# 2017 Annual Meeting of the American College of Radiology—Moreton Lecture: Forecasting the Futures of Radiology

*Jeffrey C. Bauer, PhD*[a]

## Abstract

**Purpose:** The traditional forces of change in health care are no longer working as they did in the past. Political gridlock has destroyed Washington's ability to create sensible policy for reforming the medical marketplace, creating chaos for providers. Fortunately, chaos creates opportunity. The idea of creating one's future has never been more relevant and necessary.

**Materials and Methods:** Predicting—the science of extrapolating future values from historical data—is not a valid method for looking ahead when causal relationships that explained change in the past are themselves being redefined (the current situation). Forecasting—the art of estimating probabilities of possibilities—is the appropriate method for anticipating futures when causality is being redefined. With its focus on identifying a range of possibilities, forecasting identifies many different outcomes that are simultaneously possible for radiology.

**Results:** Health care's new climate is being shaped by four defining trends: 1) revolution in biological science that is shifting caregivers' mission from acute care to disease management; 2) proliferation of information and communications technologies that are transforming the way care is delivered; 3) end of economic growth in the medical marketplace that is reshaping demand for care; and 4) political dysfunction that forces caregivers and their business partners to develop successful futures on their own.

**Conclusions:** Radiology 3.0 is nicely aligned with the transformational trends. Staying focused on implementing Radiology 3.0 is supported as the optimal strategy for creating the profession's futures. Diagnostic convergence, establishing a unified diagnostic science with laboratory medicine, is proposed as a complementary initiative.

**Key Words:** Policy, futurism, patient perspective, clinical practice, information systems, quality assurance/improvement

*J Am Coll Radiol 2017;14:1524-1529. Copyright © 2017 American College of Radiology*

## SEEKING ORDER OUT OF CHAOS

The 2017 Moreton Lecture presents a rare opportunity to look into the crystal ball from a perspective that radiology's future must be shaped by innovation—purposefully moving the science and its practitioners in unprecedented directions. Washington, DC, site of the ACR's 2017 annual meeting, provides an appropriate setting for proactive futurism because reform is traditionally driven by politics. Maneuvering between Capitol Hill and the White House historically played a fundamental role in shaping the evolution of health care, and the ACR has been a generally successful participant in the process. However, politics in Washington has become completely dysfunctional over the past few years, to the point of being unpredictable now. Any profession that waits for today's politicians to tell it what to do is almost certainly bound to descend into chaos because federal officials are incapable of developing a shared vision of where health care ought to go and what role government should play along the way.

Fortunately, impending chaos creates opportunity. History includes example after example of good things that arose from disorder. I see today's chaotic state of health care as a golden opportunity for radiology to imagine a good future for health care and the profession's role in creating it. The worst thing we can do is play

[a]Madison, Wisconsin.

Corresponding author and reprints: Jeffrey C. Bauer, PhD, 1137 Minocqua Crescent, Madison, WI 53705; e-mail: jeffreycbauer@gmail.com.

Dr Bauer is a consultant to Qaelum (Leuven, Belgium).





1546-1440/17/$36.00 ■ http://dx.doi.org/10.1016/j.jacr.2017.08.020

Chicken Little, expecting the sky to fall because there's nothing we can do to reverse current trends. Given today's counterproductive divisions between and within the political parties, health care organizations and their partners need to rise above politics, creating positive solutions that can be implemented without—even despite—policy directives from Washington.

## CREATING THE FUTURE

Creating one's own future has been a major premise of books on management and strategy for several decades now, often accompanied by a quotation attributed to Abraham Lincoln: "The best way to predict your future is to create it." I like to complement it with Confucius' observation: "Surely, we will end up where we are headed if we do not change direction." Looking at futures of radiology with both these perspectives in mind is a lot more energizing than letting entropy run its course. Creating futures is particularly relevant today because, for reasons elaborated throughout this presentation, health care is almost certain to change more in the next 5 years than it has in the past 50. (For what it's worth, I've been working full-time in health care for 48 years, experience that hopefully gives me some authority to make such a long-term statement.) Turbulent times invite us to take charge.

