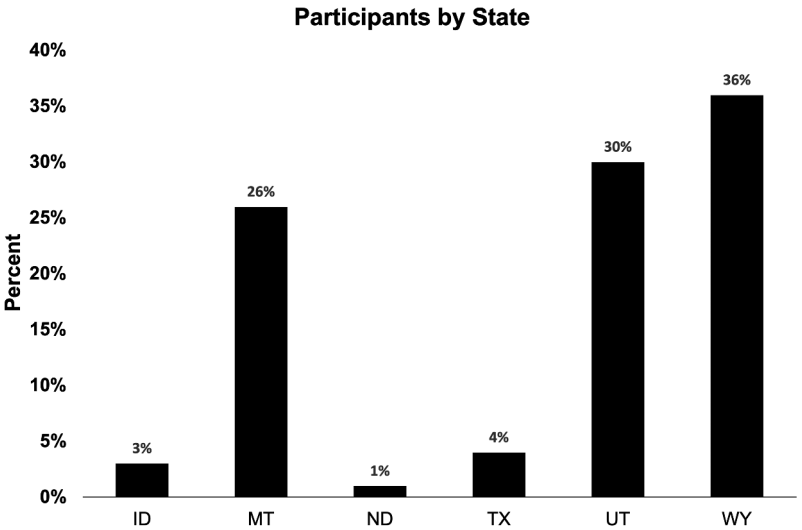

Figure 1. Cross-session summary of participants by state.

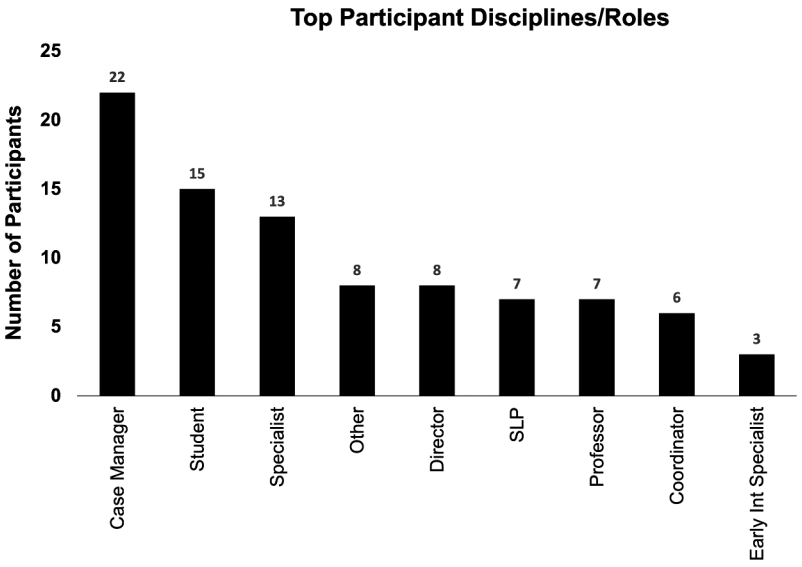

Figure 2. Cross-session summary of participant professional disciplines/roles.

practice," were "useful," provided "confidence in successfully implementing something" from their session, and increased their likelihood of "using something [they'd] learned" from their session.

Though most responses were highly positive, there were others that pointed to opposite feelings about our team's sessions. For instance, 1–2% of respondents were not satisfied with the session they attended, nor did they feel that their session contributed to their knowledge of working with autistic people. Additionally, some felt less than confident implementing elements of their session and indicated that they would "rarely" use something they learned in the session they attended.

While principles of confidentiality prevent us from discussing the clinical cases in depth here, during each ECHO session, we highlighted key factors of each case in order for attendees to discuss these case elements and make meaningful suggestions about next steps. Several indications expressed that case presenters and ECHO attendees were pleased with these discussions. For instance, post-session survey data showed that approximately 90% of participants indicated that they had "learned something useful" from the case presentation. Additionally, during post-session debriefing meetings, hub team and faculty mentors regularly commented that case presenters benefitted from case discussions and suggestions offered by the hub team and attendees. Such notions were verified by case presenters themselves when they received the reports generated by the WIND team documenting the case discussion and participant suggestions.

Discussion

Over a two-year period, we developed, piloted, and examined an ECHO Autism network for rural healthcare providers in the Western U.S. – in response to significant gaps in access to relevant and accurate information about autism and implementation of EBPs for healthcare in rural areas. All stages of the project were carried out by trainees and faculty advisors in a regional LEND program (URLEND), with technical support by staff from a University Center for Excellence in Developmental Disabilities (UCEDD; WIND). Attendees reported increased knowledge and that their learning would have positive influences on their professional/clinical practice or family life and functioning for their patients/clients. These findings support the notion that we created a feasible, cost-effective, and sustainable model for implementation.

In the following paragraphs we discuss our findings and lessons learned regarding each stage of the process. We also comment on our analysis of the reported needs of the rural healthcare providers who attended our ECHO network sessions. Finally, we make suggestions about implementation of future ECHO networks, especially those employing trainees as the hub team.

