Xenoeconomics: Reflections on What Is Impossible to Predict

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A reporter once asked me to describe myself in terms of a metaphor. He claimed he didn't understand what I do. Taking his question in stride, I told him he should look upon me as the human embodiment of a hemorrhoid. For all intents and purposes, I am a pain in the backside. Then, in a sincere effort to make my point, I handed him a tube of Preparation H. He was visibly relieved.

My remarks today will focus on the unknown. While economics will surely be a crucial issue in the future of xenotransplantation, I simply refuse to present data that do not exist.

Therefore, it seems to me that there are 3 courses of action. First, we can choose to ignore the issue altogether. This, I am afraid, is often the preferred course. Second, we can speculate out of ignorance. In this case, people are inclined to make something out of nothing. Finally, we can talk about general concerns that will eventually help us understand the issues. Today, this 3rd course will constitute my approach.

Now, let me offer a road map for those of you who might get lost. First, I am deeply concerned about the future of medical innovation. Ethics and economics are on a collision course with science. Life is at stake. Values are in doubt. Second, while costs and benefits are easy to describe, they are not simple to decide. Consequently, cost-effectiveness is an annoying concept. Third, payment for new technology is an alarming problem. Priorities are impossible to establish when everything has equal weight. Fourth, despite feelings to the contrary, health care is not free, and people are increasingly confronted with the issue of affordability. We have to reconcile needs with limits. Finally, we must distinguish between the economics of research and the cost of treatment. Research may represent a benign investment, but treatment is often a controversial topic.

There are many reasons why I believe the future of medical innovation is in peril. Xenotransplantation typifies what has become an unequivocal dilemma. In some quarters, it is now fashionable to rail against medical technology as a necessary evil, a villain if you will. If progress cannot be stopped, there are those who feel it must be contained. As we dig among the ideological rubble, it soon becomes clear that there is an underlying disagreement concerning the value of life.

While technology has the potential to save lives, it can also serve as the means to kill. As a result, xenotransplantation is considered suspect. In my opinion, any society that cannot agree on when life begins and when it ends, faces enormous challenges when death becomes the means to live. The ensuing conflict over goals and objectives becomes unconventional.

This is my 2nd topic for consideration. Regardless of the best efforts of the quantitatively minded, the concepts of costs and benefits remain elusive. In the conventional case, benefits are reflected by improved survival, enhanced quality of life, and a return to productivity. In turn, each of these outcomes is further expressed in terms of unit costs and aggregate expenditures.

I hope you now recognize what is lurking in the shadows.

Appealing as it is, cost-effectiveness has proven to be a difficult concept in both principle and practice. Ethical considerations often get in the way of empirical results. There is, so to speak, collateral damage. This does not, however, stop people from arming themselves with primitive concepts, antiquated philosophies, and dubious methodologies. Take a common example—translating costs and benefits into quality-adjusted life years. This approach ultimately does more to confuse than to clarify the issues. In the end, frivolous academic exercises may generate more heat than light, leaving policymakers to wander in the dark.

Payment for technology is my 3rd topic. In the United States, we talk about coverage and reimbursement policy. Elsewhere in the world, the discussion focuses on resource allocation and rationing. America takes a tough position. It denies the significance of costs while debating the merits of outcomes. Life is sacred.

Throughout Europe, and in Australia, Canada, and New Zealand, there is a benevolent appeal for evidence and firm support for cost-effectiveness as a basis for deciding what can be afforded. Life is valued. Even still, ignoring the rhetoric, very little has been accomplished. The inability to set priorities, which I believe is the basic problem, reflects a lack of leadership on an ill-defined battlefield. Data don't make decisions, people do. And when the solution becomes the problem, we have an issue.

Cost-effectiveness is not Santa's little helper. The concept is cold as steel. No wonder emotion is far more convincing than data, and much more appealing than evidence. When it comes to payment, the playing field is not level, and the battleground favors many reputed enemies of medicine.

The 4th topic of my presentation is difficult. People remain largely unaware of the cost of health care. This should not surprise us, but it often does. Only recently have people in the United States begun to realize that they, not their employers, pay for health care. Private health insurance is merely 1 component of total compensation, and the cost of public health insurance is defrayed through taxes we, the citizens, pay. However, as employers have directly shifted more health care costs to employees in the form of deductibles, copayments, and higher premiums, workers have begun to realize that what they assumed was free comes at a considerable price.

National health systems around the world are equally guilty. They promote ignorance in a different way. These systems are publicly supported through taxes paid by individuals and corporations. But people still do not seem to understand what it is they pay for.

On the face of it, single-payer systems certainly appear to be the fairest of them all, but I remain overwhelmingly unconvinced. No doubt, the gulf between publicly and privately insured persons is pretty much a nonissue, but there are holes in the safety net of universal coverage. In the United States, we have a tendency to segment markets based on payer sources. Privately insured patients are more attractive than those who have become a public obligation. Let's face it—profitability is a necessity.

Thus, the means to live may depend on the ability to pay. This is a reasonable, but troublesome, contingency within a capitalist system. In America, we show our warts, but other nations conceal their misdeeds. While 14% of the United States may be uninsured, health care is not completely inaccessible. We still have a heart, but sometimes struggle to find our soul.

As my thoughts imply, xenotransplantation faces some treacherous terrain. Special operations may be required to sustain us in battle, as others prepare to wage war.

