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QUALITY OF CARE IN OSTEOPOROSIS (S SILVERMAN AND J CURTIS, SECTION EDITORS)

Bone Health TeleECHO: a Force Multiplier to Improve the Care of Skeletal Diseases in Underserved Communities

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Abstract

Purpose of Review This review describes the global development of a model of technology-enabled collaborative learning for healthcare professionals called Project ECHO (Extension for Community Healthcare Outcomes) and its applications for the management of patients with skeletal diseases.

Recent Findings The prototype Bone Health TeleECHO was established in 2015, with others now operational in the USA and other countries, and more expected to follow soon. Each teleECHO program, in the right language and convenient time zone, provides a virtual community of practice for healthcare professionals to benefit from real-time interactive case-based learning and brief didactic presentations on topics of interest.

Summary Bone Health TeleECHO elevates the level of knowledge of participants and improves self-confidence in managing patients with skeletal diseases. The development of many teleECHO programs worldwide serves as a force multiplier, with the potential to narrow the osteoporosis treatment gap and enhance the effectiveness of fracture liaison services.

Keywords Osteoporosis · Telehealth · Telemedicine · Ehealth · Mhealth · FLS

Introduction

Medical knowledge is expanding at an exponential rate [1], far beyond the ability of healthcare professionals to effectively apply this information to the care of their patients. At the same time, there are global medical workforce shortages that act as barriers to essential medical services, especially in rural areas [2], and constraints associated with high costs and limited time for provider-patient encounters. This has led to challenges and opportunities in medical education, particularly at the postgraduate level, and consideration of innovative models of healthcare delivery. A recent systematic review evaluated the role of interprofessional education (IPE), defined as two or more professions learning from each other to improve health outcomes, and interprofessional collaborative practice (IPCP), defined as health workers from different professions providing comprehensive high quality care, in addressing these challenges [3]. It was found that many countries and academic institutions benefitted from collaborative learning through implementation of IPE and IPCP. Application of these initiatives varied by country, being especially low in developing regions. In recent years, computer technology has played an increasingly important role with collaborative learning, patient care, and patient education, all with the goal of expanding capacity to deliver best practice medical care. These technologies are described by a variety of terms with inconsistent and sometimes overlapping definitions, with no universal standards. General categories are as follows.

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Telehealth The US Health Resources & Services Administration (HRSA) defines telehealth as "the use of electronic information and telecommunication technologies to support and promote long-distance clinical healthcare, patient and professional health-related education, public health and health administration [4]." The World Health Organization (WHO) states that telehealth "involves the use of telecommunications and virtual technology to deliver healthcare outside of traditional healthcare facilities [5]." Others have defined telehealth as "the delivery and facilitation of health and health-related services including medical care, provider and patient education, health information services, and self-care via telecommunications and digital communication technologies [6]," using technologies such as live videoconferencing, mobile health applications ("apps") and remote patient monitoring.

Telemedicine The terms telemedicine and telehealth are sometimes used interchangeably, but more often telemedicine is considered to be a sub-category of telehealth describing the use of telecommunications systems to connect patients with providers who are geographically separated. Telemedicine typically implies the delivery of diagnostic or therapeutic medical services at a distance, while telehealth commonly refers to health education at a distance. Examples of telemedicine include a radiologist reading and interpreting an image for a patient in a different country, or a dermatologist at an academic center evaluating the rash of a patient in a remote rural community. Electronic consultations (e-consults, E-consults, eConsults) fall under the category of telemedicine.

Ehealth (e-health, eHealth, e-Health) This is a term more often used in the United Kingdom and in Europe than in the US. The WHO definition of ehealth encompasses a wide range of information and communication technologies that includes electronic medical records, data processing, patient administrative systems, and laboratory systems, as well as telehealth [5]. For some, ehealth has come to mean virtually everything that involves technology and medicine.

Mhealth (m-health, mhealth, mobile health) Mhealth refers to use of mobile devices (e.g., smartphones, tablets, laptops) with healthcare apps and programs. These can be used to schedule appointments, review lab reports, manage diabetes, monitor health measurements, evaluate symptoms, educate patients, assist with complex decision-making, and much more.

Webinar The term webinar in derived from "web" and "seminar," referring to a live online meeting, presentation, lecture, seminar, or event. When the number of attendees is small, it may be interactive, but often there are many attendees with limited opportunities for interaction. Webinars can be archived for viewing later. Webinars have become a popular means of disseminating information to large numbers of people located remotely.

This review focuses on the development of a model of technology-enabled collaborative learning for healthcare professionals called Project ECHO (Extension for Community Healthcare Outcomes) and its applications for the management of skeletal diseases. The ECHO model of learning is a type of telehealth that aims to expand capacity to deliver best practice healthcare for patients in underserved communities worldwide.

