

# Integrating a healthcare innovation bootcamp into an international medical conference to democratize innovation learning



Integration of an intensive innovation education bootcamp into a large international conference demonstrates statistically significant increases in participant understanding and knowledge of healthcare innovation.

From 2005 to 2015, there were approximately 30,000 medical conferences in the United States<sup>1</sup>. With a shift to virtual conferences, this number is poised to continue to increase. Conferences can distinguish themselves by providing learning opportunities for enterprising physicians and researchers beyond traditional scientific content. Indeed, the presence of educational opportunities at conferences influences participation rates<sup>2,3</sup>. One area of under-represented academic interest is healthcare innovation, a complex endeavor with the potential for disruptive, field-changing results and impact on patient care and societal economics.

Considering the constant demand for high-quality and efficient patient care using limited resources, as well as added challenges such as the aging population and the COVID-19 pandemic, continual healthcare innovation is crucial. However, there are many barriers to pursuing innovation. First, the practice of translating ideas to inventions and then to bedside innovations is wrought with opacity, logistical challenges, financial barriers and a lack of healthcare leaders to serve as mentors to aspiring innovators<sup>4,5</sup>. Moreover, most medical students, residents and fellows have limited time and energy and receive little, if any, training in translating ideas into new technologies<sup>5</sup>.

Providing educational opportunities at conferences may be an effective way to democratize innovation and reduce barriers for medical trainees and providers who are interested in innovation. Conferences are

**Table 1 | Participant response to “What rank are you?”**

Participant rank	Percentage of participants
PGY2	3.2%
PGY3	3.2%
Fellow	6.5%
Assistant professor	22.6%
Associate professor	16.1%
Professor	9.7%
Other	38.7%

PGY, postgraduate year.

**Table 2 | Participant response to “Do you plan to be involved in startup formation in the future, whether as a founder, employee, consultant, or advisor?”**

	Percentage of participants
Yes	74.2%
No	25.8%

widely regarded as spaces for learning, such as through attending seminars, gaining exposure to the latest medical advancements and networking with colleagues. They have the added benefit of allowing healthcare providers and researchers from smaller institutions – for example, those without institutional technology transfer offices – to gain insights and knowledge from those with resource-rich institutions through education and networking. In a practice profitability index, 42% of physicians said that they perceive conferences to be helpful for obtaining knowledge on improving their practice<sup>6</sup>. Medical residents

have also perceived conference programs to be helpful for supplementing their medical education<sup>7,8</sup>. Moreover, there is evidence that educational conference programs can effect changes in the attitudes and professional practice of medical trainees<sup>9,10</sup>. Considering positive attitudes and outcomes associated with educational conference programs, incorporating medical innovation education may enable conferences to attract more participants, increase much-needed access to innovation training and help break down traditional barriers for budding physician-innovators.

**Table 3 | Participant response to “Do you have an idea you believe would be commercializable in the medical field?”**

	Percentage of participants
Yes	58.1%
No	41.9%

**Table 4 | Course effectiveness statistics, including pre- and post-course analysis of participant understanding of key aspects of medical innovation**

Measure	Median pre-course score (IQR) (1–5)	Median post-course score (IQR) (1–5)	P value
Nine-question examination	44% (35.75–64.25)	67% (56–89)	$P < 0.05$
Overall understanding of artificial intelligence	4 (3–4)	4 (3–4)	$P > 0.05$
Overall understanding of digital health	3 (3–4)	4 (3–4)	$P = 0.05$
Overall understanding of how to structure a pitch deck	3 (2–4)	4 (3–4)	$P < 0.05$
Overall understanding of how to start a research lab	1 (1–2)	2 (2–3)	$P < 0.05$
Overall understanding of how to take an invention to venture funding	1.5 (1–2)	3 (2–3)	$P < 0.05$
Overall understanding of starting a company	1.5 (1–2)	2 (2–3)	$P < 0.05$
Overall understanding of intellectual property as it pertains to healthcare	3 (2–3)	4 (2–4)	$P < 0.05$
Overall understanding of diversity in innovation	2 (1.25–3)	3 (2–3)	$P < 0.05$
Overall understanding of leadership structures in academic specialty departments	3 (2–4)	3 (3–4)	$P > 0.05$

Responses are based on a Likert-type scale (where 1 represents “none” and 5 “a great deal”) and pre- and post-course exam scores. A Mann-Whitney  $U$  test was used for analysis. IQR, interquartile range.

