

These CT doctors look to AI to advance medicine, patient health. ‘It’s that transformational.’

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Fourteen [Hartford HealthCare](#) doctors have projects they think could be accomplished, or completed more efficiently, if only artificial intelligence were applied to them.

They recently presented those projects to 14 doctoral students from the [Massachusetts Institute of Technology’s business school](#), who are ready to take them on.

They are projects that are on the front lines of transforming health care with the aid of artificial intelligence and machine learning.

“AI and ML ... are like electricity when it was discovered. It has the opportunity to change everything about health care and how we diagnose and treat our patients,” said [Dr. Barry Stein](#), chief clinical innovation officer and chief medical informatics officer for Hartford HealthCare. “It’s that transformational.”



Dr. Barry Stein, chief clinical innovation officer and chief medical informatics officer for Hartford HealthCare

While doctors train and gain knowledge through years of experience diagnosing and treating patients, he said, “AI and ML have the potential to do both far more efficiently ... predicting what the diagnosis is and then also knowing the best treatment.”

The recent presentations were part of a collaboration that goes back several years as part of a plan called [Holistic AI for Medicine](#), led by [Dimitris Bertsimas](#), associate dean of business analytics at [MIT Sloan School of Management](#). Stein called Bertsimas “the Bruce Springsteen of analytics in the world.”

The proposals included using AI to determine whether Emergency Department patients should be admitted to the hospital, whether patients with psychosis will be among the 50% who are likely to relapse, and to show how the way Emergency Department patients are spoken to can affect their outcomes, according to the presenters.



Dimitris Bertsimas, associate dean of business analytics at the Massachusetts Institute of Technology

“We had 14 projects,” Bertsimas said. “The idea would be to demonstrate that this methodology, if it can be successfully applied in a real world hospital like Hartford, in very diverse areas of application, from cardiology to orthopedics to psychiatry to neurology ... all aspects of medicine ... I think we’ll have a dent on improving outcomes for patients and medicine in the years to come.”

After the pitches, Bertsimas matched the projects with the students, with one lead student and one assistant for each project. They are “the brightest Ph.D. students in this world, probably on the planet, doing the work in Connecticut at Hartford HealthCare,” according to Stein.

Bertsimas gave an example. “There’s a team at Hartford, a sizable team, that receives medical cases that involve images ... and they involve labs, and they want to approve or disapprove whether the patient will be inpatient in the hospital or outpatient, because (whether) insurance pays is a relevant question.”

Using AI, doctors can “automate this process and be able to make these determinations, assessing the case automatically, and also write a report that outlines the logic that would be a good output from this process,” he said.

Stein gave another example of patients with bleeding on the brain, to predict which patients will have a repeated bleed.

“As we have an aging population, we can expect folks to come in with bleeds on the brain — slight knock on the head, people on blood thinners, etc., etc. You’re going to have some bleeding on the brain,” Stein said.

“It’s extraordinarily difficult to predict which one of those patients is going to have a rebleed and each one of those rebleeds can be devastating and lethal,” he said. “This opportunity working with MIT to take multiple different data sources ... create an algorithm that can predict with high accuracy who’s at risk for rebleed ... if you know who’s at risk for rebleed with high accuracy, you can intervene and prevent the rebleed.”



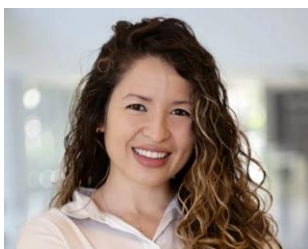
Dr. Steven Zweibel, system director of cardiac electrophysiology for the Hartford HealthCare Heart and Vascular Institute

Yet another is having AI “come up with a good way of predicting patients that are going to have problems maintaining weight loss or going on to obesity,” Stein said.

“The matchup between MIT and Hartford is amazing in that we have the best people in data analytics and then we have some of the top clinicians in what we do,” said [Dr. Steven Zweibel](#), system director of cardiac electrophysiology for the [Hartford HealthCare Heart and Vascular Institute](#).

“We learn a lot about data analytics and what’s possible and they learn a lot about the clinical practice of medicine and how we implement that,” Zweibel said. “And some of this is just talking to clinicians to get them to understand exactly what machine learning is capable of, and then how to actually bring that into our culture and to use that to help take better care of patients.”

[Kimberly Villalobos Carballo](#) is in her ninth year at MIT, beginning as an undergrad, now finishing up her doctorate in optimization and machine learning, focusing on health care applications. Originally from Costa Rica, she is one of the students working with Hartford HealthCare.



Kimberly Villalobos Carballo, doctoral student at the Massachusetts Institute of Technology

AI and machine learning are “really changing things for the health care system,” she said “I think part of the goal is to be able to extend this worldwide. There’s been a huge gap between the advances that artificial intelligence and machine learning has had and what applications they’ve had on health care.”

Among the reasons for that gap are privacy and data concerns, she said. Also, “there’s not as much work being done of collaborations between scientists, from the technology perspective and health care,” she said. “And like for this type of project, you definitely need the collaboration of the two.”

Villalobos Carballo credited her adviser, Bertsimas, with establishing the relationship with Hartford HealthCare. “This trust is crucial, because it’s not just about developing the algorithms,” she said. “It’s not just about the AI. You really do need the input and the support from all the health care providers, nurses, case managers, etc.”

Villalobos Carballo has already worked on projects with Hartford HealthCare, including one in which she and a colleague developed models to predict whether patients in all seven of the system’s hospitals would be discharged within the next 24 or 48 hours, whether they would need intensive care or whether they were at risk of death.

“All these sorts of predictions about the future allow physicians to do better planning, and nurses of course as well, case managers, it allows them to handle the discharges better,” she said.

In two years, “they have seen a reduction in length of stay (that’s) quite substantial, which translates to both better quality of care for the patient, because they don’t stay unnecessarily longer, but also of course financial benefits for the institution,” she said.

Now, she is working on a project to optimize elective surgeries.

Villalobos Carballo said physicians pitching the projects that would help them was the best format, rather than students coming up with ideas.

“There’s a lot of tasks like scheduling, for example, that are not necessarily strictly related to their medical knowledge, but that they are the ones who have to do it,” she said. “The idea is that these machine-learning models can actually help them be more efficient in their work and give them a better insight about future outcomes, for example, so that they can leverage their knowledge better.”

Villalobos Carballo called the collaboration between [MIT Sloan](#) and Hartford HealthCare unique, “what Dimitris and the leadership of Hartford HealthCare have accomplished here by leveraging not just the skills from both fields but also just the human relations that they’ve been able to build to get this far.”

She said choosing the right team is important because of privacy concerns. “When it comes to patient data, health care data, it’s just so sensitive that there is definitely potential to not use it

properly,” she said. “And that’s why I think hospitals have to be quite careful about who they collaborate with, making sure that all these regulations are respected and in place.”

Villalobos Carballo said she feels “really privileged” to be part of the collaboration.

“I think as researchers ... we get very focused on the paper itself, on what’s written, on what are we publishing, on our academic achievement, let’s say, and I think it’s crucial to make sure that the work that we do on paper is inspired by what the world actually needs, what the society actually needs, as opposed to you just only what my curiosity wants to solve,” she said.

“I think that there’s a lot of enthusiasm and excitement about the possibilities as well as a lot of trepidation,” Stein said. “And the best way to manage both is to be part of the solution: the integration, the validation, the development.”