Project ECHO

The story of Project ECHO begins in 2003, when Dr. Sanjeev Arora, a gastroenterologist at the University of New Mexico (UNM) Health Sciences Center in Albuquerque, New Mexico, USA, started a program to educate healthcare professionals. He was disturbed by the absence of care for many patients with chronic hepatitis C living in rural New Mexican communities. Often these patients could not afford the cost, travel time, and long wait times to see a specialist at the UNM gastroenterology clinic. Primary care providers who practiced close to where the patients lived had no training or experience in treating hepatitis C. At that time, there were about 34,000 patients with hepatitis C and fewer than 1600 receiving treatment [7].

The ECHO experiment used videoconferencing technology, just beginning to become widely available at that time, to create a "knowledge network" that linked a multidisciplinary team of specialists at UNM with teams of primary care providers at rural community clinics. This has sometimes been described as a "hub and spoke" system, with the hub representing the specialists, often but not always in one physical location; a spoke is a remote Internet connection where one or more participants are located. In reality, it functions more as a network or web, where participants may be located anywhere and everyone benefits from sharing knowledge. Weekly videoconferences were held, focusing on presentation and discussion of real but de-identified patient cases, including medical history, findings on exam, and laboratory tests, as well as social and cultural considerations. There were also brief didactic presentations on relevant topics of interest. Since the case-based discussions were structured to provide generalizable disease-state education and did not constitute direct patient care, there were no concerns regarding professional liability.

The outcomes of the ECHO intervention were evaluated with a prospective cohort study comparing treatment of hepatitis C at UNM with treatment by primary care physicians at 21 participating ECHO sites located in rural communities and prisons in New Mexico [8]. The primary endpoint was

sustained virologic response. There were 407 patients (146 at the UNM clinic, 152 at ECHO sites) included in the study. A sustained virologic response was observed for 58.2% of patients at the ECHO sites compared with 57.5% at the UNM clinic (P for difference = 0.89). Serious adverse events were reported in 6.9% of patients at the ECHO sites compared with 13.7% of patients at the UNM clinic. This study showed that the ECHO model could be implemented in underserved communities to improve the care of patients with hepatitis C. The findings of this study supported further development of the ECHO model of learning for other chronic complex diseases for which effective treatments are available but underutilized. This mission of Project ECHO evolved to include many chronic, common, complex conditions in underserved communities, and was later adapted for non-medical educational interventions in the USA and globally [9–18]. Project ECHO, according to a recent count, has more than 287 hubs in 35 countries with 642 programs [19] and continues to expand, with a goal of touching the lives of 1 billion people by 2025.

ECHO differs from telemedicine and e-consults, which allow a patient to receive care remotely rather than locally, but does not expand capacity to deliver care to a greater number of patients. ECHO is not the same as a webinar, which has limited opportunities for interactive discussions. With ECHO, the principal method of learning is through discussion of issues with real but de-identified patients. Learning occurs in much the same way as with postgraduate medical education in the clinic or hospital. ECHO acts as a force multiplier on two levels. First, the insights gained during teleECHO sessions can be applied to many patients seen by each participant. Second, ECHO can be scaled to reach many more healthcare professionals by creating more ECHO hubs, each with the appropriate language and time zone.

The US government has recognized the potential of telecommunications for improving healthcare. The Expanding Capacity for Health Outcomes Act (ECHO Act) [20] of 2016 called for the US Department of Health and Human Services (HHS) to submit a report to Congress that examined "technology-enabled collaborative learning and capacity building models" (i.e., ECHO and ECHO-Like Models [EELM]) and their impact on addressing a range of health conditions, health workforce issues, implementation of public health programs, and the delivery of health services to rural and other underserved populations [21]. HHS contracted with the RAND Corporation to analyze available data, including a published study on the effectiveness of Bone Health TeleECHO [22], and prepare the report, which was released in February 2019. The report to Congress stated that these models have the potential to address important gaps in care for underserved populations and recommended expanding the evidence base, including directly funding further evaluation and providing technical assistance [21]. As a consequence, legislation with ECHO Act 2019 has been proposed to provide government grants and technical assistance to develop and evaluate technology-enabled collaborative learning and capacity building models [23].

Unmet Needs in the Care of Patients with Osteoporosis

Osteoporosis is a major public health concern with serious consequences due to fractures [24]. Fractures are associated with pain, disability, death, and loss of independence, as well as high direct and indirect medical costs that expected to rise in the future [25]. Medication to reduce fracture risk with a favorable balance of benefits and risks are widely available, but often not prescribed for the patients who need them, resulting in a large osteoporosis treatment gap [26]. In association with the decline in numbers of patients diagnosed and treated for osteoporosis, hip fracture rates have been reported as higher than projected [27], suggesting an urgent need for action to reduce the treatment gap [28]. Since there are many factors responsible for the treatment gap, many approaches for reducing the gap have been proposed [28]. Bone Health TeleECHO, a technology-enabled collaborative learning and capacity building model devoted to osteoporosis and metabolic bone diseases, is a promising approach that may contribute to reducing the treatment gap and improve the care of patients with osteoporosis [29].