How did our ECHO network assist healthcare providers in local rural areas?

The telehealth effort has been increasing over the last two decades, or more (see, Dorsey & Topol, 2016 for a review). During the COVID-19 pandemic, this effort has been significantly increased and improved. Many professionals were forced to engage in various aspects of telehealth and have gained enhanced skills related to videoconferencing-based practice. Given these trends, teleconsultation using the Project ECHO model may be better positioned than ever to enhance the training of rural healthcare providers. Combined with the aforementioned structural supports of our ECHO network (e.g., staffing by trainees, collaboration among community members), the current ECHO model could significantly contribute to the ever-increasing need for remote training of healthcare professionals, especially those who practice in rural or frontier areas. Our results suggest that both attendees and case presenters were satisfied with their experience with our ECHO network. Attendees reported increased knowledge for caring for autistic individuals and confidence they would use this knowledge in practice. Like other teleconsultation networks (e.g., ECHO-MTSS; Sussman et al., 2021) and ECHO Autism networks, in particular (e.g., Sohl et al., 2017), our ECHO Autism for Rural Healthcare Providers was, therefore, an acceptable means for disseminating useful evidence-based information to practitioners in the rural Western U.S.

One novel aspect of the ECHO model is that it allowed for participants to receive support and ongoing mentorship from each other and the hub team with respect to current clinical challenges. In our experience, allowing a diverse community of professionals to weigh in on a single case led to novel insight in many instances over our ECHO sessions. To illustrate, in many cases, interventions or supports that had not originally been considered by the presenting clinician(s) were suggested by attendees. Moreover, subject-matter experts (e.g., hub team members) had the opportunity to contribute suggestions for specific practice scenarios based on the latest research and EBPs. In many such instances, presenting clinicians commented that they were going to implement these suggestions upon returning to work with their clients. Thus, this learning may have resulted in enhancement of clinical practice. Among the landscape of telepractice methodology, this aspect of the ECHO model is novel and potentially beneficial to rural healthcare providers working with autistic individuals. This may be especially true when the ECHO attendees are from similar geographic areas as case presenters and each other, enabling recommendation of local resources/referrals and input considering regional cultural attributes as relevant (e.g., in the Western U.S. states, insight on work with members of tribal communities).

In conjunction with the more specific effective network components noted above, there were several general key elements that contributed to our ECHO network's success. Such factors included a pre- and post-network survey, pilot ECHO sessions, staffing the hub team with a diverse, multidisciplinary team of trainees and faculty mentors, holding both didactic and case presentations/discussion, debriefing, and access to consultation with others knowledgeable about the technical implementation of an ECHO network. Future ECHO networks might expect similar outcomes when employing comparable methods.

What do the chosen topics and session feedback say about rural healthcare providers' needs?

Through examining the didactic session topics in which Phase 1 survey respondents were most interested, we were able to make several inferences about the needs of rural healthcare providers. Across respondents, there was a wide variety of offered topics, which may highlight the highly varied needs of rural healthcare providers. Nonetheless, some patterns emerged from our data.

Behavioral supports

For example, several of the most requested topics were related to improving behavioral supports (behavioral strategies in working with autistic individuals, parent behavior-management skills) suggesting that rural providers need information and training on behavioral methods that support autistic

individuals and their families. This finding is consistent with several previous studies that examined the needs of rural providers in other parts of the United States. For instance, Carson et al. (2021) profiled the needs of providers and families in a rural county in Florida and found that the lack of behavioral specialists (e.g., BCBAs) was one of the largest unmet needs in their community, due to parents' serious concerns about maladaptive behaviors. Professionals in rural healthcare settings are often required to serve as generalists and may lack training in the most effective and up to date behavioral supportive methods (O'Toole et al., 2010). Given the behavioral challenges cited by many parents and professionals, and the lack of behavioral support services (Greenberg et al., 2003), findings from our study show that rural healthcare providers need and want training in behavior management to support caregivers of individuals on the spectrum. Findings from our ECHO sessions centered on behavioral management topics suggest that ECHO Autism can be a viable method to provide training on EBPs in this area.

Co-occurring conditions

Another common area of need indicated by pre-ECHO survey respondents was information about co-occurring conditions in autistic individuals. It is well-established that socioeconomic factors, including rurality, are associated with lack of accessibility of high-quality health services, which further lead to poorer health and developmental outcomes (e.g., Drahota et al., 2020; Sheridan et al., 2014). Autistic individuals from socioeconomically disadvantaged groups (e.g., rural, racial minority, lower socioeconomic status) have been shown to experience even larger gaps in service, relative to others both who are autistic and do not intersect with these groups and in the general population (Bishop-Fitzpatrick & Kind, 2017; Croen et al., 2015; Hirvikoski et al., 2016).

