Leo Anthony Celi MD MS MPH,
Associate Professor (Part-time, HMS), Principal Research Scientist (MIT)

Specialty:	Intensive Care Medicine
Institute:	Harvard Medical School, Massachusetts Institute of Technology
Department:	• Division of Pulmonary, Critical Care and Pain Medicine, Beth Israel Deaconess Medical Center (BIDMC) • Laboratory for Computational Physiology (LCP), Institute for Medical Engineering and Science, MIT
City:	Boston
Country:	United States
Function:	• Intensivist, BIDMC • Clinical Research Director, LCP
Scientific focus:	secondary analysis of health data, predictive modeling, causal inference
Key words:	machine learning, artificial intelligence, data modeling

What else do I want to say?

There was never a “eureka moment” during my journey from studying medicine in the Philippines to becoming clinical research director of the Laboratory for Computational Physiology under the Harvard-MIT Division of Science and Technology (HST). Instead, it took decades of clinical practice in the intensive care unit (ICU), before I recognized that the art of medicine is woefully unscientific. I am an ICU specialist at the Beth Israel Deaconess Medical Center (half of a full-time equivalent), but I am also a data scientist and a lecturer at HST. The problem with the art of medicine is that it varies from doctor to doctor because of variability in knowledge base and experience, information gaps and uncertainties, and personal biases. I envision a system that would aggregate the health record of every patient and then analyze the dataset. Using machine learning tools, we can weigh the risks and benefits of tests and treatments for a specific patient, based on the outcomes of similar patients in the past. Thomas Frieden provides us with the most compelling reason to leverage data that is routinely collected in the process of care: “For much, and perhaps most of medical practice, RCT-based data are lacking and no RCT is being planned or is likely to be completed to provide evidence for action. … [It] leaves practitioners with large information gaps for most conditions and increases reliance on clinical lore.” Health data is being collected at a scale (exabytes), resolution (up to 500Hz), and levels of heterogeneity, which are historically unprecedented. The sheer magnitude of such data can leverage population data and facilitate the application of advanced algorithmic techniques which were previously not feasible. Critically ill patients are an ideal population for clinical database investigations because while the data from ICUs is extensive, the value of many treatments and interventions remains largely unproven, and high-quality studies supporting or discouraging specific practices are relatively sparse. The data-rich ICU environment provides a potential area for uses of artificial intelligence, a highly data dependent entity.