Bone Health TeleECHO

Bone Health TeleECHO is a proof-of-concept adaptation of the ECHO model of collaborative learning that has been operational since October 2015. It is a virtual osteoporosis community of practice that links healthcare professionals of many disciplines and vastly different baseline levels of expertise through weekly interactive videoconferences. Knowledge is shared through discussion of clinical questions arising from de-identified patient cases presented by participants. Each ECHO session also includes a short didactic presentation (about 10 to 15 min in length) and discussion, with the topic typically derived from participant feedback or emergence of new guidelines or publications of interest. The case-based discussions generate clinical concepts that may be applicable for many other patients under the care of the teleECHO participants, with learning occurring in much the same fashion as with live interactions from patient care during postgraduate residencies and fellowships.

Bone Health TeleECHO videoconferences have been conducted once weekly, except for holidays, since starting in 2015. Each session currently lasts 1 h and 15 min, beginning with a didactic presentation followed by discussion, and then case presentations followed by discussions. Some participants

have attended regularly since 2015, while others have done so intermittently. Funding for about 10 h of staff time per week, information technology (IT) support, and continuing medical education (CME) is by Project ECHO. A teleECHO coordinator provides support for logistics that include assuring that patient confidentiality is maintained, scheduling, interfacing with faculty, participants, and speakers, and disclosures, applications, and evaluations for CME. There is no compensation for faculty time other than what is normally provided, if anything, for academic teaching responsibilities. The physical hub for Bone Health TeleECHO is a videoconference room at UNM, with most faculty and participants logging on from remote locations. Didactic presentations are video-recorded and stored online as archived files for later viewing. Bone Health TeleECHO serves as a model for other hubs in other states and countries [29–31], with sharing of all information (e.g., case presentation templates, strategies for recruitment of participants, fund raising) to enhance the ease of development.

Progress of Bone Health TeleECHO

Demographic data (e.g., location, specialty, email) for participants are obtained through online registration with the Osteoporosis Foundation of New Mexico at www.ofnm.org, with follow-up by the teleECHO coordinator when the information is incomplete. Attendance records and CME evaluations are collected by the teleECHO coordinator. Over the first 41 months of Bone Health TeleECHO (October 2015 through February 2019), 163 videoconferences were held with a total of 413 individual participants; 192 patient cases were presented and discussed, and 2494 h of no-cost CME were provided. Physicians of many specialties participated, most commonly endocrinology, rheumatology, orthopedics, and primary care. Non-physician participants included advanced practice providers, physical therapists, nutritionists, and exercise physiologists. Average attendance increased from 15 per session in 2015 to 52 in 2018, and continues to rise in 2019. Attendees were located in 42 states in the USA (Fig. 1) and 11 other countries (Fig. 2). Previously reported self-efficacy outcomes showed that regular Bone Health TeleECHO participants experienced a statistically significant improvement of confidence in managing each of 20 different domains of osteoporosis care [22]. It is expected that this will lead to more effective care of patients with osteoporosis.

Development of More Bone Health TeleECHO Programs

The progressive increase in levels of participation in Bone Health TeleECHO and favorable findings of the outcomes measurements have fostered interest in development of more teleECHO hubs devoted to educating healthcare professionals for a spectrum of skeletal diseases. This process is facilitated by staff at Project ECHO, where there is a team dedicated to expanding the global footprint of the teleECHO model for many disease states. Project ECHO conducts monthly face-to-face no-cost training for anyone wanting to learn more about this model of learning and is committed to starting a teleECHO program. Additional training is available through regularly scheduled videoconferences. All aspects of Bone Health TeleECHO, including curriculum, archived presentations, and case presentation templates, are shared with others who wish to develop similar teleECHO programs. Most programs utilize Zoom software [32] provided at no cost by Project ECHO as the teleconferencing platform.

An introduction to several aspects of Bone Health TeleECHO is provided through open access YouTube videos that may be viewed, downloaded, and shared. There are videos addressing those who might be interesting in starting a Bone Health TeleECHO program [33], informing individuals about joining Bone Health TeleECHO [34], and describing the utility of teleECHO for FLS coordinators [35]. A collaborative videoconference is held every 3 months to discuss progress and challenges of operating a Bone Health TeleECHO, share information, provide support and guidance for anyone starting a program. The intention is to share all resources to encourage and enhance participation and replication of Bone Health TeleECHO worldwide.

Other Bone Health TeleECHO programs have been started and more are in various stages of development. Those that are operational or scheduled to launch in 2019 have hubs located in Grand Blanc, MI, USA; Washington, DC, USA; Galway, Ireland; Moscow, Russia; Rosemont, IL, USA; and Gaithersburg, MD, USA. The experience to date is briefly summarized as follows.

MNI Great Lakes ECHO LLC

MNI Great Lakes Bone Health ECHO was launched at the Michigan Neurosurgical Institute on February 24, 2017, with collaboration and support from Project ECHO. Between February 24, 2017, and April 24, 2019, 25 once-monthly teleECHO sessions have been held, with a total of 225 participants, 92 of which were unique individuals. Participants have been located in 50 US cities in 22 states, plus 2 other countries. This program offers a unique perspective on osteoporosis biomechanics and treatment options from a procedure-based practice with transnational research experience in the area of testing and validating vertebral fractures in vitro. Category 1 CME is sponsored by the Michigan State Medical Society for national CME credit. Future plans include increasing the frequency of the sessions and broadening the scope to topics covered. There are continuing efforts to increase consistency of "return visit" participants, expand the expert panel, and diversify didactic speakers.