When a diagnosis of ASD is complicated by co-occurring health or other neurodevelopmental conditions, which is common, the above disparities are likely even larger. For instance, some of the most common co-occurring conditions in the autistic population are gastrointestinal difficulties, hearing loss, sleep issues, and anxiety (Dizitzer et al., 2020). In rural areas, finding professionals who have experience working through these issues with autistic children and their families, such as specialist pediatricians, audiologists, psychologists, behavior specialists, and psychiatrists, can be difficult (Carson et al., 2021; Drahota et al., 2020). As requested by pre-ECHO survey respondents, we addressed co-occurring conditions during several of our ECHO sessions. For instance, we held sessions entitled *Psychiatric/Behavioral Health Co-Occurring Conditions, Coordination of Care Across Disciplines*, and *Co-Occurring Medical Conditions*. Additionally, during several of the case presentations, sleep, gastrointestinal, audiologic, and other co-occurring diagnoses (e.g., genetic syndromes) were discussed.

Both qualitative and quantitative data from our study suggest that rural healthcare providers and caregivers found these topics valuable and helpful in the identification and management of co-occurring medical and mental health conditions in autistic individuals. For example, one family allowed us to discuss their child who was diagnosed with ASD as well a rare genetic condition. The family commented that they had made progress in many areas with the help of educators and therapists but were seeking additional suggestions. After initial presentation of the case, hub and spoke members discussed some augmentative/additional supports (e.g., art therapy, music therapy, specific speech therapy techniques that had not previously been considered). Given the multidisciplinary climate of the conversation, some of these alternative treatment avenues had not been known to the family. They commented that they felt hopeful and informed. In this case, and others discussed during our ECHO sessions, the ECHO model was effective in directly supporting both professionals and families in caring for autistic children with co-occurring conditions.

Interdisciplinary collaboration

From the pre-ECHO survey, many rural providers expressed a need to learn more about interdisciplinary collaboration. Team discussions in preparation for the ECHO session related to this topic and during the session with participants elucidated the common perspective that interdisciplinary collaboration is challenging, especially in rural settings. Resource limitations in rural settings mandate professional collaboration across disciplines to best serve patients (Brems et al., 2009), but lack of proximity, technology, resources and gaps in training and knowledge about evidence-based practices, make interdisciplinary collaboration difficult. Additionally, pre- and misconceptions about other disciplines can be a hindrance to interdisciplinary collaboration.

Cross-discipline communication about a single topic may be difficult because of differing lexicons and approaches to a given issue, which can cause tension, or curtailed referral streams between professionals. This pattern can be compounded in rural settings because there may be fewer professionals from other disciplines with whom to work. Increased friction between a small number of providers could lead to unwillingness of one or more parties to work together over time. Nonetheless, training in interdisciplinary collaboration can be effective in changing people's perceptions and attitudes toward other disciplines and to the process of collaboration itself (e.g., Fertman et al., 2005; Lennon-Dearing et al., 2008), in addition to promoting bolstered consistency among providers in use of EBPs (Azad et al., 2021b).

Because of the aforementioned healthcare challenges of rural areas, it is paramount that professionals work together to maximize their effectiveness and the use of potentially limited resources, especially in complex, multifaceted cases (Fertman et al., 2005). Based on the Phase 2 post-session survey

responses, the ECHO session on interdisciplinary collaboration, in which we presented principles of effective collaboration and invited participants to submit solutions to common collaborative difficulties, was effective in assisting attendees to share creative ideas related to their collaborative difficulties. We also allowed participants to discuss obstacles they had encountered in their own practices related to interdisciplinary work. Throughout all sessions the hub team of interdisciplinary professionals modeled effective, respectful, and nonhierarchical collaboration in how cases were discussed. Thus, those working in rural settings would do well to seek out training related to interprofessional collaboration to improve their own skills, as well as promote these ideals in their educational and consultation efforts. Professionals who play a consultative role may have a unique opportunity to help such interdisciplinary efforts, since they likely interface with people from multiple disciplines, perhaps, more frequently than other professionals and may have more chances to influence collaborations. Effective interdisciplinary cooperation has great potential, and may be imperative, to improve supports for autistic individuals and their families.

Assistance for family members and other caregivers

In addition to the support needed by most autistic individuals, pre-ECHO survey responses also suggested that rural healthcare providers were concerned about how to provide assistance to family members and caregivers. It has been reported that families of autistic children in rural settings experience more obstacles and limitations to locating and accessing the services they need (Corden et al., 2021; Johnsson et al., 2016). Thus, it is likely that rural healthcare professionals are concerned about family well-being and are motivated to seek additional training and support related to this issue. Our ECHO network addressed these needs in several of our sessions, particularly the sessions entitled *Parent Behavioral Management* and *Family Education and Support: Mental Health and Resilience*. The session on parent behavioral management was one of the highest rated by participants in terms of knowledge change and plans to disseminate the information. Future ECHO networks should consider including sessions in which professionals can learn to better empower families to develop resilience and self-efficacy when caring for autistic individuals.

What did post-session survey data indicate about our ECHO model?

