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Supporting Imagers' VOICE: A National Training Program in Comparative Effectiveness Research and Big Data Analytics

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Abstract

Provided methodological training, more imagers can contribute to the evidence basis on improved health outcomes and value in diagnostic imaging. The Value of Imaging through Comparative Effectiveness (VOICE) Research Program was developed to provide hands-on, practical training in five core areas for comparative effectiveness and big biomedical data research: decision analysis, cost-effectiveness analysis, evidence synthesis, big data principles, and applications of big data analytics. The program's mixed format consists of web-based modules for asynchronous learning as well as in-person sessions for practical skills and group discussion. Seven diagnostic radiology subspecialties and cardiology are represented in the first group of program participants, showing the collective potential for greater depth of comparative effectiveness research in the imaging community.

The Rationale for a National Program in Comparative Effectiveness and Big Data Research

In recent decades, medicine has owed much of its progress to growth in the availability and options for diagnostic testing. However, consequences have included increasingly complex clinical decision-making and rapid increases in costs, particularly those associated with use of medical imaging (1). Healthcare policy has thus emphasized value, quality and improved health outcomes through care, making it clear that these are critical areas of research (2). Imagers can appraise the evidence basis accordingly, for example by examining the most effective technique for particular tests, comparing tests' performance, assessing the impact of tests on patient health outcomes, and quantifying the added value to patient care. And as more biomedical data is generated on the level of both individuals and populations,

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investigators are looking to “big data” and applications of big data analytics for breakthroughs in precision medicine and deep learning (3, 4).

Despite the radiology community’s general interest in these important areas, specialized methodological training in comparative effectiveness research (CER) and big data has not been readily available to imagers (5). Introductory presentations on CER methods are available through the RSNA (6), and individual institutions’ postgraduate training courses may include CER methods, though not necessarily specific to imaging or medicine. To address the need for a training program dedicated to imagers, our multidisciplinary, multi-institutional team of investigators and leaders in radiology, decision science, health economics and bioinformatics developed a practical and widely accessible, yet rigorous, training program.

The Value of Imaging through Comparative Effectiveness (VOICE) Research Program includes five core courses with lectures, hands-on exercises and instructor-led group discussions through mixed web-based and in-person learning. In addition to fulfilling the immediate need for larger numbers of imagers understanding and performing CER and big data analytics, a long-term goal of developing the VOICE Program was to better equip the radiology community to improve clinical practice guidelines and inform health policy decisions. We describe efforts to develop and implement this national program, and summarize participant survey responses for the courses completed to date.

Course Design and Implementation

Since the logistics of an in person course for full time Radiology faculty who have daytime as well as evening and weekend (call) time commitments would be nearly impossible, we explored a predominantly on-line or distance learning approach. Over a 3-year period over 25 million people globally have enrolled in a Massive Open Online Course (MOOCs) (7). MOOCs are offered by many organizations such as Coursera (www.coursera.org), Khan Academy (www.khanacademy.org), EdX (www.edx.org) and on a variety of topics. MOOCs are taught almost exclusively online with variable interaction with faculty by using recorded lectures, on-line home-work assignments and electronic communications. Criticisms of MOOCs are the sometimes limited access to faculty when the learner has questions and limited interaction with other learners. One popular example is the National Health Service’s virtual, global open access course on change management in health care (<http://theedge.nhs.uk/school/>). The program enrolls approximately 2000 people annually. It creates a virtual classroom discussion through the use of social media and chats during the live webinars, and more recently there have been small group discussions after each webinar module. In Radiology, the American College of Radiology has offered leadership training through the Radiology Leadership Institute (www.radiologyleaders.org) through a combination of online and in-person training.

The VOICE Program consists of five courses spanning a total of 1 year, each involving approximately 10 weeks of web-based learning followed by a 2-day weekend session attended in-person. Most in-person sessions are held at NYU Medical Center, while one is scheduled to be held at the RSNA for the first year the program is held. Every course

instructor is an experienced educator and principal investigator with research funding in the area he or she teaches, with backgrounds in decision analysis, cost effectiveness, evidence synthesis, or biomedical informatics. The course tuition is \$2500 per participant. Upon completion of the yearlong program, an optional yearlong mentored research experience can be tailored to the participant's area of interest (at an additional cost of \$5000). Neither NYU Medical Center nor the individuals involved with the program have opportunity for financial gain from any aspect of the program. The five VOICE courses include: Decision Analysis, Cost Effectiveness Analysis, Evidence Synthesis and Systematic Review, Principles of Big Data Analytics, and Applications of Big Data Analytics. To date, the first two courses have been completed.