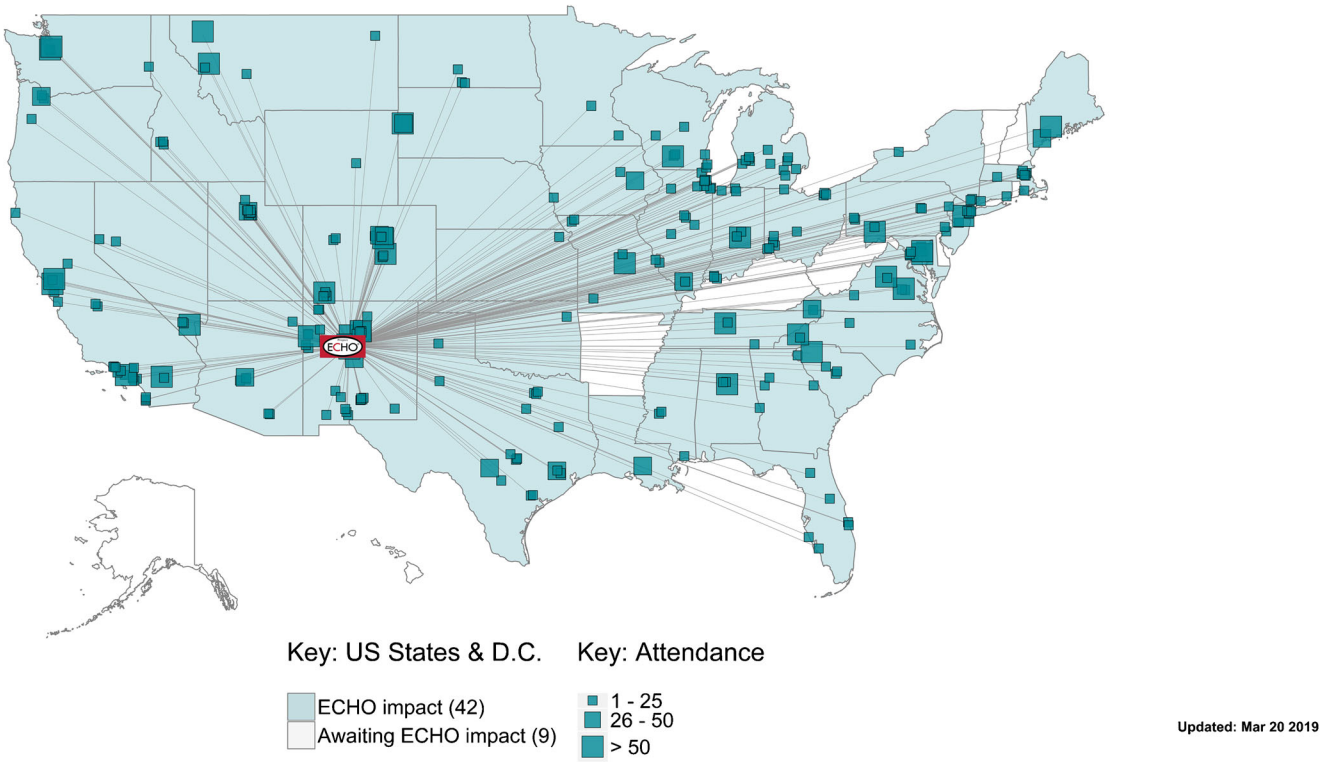

Fig. 1 US map of Bone Health TeleECHO participants. This is a map of the USA showing the "hub" at the University of New Mexico in Albuquerque, NM, USA, and locations of participants in 42 states after 41 months of weekly videoconferences. This is only one of many teleECHO programs, illustrating the broad reach of interactive case-based learning with videoconferencing technology. Map developed at Project ECHO by William Szaroletta and Nathan Banks