In general, Phase 2 post-session survey feedback suggested that the majority of respondents were satisfied with ECHO sessions and had learned valuable information that they planned to both share with others and include in their own professional practices. Such findings point to the effectiveness of the ECHO model, in general, as well as the unique aspects of our team's ECHO

network. For instance, previous ECHO networks have not been staffed by trainees, but rather depended on more seasoned professionals and academics to carry out most network-related tasks. However, many participants of our team's network were pleased with their experiences. This supports the notion that future ECHO networks on autism and other developmental disabilities implemented by graduate level trainees with mentorship from faculty with expertise are a viable model for sustaining an ECHO hub team, while providing benefit for trainees and other participants (e.g., Chrisman-Khawam et al., 2017). Our experience spans two years of different trainees with mentorship from the same faculty. Trainees within the URLEND-AE track are tasked with increasing their knowledge of the care of autistic individuals, engaging in research and enhancing their leadership skills. Project ECHO Autism for Rural Healthcare Providers has allowed trainees to get "hands on" experiences in all these areas while also creating a sustainable service to communities in need. Thus, the funding support for LEND trainees is being leveraged to simultaneously support an ECHO network and accomplish the program's training goals. Increasing the number of LEND-administered ECHO networks (or those connected to other training programs) has the potential to enhance training programs and the abilities of frontline rural healthcare providers, and downstream improvements in health outcomes for individuals with developmental disabilities.

Our team focused on creating a collaborative environment throughout our ECHO sessions to establish a community of practice in which providers were encouraged to share their expertise and ideas to help others in the network. While this effort began with simple practices such as inviting all to introduce themselves at the outset of each session, it was especially evident during case discussions. In these discussions, following the presentation of cases, network members were asked to provide their insights on the next steps that might be taken to support the presenter's client/patient. Anecdotal data from several case presenters indicated that the suggestions of the ECHO community were highly informative and helpful. Additionally, participants seemed to appreciate the ability to contribute during ECHO sessions. This model may have differed from other ECHO networks, in which the hub team engaged in most of the presentation, as well as the discussion. It is possible that, since the hub team was mostly made up of trainees, rather than more experienced "experts," attendees felt more comfortable discussing their thoughts and suggestions – an aspect of our ECHO network that seemed to be appreciated by network members.

Despite the successes mentioned above, we also identified areas of improvement through post-session survey responses and other means. For instance, though participants seemed to be generally satisfied with the ECHO sessions and deemed these sessions and their content as useful, some network members appeared to be concerned with the suitability of some of the didactic

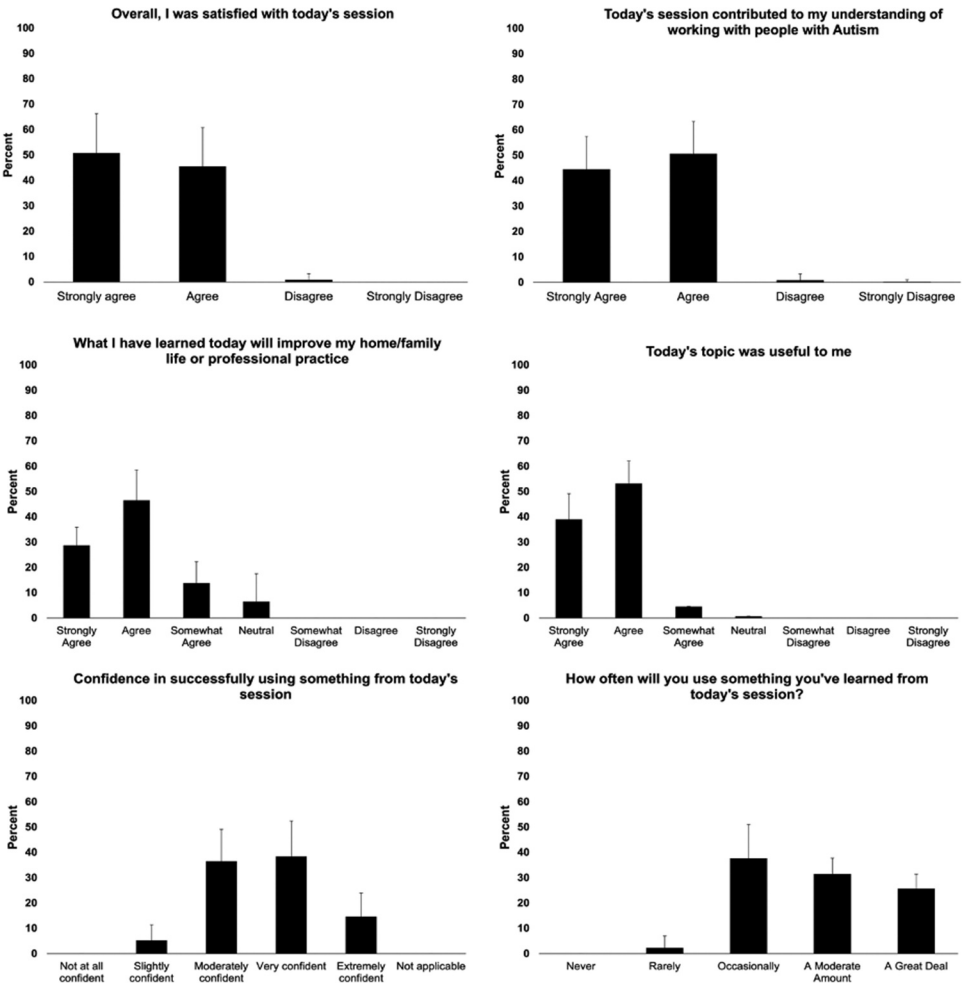

Figure 3. Aggregated post-session survey responses.

