

## How Systems Engineering Can Help Fix Health Care

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**Abstract:** When an aircraft manufacturer decides to create a new airplane, it doesn't ask pilots and crew to identify the best cabin, wings, and jet engines, and then put all the pieces together. A plane developed that way wouldn't fly. By contrast, the way we build hospitals typically happens in a piecemeal, patchwork approach. Institutions purchase hundreds of individual, siloed technologies. We then bump them into hospitals and hope that they somehow work together. The result is a constellation of technologies that rarely connect, to the detriment of patient safety, quality, and value. We need a systems engineering approach, one that puts the needs of patients and clinicians first. We need to integrate healthcare organizations, technology, people, and processes so that they are seamlessly joined in pursuit of a shared goal.

In this talk, I will demonstrate how systems engineering can help policy makers to design innovative ways to stimulate IT adoption and interconnectivity. I highlight one application. Simple mathematical models are essential for timely recommendations and insights for policy and market design; this is illustrated by an application to the Internet of Things in Healthcare (a.k.a., Health Information Exchange). I seek to understand the core dynamics of collaboration and competition in the context of healthcare markets and the sharing of patient information. Grounded in game theory and bi-level optimization, I found new national policy mechanisms are needed to stimulate smaller hospitals to share patient data. All models are wrong, but better models can help us avoid terrible investment and policy mistakes.

**Bio:** *Diego Martinez* is Postdoctoral Research Fellow of Emergency Medicine at the Johns Hopkins School of Medicine. He received his Ph.D. in Industrial Engineering from the University of South Florida, and he is recognized for his contributions to healthcare systems engineering. His data analyses and mathematical models have helped us understand the dynamics of collaboration and competition among hospitals, the mechanisms of information retrieval from the electronic medical records, and the factors that drive operational efficiency in healthcare organizations. His current focus is on building and deploying systems engineering and informatics tools to improving bed management and asset utilization. He is also interested in human-computer interaction; specifically, in developing methods that "open" black-box prediction algorithms to the clinicians. His work has appeared in top medical and engineering journals including JAMA, BMC Medical Informatics and Decision Making, Applied Health Informatics and Health Care Management Science.

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