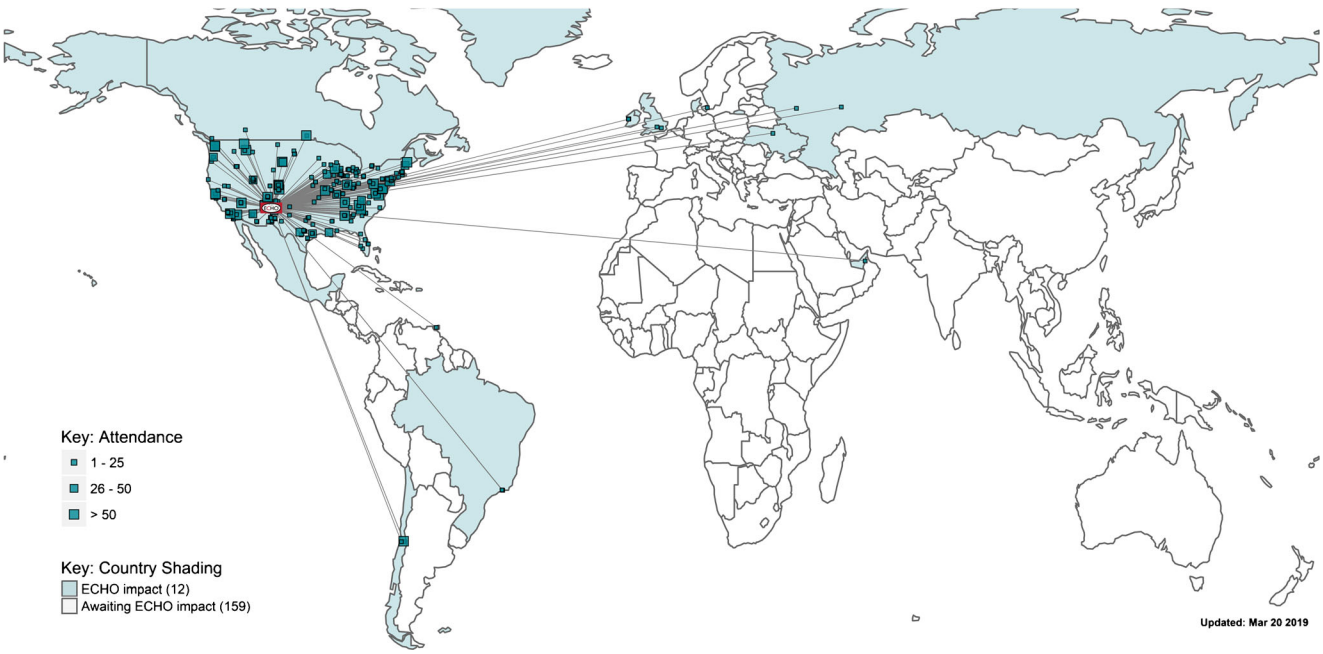

Fig. 2 World map of Bone Health TeleECHO participants. This map of 41-month data shows that a single Bone Health TeleECHO program in a middle-sized city (Albuquerque, NM, USA) can connect with participants located at great distances. The goal is to have many teleECHO programs with many "hubs" throughout the world, all in convenient time zones and in the appropriate language for those who wish to participate. Map developed at Project ECHO by William Szaroletta and Nathan Banks

National Osteoporosis Foundation Fracture Liaison Service Bone Health TeleECHO

NOF FLS TeleECHO was launched on September 21, 2017, with a focus on providing FLS coordinators with advanced levels of clinical and administrative knowledge to enhance the effectiveness of their programs. Since that time, once-monthly teleECHO sessions have been held, each with a didactic presentation related to identification, investigation, and treatment of patients with osteoporosis. For example, topics have included anabolic treatment after radiation therapy, bone density pitfalls, applying and utilizing bone health and osteoporosis resources, treatment sequencing for osteoporosis, and best practice recommendations for the management of osteoporosis. Participants have included providers from multiple specialties including orthopedics, family medicine, rheumatology, endocrinology, pain management, physiatry, oncology, neurosurgery, and others. Providers from all levels of education have attended, including nurse practitioners, physician assistants, physicians, physical therapists, and hospital administrators. Participants are eligible for 1 h of continuing education credit after completing their evaluation. The number of participants for each session has averaged 25 with a range of 15 to 60. Feedback from participants has generally been very favorable, with comments such as "great session and I feel better prepared to communicate with referring providers" and "I feel better prepared to discuss the importance of FLS to administration to improve patient outcomes." Challenges have included difficulties with audiovisual connections and facilitating broad-based interactivity with discussions of case presentations.

National University of Ireland Galway Bone Health TeleECHO

Ireland has a long experience with the use of telemedicine for the care of patients with musculoskeletal diseases. It has been found patient care with e-clinics is concordant with in-person visits for assessment, diagnosis, and patient satisfaction. Online learning has been expanded to include "rheumatology tools" to educate primary care physicians in the care of musculoskeletal diseases [36]. When virtual clinics were included as part of an FLS program, osteoporosis treatment rates rose to over 80% in patients admitted to hospital for a hip fracture.

Staff at National University of Ireland, Galway (NUIG) traveled to Project ECHO in Albuquerque, NM, USA, for on-site training prior to the launch of NUIG Bone Health TeleECHO in 2012. It was subsequently discontinued due to limited funding and loss of key staff, then reestablished in 2018. The program is now doing well, but challenges remain with limited sources of funding, limited time of participants, uncertain administrative support, and scheduling logistics. Additional teleECHO programs are planned for the future, including programs focusing on FLS. The teleECHO programs in Ireland benefit from sharing experiences with a global network of similar programs to provide better care for osteoporosis patients worldwide.