information for immediate implementation. This effect can be seen in the bottom panels of Figure 3, in which almost 50% of post-survey respondents indicated modest confidence in the use and frequency of use of session information. Additionally, on a few occasions, we heard from attendees that suggested making the didactic sessions more practical (i.e., less focused on theory). Thus, we conclude that, overall, the rural healthcare providers that attended our ECHO sessions felt confident in their knowledge of the theories that underlie the practices that were addressed, but were looking for ways to apply these theories in their everyday practices. Future ECHO networks, including future iterations of the presently discussed network, would be improved by integrating practical strategies on how to improve care into their didactic presentations.

Implications

The present study has implications for both those who desire to initiate or modify an ECHO network in their area, as well as people who support autistic people and their families in other ways, especially in rural locales. For instance, many of the topics discussed above highlight the needs of and methods for working with families and professionals living in rural settings – in other words, the topics of the ECHO sessions related to autism in rural settings that communicate needs, the potential benefits of improved interdisciplinary collaboration, principles of effective use of videoconferencing technology to provide consultation for people in rural areas, among others. Also, given the success of the present ECHO network, we submit that it would be feasible and effective to employ supervised trainees in consultation-based service for professionals working with autistic persons and their families, and these families themselves. In doing so, people in need might receive support more readily and trainees would benefit from the experience and mentoring involved in such a program. Ultimately, using the principles presented herein in future videoconferencing, telehealth, and consultation scenarios could benefit professionals and the people they serve.

Limitations and proposed revisions of the current network and study

There are limitations in the interpretation of the data presented above. Overall, 46.8% of all participants provided post-session feedback and it is unknown whether similar views of the program were held by non-responders. This effect may have occurred because of lack of incentives to complete post-session surveys. Future ECHO networks might provide external motivation for completion of attendee evaluations, such as offering CEUs only after filling out the surveys. Additionally, instead of just one post-session reminder e-mail, future ECHO teams should plan to remind people verbally at the end of each session and send more than one e-mail with a link to the survey in future iterations of our ECHO network. Furthermore, it appears that attendance may have waned gradually over time, which may be representative of those who were very interested in continuing to attend, while people who were curious or, perhaps, did not find adequate benefit from attending decided to stop. This phenomenon may have affected the responses to post-session surveys, as well as point to an improvement that could be made to our efforts and future ECHO networks – namely, continual publicizing of network activities. While we regularly reminded people who had indicated interest initially about upcoming network meetings, we did not actively continue to recruit new participants. Furthermore, while we evaluated participant satisfaction and change in knowledge, we did not assess changes in actual outcome. Therefore, despite any

suggestions of success of our ECHO network, we do not truly know if the sessions led to concrete changes in practice or improvements in services. Thus, future networks should make it a point to determine their successes via directly measuring outcome in addition to other, more subjective, participant impressions. Comfortability with topics should also be examined pre- and post-ECHO in the future.

Additionally, provider-patient confidentiality standards precluded further in-depth analysis of case presentation content in the current manuscript. While unavoidable, it is unfortunate insofar as the case presentations and discussions represented more than half of the content of our network. Survey data suggests that the case discussions were some of the most informative, helpful, collaborative, and enjoyable portions of these sessions. Thus, the proportion of the current discussion devoted to the case-related content from our ECHO sessions should not detract from future ECHO networks' inclusion of case presentations and discussion. Also, from the current data, we cannot verify participants' reports of improved knowledge or plans to share the knowledge received during our sessions. Thus, overall, instruments used to evaluate future ECHO networks should take the above into account when they are being prepared.

An improvement that we would like to implement in the future is inclusion of an autistic self-advocate as a hub team member to each ECHO session (e.g., Hogan et al., 2020; Sarju, 2021). Self-advocate insight would be essential in the coming iterations of our ECHO network and is consistent with current best practices. Many training programs, including URLEND, employ the services of autistic self-advocates and families of autistic children. While such individuals only indirectly influenced the current ECHO network, the fact that training programs commonly work with this type of advocate may facilitate their influence on future networks more directly.

Conclusions and future directions

Teleconsultation models, such as the Project ECHO hub-and-spoke model (Arora et al., 2007), have great potential to connect rural healthcare providers with cross-disciplinary experts, other practitioners with region-specific (e.g., resource, cultural) knowledge, and current research and EBPs (Azad et al., 2021a; Bice-Urbach & Kratochwill, 2016). With increasing prevalence of ASD, the widespread use of teleconsultation models such as ECHO Autism becomes increasingly valuable. The potential of this avenue for disseminating and increasing consistent, confident use of EBPs in rural, more resource-scarce regions underscores the importance of understanding the feasibility and effectiveness of such models. While LEND multidisciplinary, graduate-level training programs are not the only suitable start points for establishing ECHO Autism networks, they exemplify how such teleconsultation may be feasible

and effective in most states – offering a "win-win" setup in which clinical trainees build consultation skills while sharing up-to-date information with, and promoting discourse among, practitioners who otherwise do not have access due to geographic, financial, or institutional constraints. All of these benefits contribute to the likelihood of patients receiving quality, evidence-based healthcare and appropriate referrals to supportive services.

