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Physician Payment Reform: Getting What We Pay For

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Editorial Transition

Due to increasing administrative responsibilities at his institution, Dr William Dillon informed me of his desire to step down from his position as Senior Editor after 13 years of dedicated service to the *American Journal of Neuroradiology* (*AJNR*). I thank Bill for his invaluable work and his support during my tenure as Editor-in-Chief. After 4 years of working with him, this is how I view him: dedicated, motivated, cutting-edge, honest and fair, highly knowledgeable, down to earth, and, overall, a very nice person. Isn't this what we all strive to be? Thus, finding a replacement was not easy.

Dr Nancy Fischbein from Stanford University will take over Bill's *AJNR* responsibilities. She did her undergraduate and MD studies at Harvard and her radiology and neuroradiology training at the University of California, San Francisco. Nancy is currently Associate Professor and Chief of Head and Neck Imaging at Stanford. Her scholarly activities include nearly 100 peer-reviewed articles, 15 book chapters, and 2 books. These achievements are enhanced by her writing and people skills. She is a highly respected member of the head and neck imaging community. The work as Senior Editor will not be easy; the number of head and neck submissions continues to increase, particularly full-length original articles. She is not alone, as our head and neck manuscript reviewers are probably the best *AJNR* has. Transitions are never easy, and following Bill's steps can be intimidating. I am confident that Nancy will be able to do that and more. Please help me welcome her.

M. Castillo
Editor-in-Chief

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EDITORIAL

Physician Payment Reform: Getting What We Pay For

It has been estimated that half[1] of all of the gains in per capita income of the world, a proxy for standard of living, during the past 2 centuries are due to improvements in human health. Much of this increase in well-being is attributable to improvements in medicine or public health derived from medical knowledge. Inspiration, invention, innovation, and incremental implementation of new developments in technology have made enormous improvements in the lives of people across the globe. They live longer healthier lives, see their children survive to adulthood, and maintain mobility and vibrancy through decades of life in which the old normal was dead or disabled.

It should not surprise us that the proportion of our incomes devoted to health care has risen. This has occurred for several reasons generally summarized as "Baumol's Hypothesis,"[2] which is the profound insight that prices in the personal services sector of the economy rise relative to the prices in other sectors of the economy with time. Personal services are those whose value is determined solely or in large part by the amount of time one human being spends with another. These activities, including fine dining, live entertainment, education, and, most important, medicine, are more difficult to industrialize, mechanize, and, in a material sense, optimize than other parts of the economy. For example, a 21st century automobile factory produces better cars more efficiently than the most skilled expert craftsman of the early 20th century, but a psychiatrist still needs 50 minutes to spend an hour with a patient, notwithstanding the greater efficiency and efficacy of cognitive behavioral therapy or pharmacotherapy compared with psychoanalysis.

The relative proportion of our economy spent on health care has risen substantially, and the amount of health care spending has increased exponentially for decades. The economist Herbert Stein once wrote, "If something cannot go on forever it won't." One need only consider the phenomenon of Elvis impersonation to understand this concept. In 1977, there was only 1 Elvis, but by the 1980s, there were 15,000 or so impersonators. If this growth had continued unabated, by 2010 their number would have been greater than the entire population of the United States, 309 million. Fortunately for all of us, growth leveled off at around 80,000. Not enough of us look good in sequins. Health care is now 17% of the economy, about half of government spending, and if one accepts the concept of tax expenditures, well over half of health care spending is governmental. Because food, clothing, shelter, transportation, and other goods are declining relatively in price, it is easy to imagine an economy with a larger and larger health care sector. It is very difficult, however, to escape dystopian imagination if the current growth rate continues and health care crowds out most of what is left.

At present a majority of the productivity gains in our economy are consumed in health care spending. Most prefer not to consider a world in which almost everyone is a doctor, nurse, pharmacist, or hospital or health insurance administrator. To mitigate Baumol's curse, we need to slow the rate of growth of health care spending and allow the productivity gains in the rest of the economy to catch up. Fortunately, the example of other developed nations, presumably subject to the same macroeconomic forces, shows us that it is possible to provide a better health care system for a lower cost per covered person, at a lower proportion of national income, and at a lower rate of growth, though it is not possible to escape Baumol's curse entirely.

Perhaps we need innovation in American health care finance and economics that is comparable with the creativity and progress that we have made in the other health sciences. The article by Manchikanti and Hirsch[3] in this issue describes the latest twists, turns, and tumbles of the health care finance system in the largest economy in the world. That system is based on many of the same principles that underlay the health care finance system in the oldest civilizations. A fee-for-service (FFS) payment schedule is included in the Code of Hammaurabi, the oldest code of law. Science, culture, and technology have advanced since the code was first written in cuneiform on clay tablets, and perhaps our payment methodologies can advance as well. Optimism is somewhat constrained by observing that the Code of Hammurabi also included an early version of pay-for-performance in the form of outcome-based penalties.[4] Less draconian penalties have recently been added to Medicare.