Bone Health TeleECHO Moscow

Bone Health TeleECHO Moscow was launched on November 27, 2018, with participation of key Russian specialists in the field of osteoporosis, to discuss the Russian National Osteoporosis Guidelines update. Since that time, teleECHO sessions have been held on the last Wednesday of every month. Topics for didactic presentations have included tumor induced osteomalacia, drug induced osteoporosis, osteoporosis in patients with cancer, diabetes and bone, and hypophosphatasia. Clinical case presentations have been from participants in St. Petersburg, Novosibirsk, and Moscow, followed by discussions of best practice medical care. In 2019, Bone Health TeleECHO Moscow was granted 2 h of Russian CME credits for every session. Since the Russian accreditation system does not have an option for providing CME credits with teleECHO Zoom-based programs, all teleECHO session are recorded and made available as a webinar. With the first 6 monthly sessions of Bone Health TeleECHO Moscow, the mean number of participants was 57 (range 26–89). Recorded webinars have been viewed by a mean of 256 physicians (range 182–381). In total, 1118 physicians have viewed Bone Health TeleECHO Moscow webinars ($N = 6$). Most participating physicians were between ages 30 and 45 years (56%), followed by younger physicians age 25–30 years (32%), and those age 45 years and older (12%). Most participants were specialists: endocrinologists (71%), rheumatologists (14%), gynecologists (10%), orthopedic surgeons (2%), and general practitioners (3%). Most of the participants were from Russia, with a few attendees from Armenia. A feedback system is being developed to periodically assess the clinical outcomes of participation in Bone Health TeleECHO Moscow.

Other teleECHO Programs for Skeletal Health

Own the Bone Orthopaedic Bone Health TeleECHO has been developed by the American Orthopaedic Association in Rosemont, IL, USA. Scheduled for a launch date in mid-2019, this will be the nation's first orthopedic-focused teleECHO program. The videoconferences will initially be held once-monthly using the format of brief didactic presentations and case-based discussions.

Rare Bone Disease TeleECHO, based with the Osteogenesis Imperfecta Foundation in Gaithersburg, MD,

USA, is also scheduled to launch in mid-2019. These will be once-monthly interactive case-based videoconferences concerning genetic skeletal disorders and a wide range of diagnostic and therapeutic issues.

More Bone Health TeleECHO programs are in various stages of development. There are Endocrinology TeleECHO and Rheumatology TeleECHO programs that include osteoporosis and metabolic bone diseases as a subset of the curriculum. The Ehlers-Danlos Society TeleECHO has an ongoing series of teleECHO programs about Ehlers-Danlos syndrome and hypermobility spectrum disorders, with two hubs, one in the UK and the other in the USA.

Discussion

The use of technology-enabled collaborative learning and capacity building models such as Bone Health TeleECHO are expanding and adapting to a rapidly changing healthcare environment. Each teleECHO hub evolves to best meet the needs of its participants. There have been some surprises and lessons learned since 2015:

1. It was initially thought that Bone Health TeleECHO would be of greatest interest to primary care providers seeking an advanced level of knowledge about osteoporosis. Although this was often the case, it was surprising to find a broad range of baseline expertise of participants with a wide variety of medical disciplines. Many regular participants are already experts in the field of skeletal health, but nevertheless enjoy learning from other experts who may have a different perspective for bone care, as well as sharing their own knowledge.

2. It seemed logical at first that teleECHO would be most attractive to practitioners in underserved rural areas far away from academic centers. Although this is sometimes the case, many participants who reside in urban and suburban areas seem to benefit from participation. It also became apparent that an underserved community can be in an urban location as well as rural.

3. Finally, it was intuitive to think that teleECHO would address professional isolation in rural communities. We found that professional isolation is not necessarily determined by geography. Most provider-patient interactions occur in an examination room with a one-on-one relationship, which is much the same regardless of geography. The ECHO model of learning provides opportunities to discuss complex clinical cases and common clinical conundrums in a collegial environment.

Starting a Bone Health TeleECHO program can be a daunting experience with regard to forming a faculty team, recruiting participants, establishing a curriculum of didactic presentations, urging participants to present cases, facilitating interactive discussions, allotting the necessary time, obtaining staff and IT services, funding, and more. However, Project ECHO provides extensive no-cost support services [37] to make this as easy as it can be. It is the experience of most teleECHO program leaders that the effort to launch and maintain teleECHO is repaid many times over by the many benefits of establishing a collegial community of practice.

Summary

Bone Health TeleECHO communities of practice can elevate the level of knowledge of participants to provide better care for their patients, at lower cost, and greater convenience, compared with referral to an academic center that may be located at a distance from the patient who needs the care. This is a force multiplier with the potential of decreasing the osteoporosis treatment gap, reducing the burden of osteoporosis fractures, enhancing the effectiveness of FLS, improving the care of rare bone diseases, and adding value to medical education programs at institutions lacking local expertise in bone diseases.

Compliance with Ethical Standards

Conflict of Interest In the past year, E. Michael Lewiecki has received no direct income from potentially conflicting entities. His employer, New Mexico Clinical Research & Osteoporosis Center, has received research grants from Radius, Amgen, Mereo, Bindex; income for service on scientific advisory boards or consulting for Amgen, Radius, Alexion, Sandoz, Samsung Bioepis; service on speakers' bureaus for Radius, Alexion; project development for University of New Mexico; and royalties from UpToDate for sections on DXA, fracture risk assessment, and prevention of osteoporosis. He is a board member of the National Osteoporosis Foundation, International Society for Clinical Densitometry, and Osteoporosis Foundation of New Mexico.