## Design and implementation of a medical conference healthcare innovation bootcamp

We integrated a one-day innovation fundamentals course at the 2021 scientific assembly and annual conference of the Radiological Society of North America (RSNA). This course was based off a one-week innovation education rotation that we previously integrated into multiple medical residencies accredited by the Accreditation Council for Graduate Medical Education<sup>4,11,12</sup>. In 2021, to further improve access to innovation training, we expanded this educational opportunity to all faculty and investigators at our institution through our Innovation office, enrolling over 1,400 faculty and trainees. This expansion process culminated with our one-day course at the RSNA conference, named MESH Core: Healthcare Innovation Bootcamp. We used previously published data from course participants at our institution to inform our bootcamp curriculum, and final topics were selected with input and expertise from our

institutional technology transfer office<sup>4</sup>. The course consisted of ten sessions that encompassed eight hours and covered the following key domains of healthcare innovation: (1) artificial intelligence and machine learning, (2) digital health, (3) data-driven methods for pitching your innovation, (4) intellectual property in healthcare, (5) starting your own research lab, (6) venture financing, (7) company creation, (8) obtaining external research grants, (9) diversity in innovation, and (10) leadership for the ambitious innovator.

Here, we present results on the effectiveness of this intensive bootcamp at the 2021 RSNA annual conference.

## Survey

This survey study was compliant with the Health Insurance Portability and Accountability Act and exempt from Institutional Review Board review. Bootcamp participants completed a survey with three parts: a questionnaire about participant demographics, ten Likert-type survey questions for participants to rate their

perception of their understanding of each topic (1–5, 1 being “none” and 5 “a great deal”) and a nine-question exam on innovation content. All participants who completed a questionnaire (pre- or post-course) were included in the participant demographics analysis. Only course participants who successfully completed both questionnaires were included in the analysis of parts 2 and 3 of the survey. Exam questions were created by subject matter experts, as previously detailed<sup>4</sup>. Participant submissions were anonymous and unpaired. Assessments were administered online through SurveyMonkey. The Mann-Whitney  $U$  test was used to analyze differences in pre- and post-course scores using GraphPad Prism 9.3.0.

## Results

**Participant demographics.** Thirty-one participants filled out three survey questions about demographic background. The questions were: (1) “What (academic) rank are you?”; (2) “Do you plan to be involved in startup formation in the future, whether as a founder, employee, consultant, or advisor?”; and (3) “Do you have an idea you believe would be commercializable in the medical field?” Results for these questions are shown in Tables 1, 2 and 3, respectively. Participants who responded “other” to “What rank are you?” included two practicing physicians not otherwise specified, one private practice attending physician and former associate professor, one medical student, one postdoctoral research fellow, one hospital administrator, one retired professor, one business manager, one lead technologist, one hospital CEO, one senior vice president and one radiologist assistant.

**Prospectively tested innovation content knowledge.** The pre- and post-bootcamp exam questions were completed by 28 and 31 participants, respectively, in a prospective fashion. Exam questions and results are detailed in Table 4. There was a significant increase in overall knowledge on the exam (median pre-course value = 44%, median post-course value = 67%,  $P < 0.05$ ). The pre- and post-course Likert-type survey demonstrated significant increases in perceptions of understanding of digital health (median pre-course value = 3, post-course value = 4,  $P = 0.05$ ), structuring a pitch deck (3 versus 4,  $P < 0.05$ ), starting a research lab (1 versus 2,  $P < 0.05$ ), taking an invention to venture funding (1.5 versus 3,  $P < 0.05$ ), starting a company (1.5 versus 2,  $P < 0.05$ ), intellectual property (3 versus 4,  $P < 0.05$ ) and diversity in innovation (2 versus 3,  $P < 0.05$ ).

## Conclusions

Encouraging healthcare innovation is crucial for improving and optimizing patient care, but most healthcare students and providers do not have sufficient access to training, resources or mentors in this domain<sup>4,5</sup>. While most institutions do not have sufficient resources, expertise or interest to conduct individual innovation educational programs for their trainees and staff, medical conferences can bridge this gap by connecting lower-resource innovators with those from resource-rich institutions. In this article, we present creation and quantitative impact of a pilot adapted healthcare innovation curriculum suitable for medical conferences. In a pre- and post-course exam, we demonstrate statistically significant increases in participant understanding and knowledge of key domains of healthcare innovation, including digital health, structuring a pitch deck, starting a research lab, taking an invention to venture funding, starting a company, intellectual property and diversity in innovation. While we acknowledge a potential confounding effect of exam repetition, we believe the exam results provide insight into the potential benefits of providing academic healthcare innovation education at conferences. We also show that participants from

a variety of career ranks, levels of interest in startup involvement and levels of involvement in idea commercialization are interested in our innovation bootcamp. This suggests that our healthcare innovation curriculum may be of interest to a broad range of participants at other medical conferences.

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## Author contributions

The authors declare that they had full access to all of the data in this study and the authors take complete responsibility for the integrity of the data and the accuracy of the data analysis.

## Competing interests

The authors declare no competing interests.