The options for payment for health care are quite varied, and many have been tested in this country and around the world. In general, the systems include fixed payments to providers at the one extreme and direct patient responsibility FFS at the other. Most systems fall in the middle somewhere and differ primarily in the level of the health care system that receives patients' money, from whom the health care system receives the payment, whether or not there is a portion of the payment that is at risk, and whether the risk is clinical, economic, or both.

Along 1 axis, systems range from pure FFS augmented by pay-for-performance, which puts a percentage of the total compensation at risk for certain quality or value benchmarks. Another step along this continuum might be penalties for specified adverse events. The foregoing are all features of the current Medicare program, in which a basic FFS program is enhanced at the margins with bonus and malus features. These features tend to reward desirable outcomes, processes, or structures within the health care system, facility, or practice but still conceptualize health care as discrete activities occurring almost in isolation from each other.

Episode-of-care methodologies unify the clinical activity at the level of each illness or episode of interaction from start to finish. These are best suited to discrete events such as spinal fusions or strokes and seek to bundle all of the necessary services and medications required into a single payment to be parceled out among facilities, caregivers, pharmacies, and others by the entity selected to care for the patient. Because many of these discrete events are really part of the predictable course of chronic diseases, a further step along this axis might be disease-management plans with specific budgets per diagnosed patient per unit of time. This payment methodology, in theory, would reward the efficient use of resources to prevent complications, hospitalizations, surgeries, and other expensive, and otherwise undesirable outcomes.

Finally, one might proceed to full risk capitation, in which the entire responsibility for patient care for a unit of time would be assumed by an entity paid a fixed price. One might rationalize the risks involved by diagnosis and/or demographic risk stratification and add some sort of stop-loss or outlier carve-out. This methodology is thought to produce disincentives to provide appropriate care in some circumstances and is, therefore, often regarded with skepticism. Because only the patient, his or her family, or the polity in which they live has a relationship that spans an entire lifetime, many prefer that either the individual or the state decide what is appropriate medical care.

Another axis along which payment methodologies may vary is the level of society that allocates the resources or decides how they are to be spent. Around the world, we have seen many variations along this theme ranging from purely centralized single-payer systems with or without patient autonomy with respect to the selection of health care providers, to purely private systems in which health care is simply a service that is purchased according to supply and demand. Most single-payer systems permit individuals to access other systems of care, usually at individual expense, when they think that the system does not meet their needs. Conversely, virtually all nations have some sort of safety net system to provide for individuals, sometimes a majority of the population, who are unable to access the private health care market. Variation along this axis may be thought of as a continuum, as well. A government can fund a system for its citizens, ultimately paid for by taxes or mineral wealth, for example. On the other hand, money raised through taxation or by other means might be redistributed to the citizenry in the form of vouchers for health care or health insurance. Some systems go so far as to adjust the voucher according to the health status of each citizen so that people are not disadvantaged by ill health when they purchase insurance in the private market.

Medicare payment methodologies must move along these axes to promote improved results, both in terms of health outcomes and value for the money spent. Providers of health care services ought to be paid in a manner that encourages desirable health outcomes at the best possible value. This almost certainly will require moving along the continuum away from FFS and toward rewarding quality and value and penalizing poor outcomes and waste. At the same time, our society appears to be moving along the axis from individual- or employment-based coverage to a more universal system of health care coverage. It is hoped that ideas from numerous positive international examples and successful commercial and community-based health systems and the results of empirical research on payment methodologies will yield systems that reduce the growth of health care costs and improve our health at the same time.

Recently, the Centers for Medicare and Medicaid Services has enacted numerous reforms aimed at linking quality and value with payment. These have culminated in the recent announcement of rules for the Accountable Care Organization (ACO) program. Some key features that indicate recognition of the theoretical and practical problems of payment reform merit discussion.[5,6] First, the program permits both payment bonuses and penalties based on quality and cost savings. Second, there are quality metrics that seek to prevent cost savings at the expense of care quality. Third and most pertinent to the current discussion, the cost-savings component is calculated on the basis of the expected rate of growth of cost of care in the population assigned to the ACO, whether or not the patient or the ACO acknowledges the individual as a member. We do not yet know many details, and we do not know whether the program will be successful.

It ought not surprise us that the policy discussions regarding the future of Medicare payment systems are oriented along the axes of individual procedure versus global payment, market versus social payment allocation, and patient versus governmental financial responsibility. Recent proposals, premium support and market allocation, on the one hand, and population-based quality and cost incentives and a powerful payment setting commission, on the other, represent choices along the continua that reflect differing values with respect to the role of health care in society. Another level of the discussion pays homage to Baumol. One choice is to cap Medicare spending at the level of overall price inflation; the other, at the gross domestic product plus a small percentage. If one used data from recent years, both of these metrics would only slow the growth of health spending relative to the size of the economy as a whole.