Avery Jackson is a consultant and speaker for Medtronic.

Anne F. Lake is a consultant and advisor for Radius Health on Fracture Liasion Services.

John J. Carey has received speaker fees from Eli Lilly, Amgen, Pfizer, UCB Ireland and Europe, Pfizer Canada, Brazil and Europe, Hospira UK, Europe, and Canada, and Celltrion USA and Europe. He has received consulting fees from Hospira UK, Canada, and Europe, and UCB Europe. He has received grant and educational support from Amgen Ireland, UCB. Europe, Eli Lilly Ireland, Abbvie, MSD Ireland, and the Irish Society for Rheumatology. He has gotten travel support from Roche, Amgen, Eli Lilly, MSD, and UCB Ireland with meals and educational programs from MSD and Pfizer Ireland. He has also served on several committees for, and as President, of the International Society for Clinical Densitometry, is a member of the Committee for Scientific affairs for the International Osteoporosis Foundation, and is a founding member of, and current president, of the Irish DXA Society.

Zhanna Belaya, Galina A. Melnichenko, and Rachelle Rochelle have nothing to disclose.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:
- • Of importance

1. Densen P. Challenges and opportunities facing medical education. Trans Am Clin Climatol Assoc. 2011;122:48–58.
2. World Health Organisation. Global strategy on human resources for health: workforce 2030. 2016. Available from http://www.who.int/hrh/resources/global_strategy_workforce2030_14_print.pdf?ua=1. Accessed 6 Oct 2018.
3. Herath C, Zhou Y, Gan Y, Nakandawire N, Gong Y, Lu Z. A comparative study of interprofessional education in global health care: a systematic review. Medicine (Baltimore). 2017;96(38):e7336.
4. Health Resources & Services Administration. Telehealth programs. Available from https://www.hrsa.gov/rural-health/telehealth/index.html. Accessed 6 Oct 2018.
5. World Health Organisation. Telehealth. Available from https://www.who.int/sustainable-development/health-sector/strategies/telehealth/en/. Accessed 22 April 2019.
6. What is telehealth? 2018. Available from https://catalyst.nejm.org/what-is-telehealth/. Accessed 23 April 2019.
7. Arora S, Kalishman S, Dion D, Som D, Thornton K, Bankhurst A, et al. Partnering urban academic medical centers and rural primary care clinicians to provide complex chronic disease care. Health Aff (Millwood). 2011;30(6):1176–84.
8. • Arora S, Thornton K, Murata G, Deming P, Kalishman S, Dion D, et al. Outcomes of treatment for hepatitis C virus infection by primary care providers. N Engl J Med. 2011;364(23):2199–207. **This is the original teleECHO proof-of-concept study with hepatitis C that supported the continuing development of this model of learning.**
9. Dubin RE, Flannery J, Taenzer P, Smith A, Smith K, Fabico R, et al. ECHO Ontario chronic pain & opioid stewardship: providing access and building capacity for primary care providers in underserviced, rural, and remote communities. Stud Health Technol Inform. 2015;209:15–22.
10. Kauth MR, Shipherd JC, Lindsay JA, Kirsh S, Knapp H, Matza L. Teleconsultation and training of VHA providers on transgender care: implementation of a multisite hub system. Telemed J E Health. 2015.
11. Katzman JG, Comerci G Jr, Boyle JF, Duhigg D, Shelley B, Olivas C, et al. Innovative telementoring for pain management: project ECHO pain. J Contin Educ Health Prof. 2014;34(1):68–75.
12. Mitruka K, Thornton K, Cusick S, Orme C, Moore A, Manch RA, et al. Expanding primary care capacity to treat hepatitis C virus infection through an evidence-based care model–Arizona and Utah, 2012-2014. MMWR Morb Mortal Wkly Rep. 2014;63(18):393–8.
13. Scott JD, Unruh KT, Catlin MC, Merrill JO, Tauben DJ, Rosenblatt R, et al. Project ECHO: a model for complex, chronic care in the Pacific Northwest region of the United States. J Telemed Telecare. 2012;18(8):481–4.
14. Lewiecki EM, Bilezikian JP, Carey JJ, Dell RM, Gordon CM, Harris ST, et al. Proceedings of the 2017 Santa Fe Bone Symposium: insights and emerging concepts in the management of osteoporosis. J Clin Densitom. 2018;21(1):3–21.
15. Bennett KA, Ong T, Verrall AM, Vitiello MV, Marcum ZA, Phelan EA. Project ECHO-geriatrics: training future primary care providers to meet the needs of older adults. J Grad Med Educ. 2018;10(3):311–5.
16. Hager B, Hasselberg M, Arzubi E, Betlinski J, Duncan M, Richman J, et al. Leveraging behavioral health expertise: practices and potential of the project ECHO approach to virtually integrating care in underserved areas. Psychiatr Serv. 2018;69(4):366–9.