## PREDICTING VERSUS FORECASTING

To begin, I make a strong distinction between predicting and forecasting. They are not synonyms. Understanding the difference between predicting and forecasting is important for radiologists who want to establish diagnostic imaging as a force for creating better futures for American health care. As the physicist Max Planck observed, "When you change the way you look at things, the things you look at change." Predictions and forecasts provide different pictures of the future, so selecting the right approach is a critical first step in the process of looking ahead and making plans.[1]

A prediction is a specific estimate of the expected value of a key variable at a future point in time. Making predictions is a science with formal mathematical models and computational methods, based on the critical assumption that how things worked in the past is how they will continue to work in the future. The process begins with specification of an equation that defines the relationship between a dependent variable (the parameter to be predicted) and independent variables that have explained changes in it in the past. The mathematical function (eg, linear, exponential, wave) that "best fits" the historical relationship is then used to compute a future value of the dependent variable—the prediction—by extrapolation from historical data.

For example, when Barack Obama was inaugurated in 2009, the Congressional Budget Office published a prediction that health care spending in the United States would consume 20% of the gross domestic product (GDP) in 2015, a substantial increase from approximately 15% at the time the prediction was made (see Fig. 1). President Obama unexpectedly decided to focus on reforming health care—a goal he opposed as a candidate—because he believed that the predicted increase in medical spending would prevent him from pursuing other goals he favored.

Actual health care spending in 2015 was approximately 17% of GDP, with growth 60% lower than predicted (ie, an increase of only 2% in GDP share rather than 5%). How could the prediction be so wrong? The Patient Protection and Affordable Care Act's (ACA) main provisions did not begin until 2014, so Obamacare cannot claim credit for lower than predicted spending. Rather, the prediction was wrong because of unprecedented changes in relationships among the variables that explained health spending through 2004 (the last year of real data used to compute the prediction) and those that explained it over the following decade. These changes, precursors of new forces and relationships that are radically transforming health care, are elaborated later in this lecture.

## THE SUPERIORITY OF FORECASTING

The key conclusion at this point in my analysis is that predicting the future of health care is inappropriate because the realities of health care's evolution today violate the assumptions of predictive science. Extrapolating from historical trends will not give an accurate picture of where health care is likely to go; new trends prevail. Prognosticators need another way to look at the future when the future is not an extension of the past. As luck would have it, I was formally trained in the other established quantitative approach—forecasting—before I got my graduate degrees in a predictive science (economics). I learned how to forecast as a weatherman before becoming a medical economist.

[1]For a detailed analysis of the differences and how to operationalize them, see Bauer [1].

