The Zerhouni Challenge: Defining the Fundamental Hypothesis of Emergency Care Research

What is your hypothesis? This is almost always the first question I ask graduate students when they enter my office to propose a new research project. It is also the first thing I look for when reviewing a research grant or original research manuscript. The hypothesis is fundamental to modern scientific inquiry. Without one, it is impossible to judge the potential impact of a proposed line of investigation. Why, then, was I surprised, and somewhat unprepared, when the same question was asked by the director of the National Institutes of Health (NIH), Dr. Elias Zerhouni? What makes Dr. Zerhouni's question compelling is that it wasn't directed at a specific research grant or manuscript: it was directed at an entire field of investigation, the field of emergency care research.

On January 25, 2007, a group of Emergency Medicine investigators, including Chuck Cairns, Jim Hoekstra, Judd Hollander, Roger Lewis, Sandy Schneider, and me, met with Dr. Zerhouni at the NIH to discuss the future of emergency care research. After numerous conference calls and e-mail exchanges, we were prepared to highlight the synergy between the recent reports of the Institute of Medicine (IOM) Committee on the Future of Emergency Care in the United States Health System[1–3] and the NIH roadmap initiative to "reengineer the clinical research enterprise" in the United States.[4–6] Dr. Zerhouni listened attentively to a well-orchestrated proposal that was primarily focused on integrating emergency care research and research training into the new Clinical Translational Science Award program.[7,8] Although he acknowledged the importance of building our research infrastructure, he asked us to consider the "why" as much as the "how." He challenged us to define and prioritize emergency care research. What areas of scientific investigation are unique to emergency care, best studied by emergency care investigators, and inadequately explored by other groups of scientists? He asked us to state the unique fundamental hypothesis of emergency care research.

Before he even finished articulating the question, my mind was racing to recall the text of the IOM reports,[1–3] the American College of Emergency Physicians (ACEP) Research Committee report submitted to the IOM,[9] and even the original 1995 Josiah R. Macy Foundation report "The Role of Emergency Medicine in the Future of American Medical Care."[10] Although each described the scope of emergency care research, none had a clearly stated hypothesis. As the members of our group began to respond, it was obvious that the question was unexpected. Our tightly choreographed interchange rapidly evolved into a frank and open discussion about the challenge of defining emergency care research in such terms. The breadth of our research programs and accomplishments mirrors the breadth of our clinical practice. Our niche is more related to timing, location, and access to care rather than ownership of a specific organ system or set of diseases. Unaware that anyone in the history of emergency medicine had defined our unifying research hypothesis and not hearing one coming out of the ongoing discussion, my contribution was that it might not be possible. The fact that I am writing this editorial reveals that I was not satisfied with my answer.

The 1995 Macy Foundation report recommended that the specialty of emergency medicine develop a research agenda and strategic plan.[10] However, there was no recommendation to generate a fundamental research hypothesis. Perhaps as a result, an overall research agenda and strategic plan was never developed. In 2003, the ACEP research committee examined the progress made on the objectives outlined in the Macy report.[11] Although modest advances had occurred in terms of emergency care research infrastructure and funding, a research agenda and strategic plan were still lacking. Most recently, the reports of the IOM Committee on the Future of Emergency Care in the US Health System highlight our scientific achievements and lists future directions in basic science, translational, and health services research. However, a fundamental unifying hypothesis remains absent.

The MedlinePlus Medical Dictionary defines hypothesis as "a proposition tentatively assumed in order to draw out its logical or empirical consequences and test its consistency with facts that are known or may be determined."[12] In the same reference, J. S. Mill is quoted as saying "it appears, then, to be a condition of the most genuinely scientific hypothesis that it be…of such a nature as to be either proved or disproved by comparison with

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observed facts." Is there a general proposition that we assume as emergency care investigators? One that can be proved or disproved in the preclinical models we use and patients we study?

After reflecting on Dr. Zerhouni's question, I now feel compelled to propose a "straw man" hypothesis, not that I expect it to be adopted, but rather to stimulate a dialogue that I hope will result in an acceptable answer to the question. The 2006 IOM report titled *Hospital-Based Emergency Care:* At the Breaking Point contains the following statement: "…the quality and speed of the care that is provided in the relatively brief emergency care encounter can mean the difference between life and death or a prolonged period of disability."[1] Restated as the fundamental hypothesis of emergency care research, *rapid diagnosis and early intervention in acute illness or acutely decompensated chronic illness improves patient outcomes*.

Too simple? Maybe, but it does encompass the majority of our research portfolio. The temporal importance unique to emergency care is highlighted while preserving the generality of our practice and research pursuits. Furthermore, it yields a set of separate testable hypotheses for each disease process we encounter. For some diseases, this general hypothesis may have already been proved to be true. Examples include early reperfusion in total body and focal organ ischemia, early antibiotics in acute bacterial infection, and early control of hemorrhage. However, even for these, important subhypotheses related to optimizing diagnostic and therapeutic strategies remain to be tested. On the opposite end of the spectrum there are numerous disease presentations for which the associated subhypothesis has not proved true. Examples include antibiotics for acute bronchitis, splinting of minor ankle sprains, and routine use of radiographic studies based solely on chief complaint or injury mechanism.

Agreeing on a fundamental hypothesis for emergency care research is not without risk. Most important is the risk of excluding areas of investigation that are important to emergency care investigators, practitioners, and our patients. Do emergency department (ED) interventions related to substance abuse and domestic violence fit? If one equates acute intoxication or domestic assault with acute illness or acutely decompensated chronic illness, then the hypothesis that rapid diagnosis and early intervention will improve patient outcome is reasonable and testable. What about health services research? Rapid diagnosis and early intervention require more than choosing the right test and treatment. They require appropriate, efficient, and error-free execution in the out-of-hospital and ED settings. This fertile area of investigation belongs to emergency care researchers and is not excluded by the fundamental hypothesis stated above. Furthermore, disaster response, a field in desperate need of rigorous scientific investigation, fits well into this construct.

In response to the 2006 reports of the IOM Committee on the Future of Emergency Care in the United States Health System, the NIH and other federal research funding agencies will evaluate their past, present, and future support of emergency care research. If we do not define and prioritize the body of science unique to emergency care, someone else will do it for us. I fully expect that we will be challenged again to state our fundamental hypothesis. My hope is the next time we will have the right answer. Are we up to the challenge?

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