Courses were designed for an audience of clinical imagers, whose routine schedules leave limited time to join scheduled webinars or lectures. Asynchronous learning on Brightspace (D2L Corporation, Kitchener, Ontario), a Learning Management System software platform, provided the flexibility to view lectures and complete exercises at an individualized pace. While a schedule was recommended for completion of each sub-section and assignment, a timeline was not strictly enforced. Practical skills with software were emphasized at the outset. The web-based assignments for the first two courses, Decision Analysis and Cost Effectiveness Analysis, were performed using a widely utilized software program for decision-analytic modeling, called TreeAge Pro (2016) [TreeAge Software, Inc., Williamstown, MA]. Participants were encouraged to supplement learning by attending online "office hours," posting questions on the web forum, and contacting the teaching assistants or instructors directly with questions.

The in-person session provided a review of the major concepts covered by the online materials, intensive hands-on experience using the software program, and opportunity for group discussions critiquing major publications on the comparative effectiveness of imaging tests. In addition, participants were invited to submit their individual research questions related to the course methods for exploration during the 2-day session. Breakout sessions at each course enabled high-level, focused examination of such submitted topic in a small group setting with the course instructor.

Course Participants: Characteristics and Survey Results

Seven diagnostic radiology subspecialties and cardiology are represented in the group of 30 imagers who joined the VOICE Program for its first year. Underscoring the importance of an online format, participants have shown progress through course modules at a variable pace, usually involving bursts of activity rather than steady completion of each new module upon release. For the first two courses completed to date, surveys were conducted to assess the participants' perception of the quality of course content and updated research interests. Questions asked using a 5-point scale included: 1) how helpful was this course for introducing you to cost effectiveness analysis; 2) how would you rate the overall quality of the online portion of the course; and 3) how would you rate the overall quality of the in-person portion of the course?

In addition, participants provided initial and updated research interests. During the initial course, we asked whether or not participants had prior educational or research exposure to CER. At the end of the first course as well as the second course (Cost Effectiveness Analysis), we inquired if and how participants planned to incorporate decision analysis or cost effectiveness analysis (CEA) into their own research. At the end of the second course we also gauged interest in the VOICE mentoring program for focused research after completion of all five courses.

Survey responses were compiled from the two courses completed to date. There were 25 students in attendance for the first in-person session and 21 participants at the second in-person session who served as potential survey participants. For both courses, 100% (25/25, 20/20) of survey respondents reported that the course was helpful or very helpful for introducing them to decision analysis and cost-effectiveness analysis, and 100% also felt that both in-person sessions were of high or very high quality. In addition, 88% (22/25) and 95% (19/20) of participants reported the overall quality of the online portion of the course was of high or very high quality for the first course and second course, respectively. The mean scores for the quality of the online and in-person course components were 4.4 and 4.7, and 4.8 for how helpful the courses were overall as an introduction.

In terms of research prior to the course, 28% (7/25) of participants indicated prior educational exposure to CER, mostly in the form of lectures outside their departments and institutions, and 28% also reported at least some prior experience in health services research. However, after two courses, 85% (17/20) of respondents reported plans to apply decision analysis or cost effectiveness to their research. Finally, at the end of two courses, 60% (12/20) of respondents indicated at least preliminary interest in being matched with a VOICE Program mentor upon completion of the yearlong program, for a year of focused research in CER or big data.

Plans to Assess Early Impact

As the earliest sign of the influence of this program, the majority of participants reported an interest in applying decision analytic modeling to their research after two courses, and with the possibility of mentoring to publish such work. We will survey participants after the first year of courses is complete, in order to assess how many individuals take further steps to perform studies in CER or big data analytics. We also hope to offer a research forum, possibly at the AUR meeting in 2019, to allow participants to present their research and also to deepen the community of recently trained and more established CER investigators. The VOICE Program is supported by the National Institutes of Health, the ACR and RSNA for financial and in kind support, as well as philanthropy from industrial partners. NIH support is limited to three years, but we will seek to continue the program beyond this funding period as we believe the investment of time and resources by each class of participants will help shape the evidence basis for imaging-based outcomes.

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Take Home Points

- Healthcare policy increasingly emphasizes value, quality and improved health outcomes, underscoring the critical need for comparative effectiveness and big data researchers in radiology.
- The Value of Imaging through Comparative Effectiveness (VOICE) Research Program was created to train imagers through five core courses using a mix of web-based and in-person learning.
- With two courses completed to date in the first year of the VOICE Research Program, the majority of participants plan to incorporate the methods (decision science and cost-effectiveness analysis) into their research, and to potentially pursue mentored projects in CER or big data analytics.