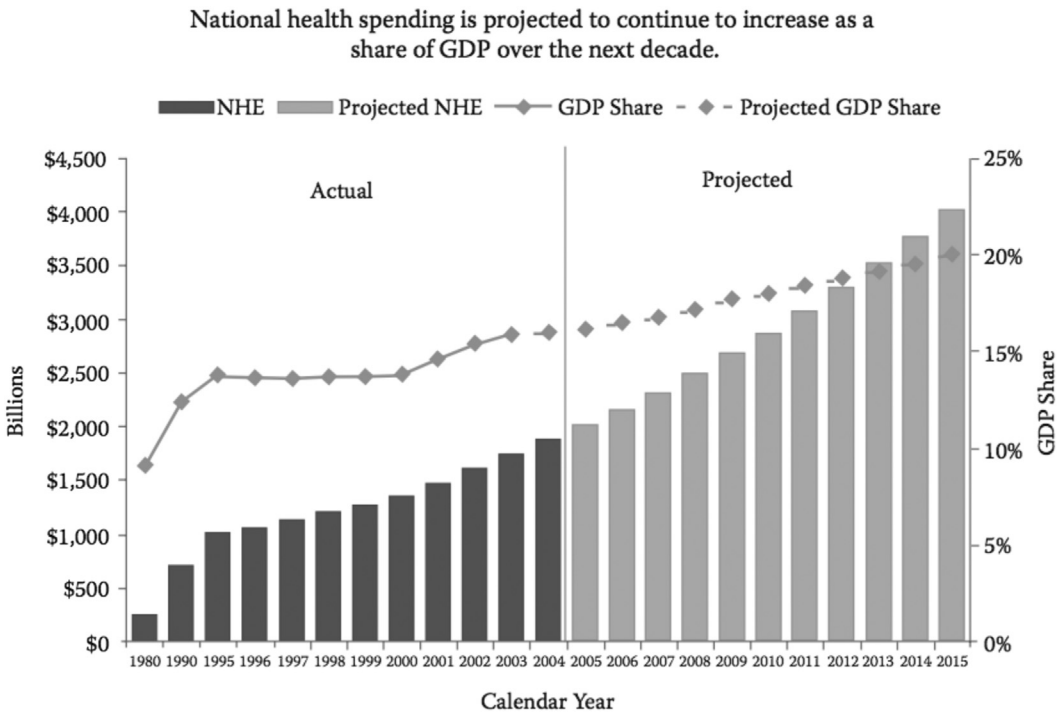


Fig 1. National health expenditures and their share of gross domestic product 1980-2015. Source: CMS, Office of the Actuary, National Health Statistics Group.

A forecast is an estimate of the probabilities of possibilities for a key variable at a future point in time—something very different from the estimate of a single future value (ie, a prediction). In contrast to the Newtonian certainty of predictive science, forecasting incorporates expectations that a system can move in more than one direction and that the movement from present to future state is subject to chance (ie, does not follow a predictable trend). To a forecaster, the future is a range of possibilities. The art of forecasting requires an ability to identify these possibilities and the likelihood that each can occur.

As with predicting, the first step in forecasting is to develop a conceptual model that relates the dependent variable of interest to independent variables that cause it. Let's use rain as an example. Rain occurs, or doesn't, as a result of interactions between water, temperature, pressure, and wind. Meteorologists have extensive historical data on the current values of each of these independent variables for their forecast areas, but they don't know for sure how the variables will interact at any given time in a given place. Indeed, several outcomes are possible: thunderstorms, showers, clouds without precipitation, sunny skies, and so on.

A forecast is made by examining historical data to see what happened when previous values of the independent variables were the same as the current values. If it rained between noon and 6 PM on 40 of the past 100 days when humidity, temperature, pressure, and wind were the same at 6 AM on those days as they are today, the afternoon forecast will be a 40% chance of rain. Of course, a 40% chance of rain is a 60% chance of something else, so a good forecaster evaluates the full range of possibilities and the ways they could occur. This orientation is essential for radiologists who want to shape the future of health care because many different futures and strategies for achieving them are possible. Indeed, two or more different possibilities can occur at the same time.

## CLIMATE AND CLIMATE CHANGE

Using meteorology to illustrate the basic concepts of forecasting raises one more crucial point: the deterministic role of climate. Climate is the set of fixed factors that determine how water, temperature, pressure, and wind interact on the basis of the "lay of the land." Meteorologists like to say that climate is what you expect, weather is what you get. Variations in local climate (eg, altitude, latitude, surface features, economic activity) at a fixed point in time are the reason why identical values of the weather variables produce different outcomes in different

geographic areas. Likewise, changes over time within fixed locations lead to changes in the local weather. There's no "one size fits all" weather forecast because one area has different climates compared with other areas at a given point in time and because local climates change over time.

The general concept of climate applies to health care as well, with direct implications for how to approach futures of radiology. We all know that health care is inherently local because of remarkable diversity in the key variables that shape outcomes in local marketplaces. The characteristics of radiology in one market should not be expected to be identical to those in a different market. Radiology's overall circumstances in New York City and New Orleans are different in many significant ways today and have different realms of possibilities for tomorrow; likewise for radiology within community or academic hospitals in each city.