We do not expect that Baumol's hypothesis[2] will be proved false, but one may reasonably hope that the previously inexorable expansion of the fraction of our national effort that is devoted to health care may proceed more slowly than it has since the Medicare program began in the 1960s. Perhaps, when observing from some future vantage point, we will attribute a large part of our social progress to medical improvements and see a society in which health care has not consumed all of the increases in wealth that our ingenuity has created. Perhaps when health care spending has increased as Baumol's hypothesis predicts, at least we will see that the money has been allocated as effectively as possible.

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EDITORIAL

Computational Modeling and Flow Diverters: A Teaching Moment

Less than a decade ago *AJNR* published some of the first case studies of cerebral aneurysm hemodynamics using the then-novel combination of computational fluid dynamics (CFD) and 3D medical imaging. *AJNR* has since become the pre-eminent venue for such "image-based" or "patient-specific" CFD models, which have provided important clues about the roles that hemodynamic forces may play in the natural history and management of cerebral aneurysms. It is perhaps no surprise, then, that *AJNR* now plays host to what is arguably this young field's first real controversy, by virtue of its potential for immediate clinical and economic impacts.

In last month's issue of *AJNR*, Fiorella et al[1] took exception to conclusions drawn by a paper published earlier this year by Cebral et al,[2] which had used image-based CFD models to show that "flow-diversion devices can cause intra-aneurysmal pressure increases, which can potentially lead to rupture, especially for giant aneurysms." Fiorella et al expressed grave concerns about the accuracy of the CFD models and the design of the study, and cautioned against any rush to judgment about the safety of these devices for certain patient populations. In their reply, Putman et al[3] vehemently defended their results and study design, and took exception to what they perceived as an attack on their scientific integrity.

What is the reader to make of this heated and often highly technical exchange between 2 of the most expert groups in aneurysm hemodynamics and flow diverters? As it turns out, both sides raise valid and important points that reflect issues at the heart of computational modeling and its use in clinical research. And so, in the parlance of contemporary American political discourse, this presents an opportune "teaching moment."

In theory there is no difference between theory and practice. In practice there is. – Attributed to Yogi Berra

On the face of it, Cebral et al's study was straightforward: 1) take 3 cases of aneurysms that had ruptured during or soon after treatment with flow diverters; 2) perform image-based CFD analysis of each aneurysm before and after virtual deployment of the device(s); and 3) identify any hemodynamic factors that might have differed between the 2 simulations. In cases 1 and 3, strong pressure drops proximal to the aneurysm, arising from a stenosis or area reduction, were resolved following recanalization of the parent artery, exposing the CFD model aneurysms to 20–25 mm Hg higher peak systolic pressures posttreatment. For case 2, the virtual deployment of the flow diverter resulted in an increase in flow resistance that required a 25-mm Hg–pressure increase to maintain the same flow rate.

Referring to cases 1 and 3, Fiorella et al argue that the pretreatment pressure drops (and hence the posttreatment aneurysmal pressure rises) predicted by CFD are as much as an order of magnitude greater than those calculated via "the principles of conventional fluid mechanics," which are in turn shown to be consistent with classic in vitro and animal experiments. Putman et al's reply is essentially to point out that those principles and experiments are based on idealized or simple vascular geometries, whereas CFD implicitly accounts for the anatomically realistic geometries in the Cebral et al study.

To help makes sense of this disagreement, consider that the Navier-Stokes equations, which govern fluid flow, comprise 4 competing terms, which account for pressure, shear, momentum, and inertia. Under certain simplifying assumptions (eg, long straight tube, unidirectional flow, etc), these equations can be simplified greatly, such that the effects on pressure of shear, momentum, and inertia can each be separated and solved by hand, namely the Poiseuille, Bernoulli, and Newton laws employed by Fiorella et al. As long as those simplifying assumptions hold approximately, these laws can be used individually or together with confidence. Such is likely the case for the experiments cited by Fiorella et al to back up their calculations, which involved the use of relatively straight tubes or arteries, shallow ($<1°$) tapers, and/or ideal stenosis geometries. It is debatable, however, whether they hold for the complex, irregular, and tortuous geometries considered by Cebral et al.

Having said this, Fiorella et al's back-of-the-envelope calculations are an essential part of any engineering analysis, because such large discrepancies with theory can indeed point to problems in an experiment or simulation; however, they may simply reflect factors that cannot be captured by simple calculations. The former is the position of Fiorella et al, the latter that of Putman et al. Without further evidence it is difficult to know who is right, but as is often the case, the truth probably lies somewhere in between. To their credit, Putman et

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