The current project demonstrates the feasibility of including trainees from long-established and durable programs such as LEND, who are often more available, bring significant expertise and knowledge of new and promising practices, are in need of clinical/consultation experiences and real-world mentoring from supervising faculty, and can leverage training grant funding to support their time, in the development and delivery of ECHO networks. We propose that future ECHO networks use these strategies to increase access to high-quality training for rural healthcare providers and enhance experiences for trainees. Similar efforts in the future might also evaluate the impact of ECHO network participation on trainees and their future careers. Most importantly, future work in these areas should continue to be aimed at improving clinical care for autistic individuals and their families. Achieving this ideal will require thoughtful implementation of methods similar to those described herein, as well as improved evaluation of outcomes of these efforts on both service providers and those they support.

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References

American Psychological Association. (2017). *Ethical principles of psychologists and code of conduct*. https://www.apa.org/ethics/code

American Speech-Language-Hearing Association. (2016).*Code of ethics*. https://www.asha.org/code-of-ethics/

Antezana, L., Scarpa, A., Valdespino, A., Albright, J., & Richey, J. A. (2017). Rural trends in diagnosis and services for autism spectrum disorder. *Frontiers in Psychology*, *8*, 590. https://doi.org/10.3389/fpsyg.2017.00590

Arora, S., Geppert, C. M., Kalishman, S., Dion, D., Pullara, F., Bjeletich, B., Simpson, G., Alverson, D. C., Moore, L. B., Kuhl, D., & Scaletti, J. V. (2007). Academic health center management of chronic diseases through knowledge networks: Project ECHO. *Academic Medicine*, *82*(2), 154–160. https://doi.org/10.1097/ACM.0b013e31802d8f68

Arora, S., Kalishman, S., Dion, D., Som, D., Thornton, K., Bankhurst, A., & Yutzy, S. (2011). Partnering urban academic medical centers and rural primary care clinicians to provide

complex chronic disease care. *Health Affairs*, *30*(6), 1176–1184. https://doi.org/10.1377/hlthaff.2011.0278

Arora, S., Kalishman, S., Thornton, K., Dion, D., Murata, G., Deming, P., & Pak, W. (2010). Expanding access to hepatitis C virus treatment–Extension for Community Healthcare Outcomes (ECHO) project: Disruptive innovation in specialty care. *Hepatology*, *52*(3), 1124–1133. https://doi.org/10.1002/hep.23802

Association of University Centers on Disabilities (AUCD). (2011). *About LEND*. https://www.aucd.org/template/page.cfm?id=473

Azad, G. F., Marcus, S. C., & Mandell, D. S. (2021a). Partners in School: Optimizing communication between parents and teachers of children with autism spectrum disorder. *Journal of Educational and Psychological Consultation*, *31*(4), 438–462.https://doi.org/10.1080/10474412.2020.1830100

Azad, G. F., Minton, K. E., Mandell, D. S., & Landa, R. J. (2021b). Partners in school: An implementation strategy to promote alignment of evidence-based practices across home and school for children with autism spectrum disorder. *Administration and Policy in Mental Health and Mental Health Services Research*, *48*(2), 266–278. https://doi.org/10.1007/2Fs10488-020-01064-9

Bauer, M. S., Damschroder, L., Hagedorn, H., Smith, J., & Kilbourne, A. M. (2015). An introduction to implementation science for the non-specialist. *BMC Psychology*, *3*(32), 1–12. https://doi.org/10.1186/s40359-015-0089-9

Bice-Urbach, B. J., & Kratochwill, T. R. (2016). Teleconsultation: The use of technology to improve evidence-based practices in rural communities. *Journal of School Psychology*, *56*, 27–43. https://doi.org/10.1016/j.jsp.2016.02.001

Bishop-Fitzpatrick, L., & Kind, A. J. H. (2017). A scoping review of health disparities in autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *47*(11), 3380–3391. https://doi.org/10.1007/s10803-017-3251-9

Bottema-Beutel, K., Kapp, S. K., Lester, J. N., Sasson, N. J., & Hand, B. N. (2021). Avoiding ableist language: Suggestions for autism researchers. *Autism in Adulthood*, *3*(1), 18–29. https://doi.org/10.1089/aut.2020.0014

Brems, C., Johnson, M. E., Warner, T. D., & Roberts, L. W. (2009). Barriers to healthcare as reported by rural and urban interprofessional providers. *Journal of Interprofessional Care*, *20*(2), 105–118. https://doi.org/10.1080/13561820600622208