Therefore, each of us needs to approach the future of radiology in the context of local realities and opportunities. Many different futures are not only possible but inevitable. (This explains my general disdain for health reforms directed from Washington; politicians tend to seek "one sizes fits all" solutions.) By extension, there are many different things that could be done to improve health care in general and radiology in particular in our local marketplaces. None of us will have the time and money to implement all of them, nor will we select the same solutions. Vive la différence.

## TRANSFORMATIONAL TRENDS

Climate change is the number one reason I believe health care will change more in the next 5 years than it has in the past 50. The four variables that most significantly shape our futures are undergoing seismic shifts, restructuring the realm of possibilities and forcing us to restructure our strategies accordingly. Here's a brief review of the these transformative changes:

- A revolution in biologic science, shifting providers' core function from acute care to disease management: As a result of the Human Genome Project and its extensions, medical scientists now know that disease entities once thought to be homogeneous are actually quite diverse. Patients with the same diagnosis (ie, the same signs and symptoms) can have conditions with very different biologic explanations and possibilities, necessitating personalization of prognosis and therapy. Growing knowledge about complexity shifts the goal of treatment from curing diseases to managing them. Complexity also creates the need for team-based care because no single practitioner has the knowledge and skills to meet all of a patient's needs.
- Proliferation of information and communications technologies, transforming the business of health care: Thanks to amazing advances in computer science, today's caregivers can collect and process the massive amounts of information generated by precision (personalized) medicine. Integrated systems and artificial intelligence perform many functions that are beyond human capability, with promise to enhance the productivity of caregivers as they are liberated from purely clerical and computational functions. Virtual technologies (eg, telemedicine, robotics) also allow caregivers to overcome the barriers of space and time.
- End of growth in health spending, shifting significant financial responsibility to patients: The governments and business that have historically financed 80% of medical spending have reached the limits of what they are willing and able to pay. Health reforms are rapidly shifting the burden of payment to patients at a time when consumers' disposable income has stagnated. Ninety percent of the American population has fewer resources today than it did before the 2008 recession, with no return to growth in sight. The related volume-to-value shift in reimbursement policy is starting to link payment to demonstrated efficacy of care. Consequently, health care is no longer the growth industry that it has been for the past 50 years, and providers are beginning to realize that the only way to survive in a no-growth market is to become efficient (ie, eliminate waste) and effective (ie, provide services of expected quality).
- Dysfunction in the politics of health reform, forcing providers and their business partners to develop successful futures on their own: Democrats were barely able to pass the ACA in 2010 without a single Republican vote, even though they controlled the White House and the House of Representatives. Now, even with control of the White House and both branches of Congress, Republicans lack the internal cohesion to fulfill their promise to repeal and replace the ACA. There's no consensus on a viable alternative in either party, so coherent reform at the national level is highly unlikely for the foreseeable future. The probability of finding public money to support major health reform is just as unlikely. This grim political outlook reinforces providers' needs to develop new care delivery models on their own.

## CURRENT FORECASTS

Today's juxtaposition of unprecedented economic and political pressures is directly reflected in my forecasts for the future of health care. Regarding total health care spending as a share of the GDP over the next 5 years, I forecast chances of growth at 10%, with a 50% chance relative spending will stay where it is in 2017 (between 17% and 18% of GDP) and a 40% chance it will decrease. The "take-home" point for anyone in the business of health care is to plan for a future in which the key to success is cutting waste out of operations. Simply raising prices and/or increasing volume, the traditional approaches to growth over the past 50 years, is no longer guaranteed to sustain an enterprise in this industry.

The impact of no growth on today's health care enterprises is likely to be significant. I forecast that 35% of all business entities in the industry will fail between now and 2022. (Some will fail completely; others will reorganize, merge, or be acquired to avoid dissolution or bankruptcy.) Of those remaining in business as currently organized, 40% will survive "as is," and 25% will thrive by reinventing the way they do business. In other words, my outlook is not "gloom and doom" across the industry. Some health care enterprises should be fearful, others optimistic. Indeed, I am energized by the small but growing number of provider and payer organizations that are positioning for success in a much-changed medical marketplace. Innovative leaders across the industry are laying the foundations of a good health care system, one that will offer core services in many different ways.