17. Carlin L, Zhao J, Dubin R, Taenzer P, Sidrak H, Furlan A. Project ECHO telementoring intervention for managing chronic pain in primary care: insights from a qualitative study. Pain Med. 2018;19(6):1140–6.
18. Sockalingam S, Arena A, Serhal E, Mohri L, Alloo J, Crawford A. Building provincial mental health capacity in primary care: an evaluation of a project ECHO mental health program. Acad Psychiatry. 2018;42(4):451–7.
19. Project ECHO at University of New Mexico School of Medicine. ECHO Hubs: Global. 2019. Available from https://echo.unm.edu/locations/global. Accessed 2 May 2019.
20. www.GovTrack.us. S. 2873 (114th): ECHO Act. (May 29, 2017). Available from https://www.govtrack.us/congress/bills/114/s2873. Accessed 3 Aug, 2017.
21. U.S. Department of Health and Human Services. Report to Congress: Current State of Technology-Enabled Collaborative Learning and Capacity Building Models. 2019. Available from https://aspe.hhs.gov/system/files/pdf/260691/ECHOAct-ConsolidatedReportToCongress.pdf. Accessed 21 April 2019.
22. • Lewiecki EM, Rochelle R, Bouchonville MF 2nd, Chafey DH, Olenginski TP, Arora S. Leveraging scarce resources with bone health TeleECHO to improve the care of osteoporosis. J Endocr Soc. 2017;1(12):1428–34. **This first report of favorable outcomes with Bone Health TeleECHO.**
23. Introduced by Senators Schatz (D-HI) KD-V, and Murkowski (R-AK). The Expanding Capacity for Health Outcomes Act of 2019 (ECHO 2019 Act). 2019. Available from https://www.schatz.senate.gov/imo/media/doc/ECHO%202019%20Act%20One%20Pager.pdf. Accessed 31 May 2019.
24. US Department of Health and Human Services. Bone health and osteoporosis: a report of the Surgeon General. Rockville: US Department of Health and Human Services, Office of the Surgeon General; 2004.
25. Burge R, Dawson-Hughes B, Solomon DH, Wong JB, King A, Tosteson A. Incidence and economic burden of osteoporosis-related fractures in the United States, 2005-2025. J Bone Miner Res. 2007;22(3):465–75.
26. Miller PD. Underdiagnosis and undertreatment of osteoporosis: the battle to be won. J Clin Endocrinol Metab. 2016;101(3):852–9.
27. • Lewiecki EM, Wright NC, Curtis JR, Siris E, Gagel RF, Saag KG, et al. Hip fracture trends in the United States, 2002 to 2015. Osteoporos Int. 2018;29(3):717–22. **A study finding a disturbing rate of hip fractures at levels higher than projected in the USA, highlighting the importance of the osteoporosis treatment gap.**
28. • American Society for Bone and Mineral Research. Call to action to address the crisis in the treatment of osteoporosis. 2016. Available from https://www.asbmr.org/call-to-action.aspx. Accessed 11 Jan 2017. **This is a call to action to urgently initiate measures to address the crisis in osteoporosis care and reduce the burden of osteoporotic fractures.**
29. Lewiecki EM, Boyle JF, Arora S, Bouchonville MF 2nd, Chafey DH. Telementoring: a novel approach to reducing the osteoporosis treatment gap. Osteoporos Int. 2017;28(1):407–11.
30. Lewiecki EM. Bone Health TeleECHO for orthopedists and rheumatologists. Ortho Rheum Open Access. 2017;7(4):555716.
31. Lewiecki EM, Bouchonville MF 2nd, Chafey DH, Bankhurst A, Arora S. Bone Health ECHO: telementoring to improve osteoporosis care. Womens Health (Lond Engl). 2016;12(1):79–81.
32. Zoom. The Cloud Meeting Company. 2018. Available from https://operative.zoom.us/. Accessed 27 Oct 2018.
33. Osteoporosis Foundation of New Mexico, Project ECHO. Start Your Own Bone Health TeleECHO. YouTube Video. 2018. Available from https://www.youtube.com/watch?v=pgyZ8sxiFq0. Accessed 10 May 2019.

34. Osteoporosis Foundation of New Mexico, Project ECHO. Join Bone Health TeleECHO. YouTube Video. 2018. Available from https://vimeo.com/246121236/76efb37b39. Accessed 10 May 2019.
35. Osteoporosis Foundation of New Mexico, Project ECHO. Fracture Liaison Service. YouTube Video. 2019. Available from https://youtu.be/NeC27qXt_Vg. Accessed 10 May 2019.
36. Conway R, Kavanagh R, Coughlan RJ, Carey JJ. Expanding access to rheumatology care: the rheumatology general practice toolbox. Ir Med J. 2015;108(2):48–50.
37. University of New Mexico. Start an ECHO. 2019. Available from https://echo.unm.edu/join-the-movement/start-an-echo. Accessed 5 June 2019.

Addendum Since the original submission of this manuscript, Own the Bone Orthopaedic Bone Health TeleECHO and Rare Bone Disease TeleECHO have both become operational, with ongoing monthly case-based interactive videoconferences.