My 5th topic reflects the need for strategy. Our commitment to a long-term campaign is unclear. Research support will be vital in our efforts to perfect xenotransplantation. I have looked for analogies, but I am afraid there are few. The development of the artificial heart may offer some relevant insights.

Briefly, here is what I found. Between 1964 and 2000, the United States, through the National Institutes of Health, spent $403 million on the development of all forms of mechanical circulatory support systems. Adjusting for inflation, this is approximately $893 million—in my opinion, an amazingly paltry sum when spread over 38 years.

Perhaps you disagree. This may actually seem like a substantial commitment. If it does, consider the following. The top 5 Formula 1 racing teams, Ferrari, McLaren, Williams, Jordan, and Benetton, all of which were in Indianapolis this past weekend, will have spent an even larger sum to compete in 17 races this year alone. While this may appear absurd, I can honestly tell you that the return on investment in auto racing exceeds the progress we have thus far made in replacing a failed heart with a mechanical alternative. Although I am not cynical, I am quite skeptical. From the perspective of research, I suspect xenotransplantation will be an even tougher sell than the artificial heart.

Treatment expenditures should be considered separately from research costs. While neither can be precisely estimated at this time, there can be no doubt that xenotransplantation represents a significant technological change in the treatment of end-stage disease. Two concepts capture how transplant services might be affected, and each will have important economic consequences.

First, new technologies, such as xenotransplantation, often replace previous treatment approaches, yielding what is called a *substitution effect*. The unit, or per procedure, costs of new technologies may be higher or lower than the technologies they replace. But, once again, difficult as it may be, benefits must be considered relative to costs. New technologies might offer superior benefits, but at a greater expense that we are willing to bear.

Second, more people may benefit from a new technology than might otherwise be expected. This effect is described as *treatment expansion*. Removing constraints on donor organ supply will necessarily have an expansion effect. I can assure you, human donor organ supply, under any scenario, will never be satisfactory to meet the need for them. In addition, treatment expansion will occur for at least 2 other reasons. First, patients may be transplanted earlier in their disease course. This may lower unit costs, enhance outcomes, and decrease mortality. Second, the indications for transplant are likely to become more liberal, thereby leading to even more transplants.

As you can appreciate, both treatment substitution and expansion will each have tremendous financial implications, but I will insist that these must be, once again, placed in perspective. Restated, treatment substitution may magnify unit costs, but it will yield better patient outcomes at a price we can justify given available resources. Meanwhile, treatment expansion leads to an increase in total aggregate health care expenditures, but it produces a higher level of population health.

Let me conclude with a few minutes of troublesome thoughts about adversaries and allies. In a matter of minutes on September 11, human life as we have known it, ceased to exist. On a global scale, we now face a more complex world.

For the moment, priorities have changed. There are, indeed, other costs and benefits that must be entertained. This will, I am certain, be reflected in research budgets worldwide. National and international security will necessarily be juxtaposed with health sciences research. Of course, there are different means to achieve the same goals. We will soon learn that life science has many disguises.

I am uncertain about the future of technology. The world is hardly as naïve as it once was. There may be fallout for which the scientific community is unprepared. Although I hesitate to speculate, I do wonder if debates

about the value of life, the merits of innovation, and the cost-effectiveness of technology will be dismissed as benign cells in a worldwide conspiracy. As a result, perhaps it will be more expedient to ignore than to understand these issues.

The solution may be easy—eliminate technology and avoid the conflict. Thus, it is conceivable that the future debates pertaining to xenotransplantation will have to resort to unorthodox means. Humanitarian arguments may be more persuasive than scientific elegance. So much for the usual nonsense about evidence.

If our efforts fail, technological terrorism could become a curse rogue scholars will seek to instigate. These thoughts substantiate what I have always believed—the most significant problems in health care today have little, if anything, to do with medicine.

In retrospect, as 6,000 lives lie amid the tangled mess that was once the World Trade Center, and hundreds more lie scattered about the Pentagon, it now seems almost unthinkable that in the aftermath of evil there would have been a grave concern about the inability of grounded aircraft to transport donor organs to dying patients. I am not surprised. You see, even in times of incredible tragedy, there remained an unwavering commitment to humanity—whether it was one life or thousands of lives, each and every one was considered of equal value. We do not discriminate. We are one people.

In horror, we reaffirmed our resolve—we are all a part of a human community and, despite violent opposition and extreme adversity, we must not abandon our efforts to extol its virtues. We have to go on, taking what will always be exceedingly small steps in an attempt to balance the ledger between the killing ways of lunatics and the compassionate caring of health care professionals.

We must never abandon the sanctity of life in an effort to advance political ideology. There is, however, a special place for barbarians—a place where neither political nor religious zealots will find the asylum they seek. And upon reading their final destination, it will become clear to these worthless creatures that hell would have been the preferred alternative.

In closing, I would like to take this opportunity to wish you well on the journey that lies ahead. I admonish you to fear no evil, for we are in this together, until the bitter end.

Amen.

Acknowledgments

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Roger W. Evans, Ph.D.
Consulting Investigator
2251 Baihly Hills Drive Southwest
Rochester, Minnesota, USA 55902-1311
Tel.: 507.281.0886
email: RogerWEvans@aol.com