## CONCLUSION AND STRATEGIC RECOMMENDATION

If medical spending has peaked and many enterprises consequently fail or stagnate, careful management of the demand for health care becomes a new key to survival and growth. Few (if any) questions were asked in the past when a doctor wrote an order, but those days are over, one of the main reasons why the medical marketplace has stopped growing. Now, with more research showing lack of benefit or even negative effects for many medical services and limited money to pay for them, providers must strive to eliminate care that patients do not need and cannot afford. The likely growth of bundled payment over the next few years will reinforce this new constraint on demand.

To its great credit, the ACR is already leading the medical marketplace in the right direction with its Imaging 3.0™ initiative. The innovative program's goal, "delivering all the imaging care that is beneficial and necessary and none that is not," aligns precisely with my forecasts and resulting recommendations. Furthermore, Imaging 3.0 includes an excellent road map for implementation through professional development, practice management, and association outreach. (Dr. Moreton would approve!) The mission of Imaging 3.0 is also ethically and professionally correct, even if my forecast turns out to be economically wrong. The precepts of Imaging 3.0 are already permeating the ACR, as I observed by reviewing dozens of articles in the organization's publications for the past year and attending a full day of sessions at the 2017 annual meeting before writing and delivering this Moreton Lecture. The ACR and its members are walking the talk.

Consequently, my strategic recommendation to ACR's members is to stay focused on implementing Imaging 3.0, adapting it as necessary to ongoing changes in science, technology, economics, and politics that shape the realm of possibilities. Unlike some other professional associations that have gotten less favorable assessments and recommendations from me in recent speeches and articles, the ACR has already done its homework in preparing for the uncertain future. It should not be diverted to doing something else just because health reform is in such disarray across town at the White House and Capitol. Radiology is headed in a very good direction, but the journey will not be easy. It's all downhill from here on up.

## P.S. DIAGNOSTIC CONVERGENCE

Looking a bit deeper into the crystal ball, beyond the 5-year horizon of my forecasts, I see another opportunity (in addition to Imaging 3.0, not in place of it) for radiology to be the exemplary leader in health reform through reinvention of the way care is delivered. This change will almost certainly occur, but radiology as a profession is positioned to help make it happen sooner rather than later. I call it diagnostic convergence: research-driven integration of radiology and laboratory medicine to create a unified medical specialty of diagnostic science, focused on eliminating unnecessary overlaps between radiology and pathology, identifying the most cost-effective test, and sequencing tests in accord with economic constraints to optimize population health. This envisioned convergence of radiology and laboratory medicine embodies the same clinical and economic principles that ACR pioneered in developing the foundations of Imaging 3.0. Something to think about—maybe one more way for radiologists

to establish themselves as essential partners in the "big picture" of health care?

## TAKE-HOME POINTS

- Health care delivery in the United States is likely to change more in the next 5 years than it has in the past 50, compelling providers to create their own futures because political dysfunction will continue to prevent government from leading viable reform.
- Predicting (extrapolating a future state from historical data) and forecasting (estimating the probabilities of future possibilities) are very different methods for identifying likely changes to support strategic planning for creating viable futures.
- Given rapid evolution in the science and technology of their profession, radiologists should use forecasting to identify the range of possibilities and to create transformational changes specifically adapted to the unique needs and opportunities of the markets they serve.
- The end of growth in health care spending threatens the survival of many existing medical enterprises and compels radiologists to focus on developing their roles in integrated systems that "deliver all the imaging care that is beneficial and none that is not," staying focused on implementing Imaging 3.0 because it is already well-aligned with future trends.
- Radiologists should begin thinking about leadership in diagnostic convergence, creating a unified medical specialty of diagnostic science via the merger of diagnostic imaging and laboratory medicine.

## REFERENCE

1. Bauer JC. Upgrading leadership's crystal ball: five reasons why forecasting must replace predicting and how to make the strategic change in business and public policy. Boca Raton, Florida: CRC Press; 2014.