Brookman-Frazee, L., Roesch, S., Chlebowski, C., Baker-Ericzen, M., & Ganger, W. (2019). Effectiveness of training therapists to deliver individualized mental health interventions for children with ASD in publicly funded mental health services – A cluster randomized clinical trial. *JAMA Psychiatry*, *76*(6), 574–583. https://doi.org/10.1001/2Fjamapsychiatry.2019.0011

Carson, T. B., Palacio, A. E., Hextall, S., & Guerrero, L. A. (2021). Therapy needs for children with autism in a rural, underserved island community. *Journal of Rural Mental Health*, *45*(2), 129–140. https://doi.org/10.1037/rmh0000177

Chrisman-Khawam, L., Abdullah, N., & Dhoopar, A. (2017). Teaching health-care trainees empathy and homelessness IQ through service learning, reflective practice, and altruistic attribution. *The International Journal of Psychiatry in Medicine*, *52*(3), 245–254. https://doi.org/10.1177/0091217417730288

Corden, K., Brewer, R., & Cage, E. 2021. A systematic review of healthcare professionals' knowledge, self-efficacy and attitudes towards working with autistic people. *Journal of Autism and Developmental Disorders*, Epub ahead of print. https://doi.org/10.1007/s40489-021-00263-w

Croen, L. A., Zerbo, O., Qian, Y., Massolo, M. L., Rich, S., Sidney, S., & Kripke, C. (2015). The health status of adults on the autism spectrum. *Autism*, *19*(7), 814–823. https://doi.org/10.1177/1362361315577517

Dearing, J., Cruz, S., Kee, K., Larson, R. S., & Kulchak Rahm, A. (2019). Project ECHO: Review and research agenda. *Diffusion Associates*.

Dizitzer, Y., Meiri, G., Flusser, H., Michaelovski, A., Dinstein, I., & Menashe, I. (2020). Comorbidity and health services' usage in children with autism spectrum disorder: A nested case–control study. *Epidemiology and Psychiatric Sciences*, *29*. http://dx.doi.org.uidaho.idm.oclc.org/10.1017/S2045796020000050

Dorsey, E. R., & Topol, E. J. (2016). State of telehealth. *The New England Journal of Medicine*, *375*(2), 154–161. https://doi.org/10.1056/nejmra1601705

Drahota, A., Sadler, R., Hippensteel, C., Ingersoll, B., & Bishop, L. (2020). Service deserts and service oases: Utilizing geographic information systems to evaluate service availability for individuals with autism spectrum disorder. *Autism*, *24*(8), 2008–2020. https://doi.org/10.1177/1362361320931265

Fertman, C. I., Dotson, S., Mazzocco, G. O., & Reitz, S. M. (2005). Challenges of preparing allied health professionals for interdisciplinary practice in rural areas. *Journal of Allied Health*, *34*(3), 163–168. PMID: 16252679

Fowler, R. C., Katzman, J. G., Comerci, G. D., Shelley, B. M., Duhigg, D., Olivas, C., & Arora, S. (2018). Mock ECHO: A simulation-based medical education method. *Teaching and Learning in Medicine*, *30*(4), 423–432. https://doi.org/10.1080/10401334.2018.1442719

Greenberg, M. T., Weissberg, R. P., O'Brien, M. U., Zins, J. E., Fredericks, L., Resnik, H., & Elias, M. J. (2003). Enhancing school-based prevention and youth development through coordinated social, emotional, and academic learning. *American Psychologist*, *58*(6–7), 466–474. https://doi.org/10.1037/0003-066x.58.6-7.466

Hale, N., Probst, J., & Robertson, A. (2016). Rural area deprivation and hospitalizations among children for ambulatory care sensitive conditions. *Journal of Community Health*, *41*(3), 451–460. https://doi.org/10.1007/s10900-015-0113-2

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, R. G. (2009). Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics. Apr*, *42*(2), 377–381 doi:10.1016/j.jbi.2008.08.010. Epub 2008 Sep 30. PMID: 18929686; PMCID: PMC2700030..

Hirvikoski, T., Mittendorfer-Rutz, E., Boman, M., Larsson, H., Lichtenstein, P., & Bölte, S. (2016). Premature mortality in autism spectrum disorder. *British Journal of Psychiatry*, *208*(3), 232–238. https://doi.org/10.1192/bjp.bp.114.160192

Hogan, A., Jain, N. R., Peiris-John, R., & Ameratunga, S. (2020). Disabled people say 'Nothing about us without us. *The Clinical Teacher*, *17*(1), 70–75. https://doi.org/10.1111/tct.13022

IBM Corp. Released. (2020). *IBM SPSS Statistics for Macintosh, Version 27.0*.

Janvier, Y. M., Harris, J. F., Coffield, C. N., Louis, B., Xie, M., Cidav, Z., & Mandell, D. S. (2016). Screening for autism spectrum disorder in underserved communities: Early childcare providers as reporters. *Autism*, *20*(3), 364–373. https://doi.org/10.1177/1362361315585055

Johnsson, G., Kerslake, R., Crook, S., & Cribb, C. (2016). Investigation of training and support needs in rural and remote disability and mainstream service providers: Implications for an online training model. *Australian Health Review*, *41*(6), 693–697. https://doi.org/10.1071/AH16132

Kenny, L., Hattersley, C., Molins, B., Buckley, C., Povey, C., & Pellicano, E. (2016). Which terms should be used to describe autism? Perspectives from the UK autism community. *Autism*, *20*(4), 442–462. https://doi.org/10.1177/1362361315588200

Lennon-Dearing, W. R., Florence, J., Fnp, L. G. D. A. B., MA, I. A. C., & Sw, S. A. (2008). A Rural community-based interdisciplinary curriculum: A social work perspective. *Social Work in Health Care*, *47*(2), 93–107. https://doi.org/10.1080/08841240801970177

Maenner, M. J., Shaw, K. A., Baio, J. E., Washington, A., Patrick, M., DiRienzo, M., Christensen, D. L., Wiggins, L. D., Pettygrove, S., Andrews, J. G., Lopez, M., Hudson, A., Baroud, T., Schwenk, Y., White, T., Rosenberg, C. R., Lee, L.-C., Harrington, R. A., & Dietz, P. M. (2020). Prevalence of autism spectrum disorder among children aged 8 Years — Autism and developmental disabilities monitoring network, 11 sites, United States, 2016. *MMWR Surveillance Summaries*, *69*(4), 1–12. https://doi.org/10.15585/mmwr.ss6904a1

Malik-Soni, N., Shaker, A., Luck, H., Mullin, A. E., Wiley, R. E., Lewis, M. E. S., Fuentes, J., & Frazier, T. W. (2021). Tackling healthcare access barriers for individuals with autism from diagnosis to adulthood. *Pediatric Research*, 1–8. https://doi.org/10.1038/s41390-021-01465-y

Mazurek, M. O. (2020). ECHO Autism transition: Enhancing healthcare for adolescents and young adults with autism spectrum disorder. *Autism*, *24*(3), 633–644. https://doi.org/10.1177/0009922816648288

Mazurek, M. O., Brown, R., Curran, A., & Sohl, K. (2017). ECHO Autism. *Clin Pediatr*, *56*(3), 247–256. https://doi.org/10.1007/s10803-018-3696-5

Mazurek, M. O., Curran, A., Burnette, C., & Sohl, K. (2019). ECHO Autism STAT: Accelerating early access to autism diagnosis. *Journal of Autism and Developmental Disorders*, *49*(1), 127–137. https://doi.org/10.1177/1362361319879616

Miller, V.-D., & Coley. (2019). Poverty and academic achievement across the urban to rural landscape: Associations with community resources and stressors. *Rsf Russell Sage Found J Soc Sci*, *5*, 106. https://doi.org/10.7758/2FRSF.2019.5.2.06

National Association of School Psychologists (NASP). (2020). *NASP 2020 professional standards, including the principles for professional ethics*. https://www.nasponline.org/standards-and-certification/professional-ethics

Neumann, A. A., Desmarais, E. E., Iverson, S. L., & Gartstein, M. A. (2020). Ecological contributions to maternal-infant functioning: Differences between rural and urban family contexts. *Journal of Community Psychology*, *48*(3), 945–959. https://doi.org/10.1002/jcop.22313

O'Toole, K., Schoo, A., & Hernan, A. (2010). Why did they leave and what can they tell us? Allied health professionals leaving rural settings. *Australian Health Review*, *34*(1), 66–72. https://doi.org/10.1071/ah09711

Probst, J., Braker, J., Ender, A., & Gardiner, P. (2016). Current state of child health in rural America: How context shapes children's health. *Journal of Rural Health*, *34*(S1), s3–s12. https://doi.org/10.1111/jrh.12222

Sarju, J. P. (2021). Nothing about us without us – towards genuine inclusion of disabled scientists and science students post pandemic. *Chemistry*, *27*(41), 10489–10494. https://doi.org/10.1002/chem.202100268

Sheridan, S. M., Koziol, N. A., Clarke, B. L., Rispoli, K. M., & Coutts, M. J. (2014). The influence of rurality and parental affect on kindergarten children's social and behavioral functioning. *Early Education and Development*, *25*(7), 1057–1082. https://doi.org/10.1080/10409289.2014.896682

Sohl, K., Mazurek, M. O., & Brown, R. (2017). ECHO Autism: Using technology and mentorship to bridge gaps, increase access to care, and bring best practice autism care to primary care. *Clinical Pediatrics*, *56*(6), 509–511. https://doi.org/10.1177/0009922817691825

Sussman, K., Burns, M. K., & Lembke, E. S. (2021). Effects of ECHO MTSS teleconsultation model on self-efficacy of data-based individualization of academic interventions. *Journal of Educational and Psychological Consultation*, *31*(4), 1–21. https://doi.org/10.1080/10474412.2021.1996243

U.S. Census Bureau. (2020). *Rural America*. https://mtgis-portal.geo.census.gov/arcgis/apps/MapSeries/index.html?appid=49cd4bc9c8eb444ab51218c1d5001ef6