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Will the United States maintain its position as a world leader in medical technology?

Conflict-of-interest statement
I am seriously conflicted. You may assume that I have a financial interest and conflicts with any emerging med-tech company you choose. In addition, I actually take royalties when possible and encourage innovation and entrepreneurship in others.

As an inventor, my perspective on financial relationships with medical technology companies is quite different from the one presented by Dr. Arnold Relman in his earlier keynote address (see page S33). Although I agree with him that the state of medicine is indeed a mess, the mechanism by which that mess can be cleaned up is debatable. I believe strongly that the mechanism advocated by Dr. Relman—prohibiting financial rewards (outside of salaries) to physicians involved in innovation—will do nothing to benefit patients.

My assessment of the topic I am charged with addressing—will the United States maintain its preeminence in medical technology?—is that it will not. I will use this talk to present the reasons for that assessment in the hope that you will understand that we are going the wrong way in American medicine today.

Committees usually consist of a group of the unwilling picked from the unfit to do the unnecessary.

THE NATURE OF INNOVATION

True innovation requires broad acceptance

Innovation, invention, and technology development are not simple or single occurrences. They represent an iterative process requiring reduction to practice and, most important, acceptability by others. An inventor does not determine the worth of his invention; his peers do. Self-proclaimed inventors are numerous and multiple, and the technologies that they put forward rarely receive broad acceptance. Everybody wants to be an inventor, recognizing that it brings attention and reward, but it also brings a lot of baggage, which I will discuss shortly.

What's wrong with a medical-industrial complex?

Dr. Relman and others may object to the term "medical-industrial complex," but to do so is to deny reality, because health care in the United States simply is a medical-industrial complex, but one devoted to optimal patient care.

The process by which optimal patient care is delivered involves relationships among a whole host of people. In my view, the key players are the engineers and physicians coming together to develop a technology intended to benefit patients—this relationship is a critical element of invention and innovation. At the same time, patients are the most important individuals involved in any process of innovation. Without patients, we simply could not innovate. Of course, other players have roles as well: institutions, the government, industry, entrepreneurs, lawyers, payors, investors. And in the middle of this mix we have chief executive officers of industry, whose job is to make sure all these players are talking to one another and collaborating for the benefit of patients.

CHALLENGES TO INNOVATION

Challenges to innovation are abundant, and some of them have been with us for decades. I have outlined some major challenges below.

Technology evaluation

There are many ways that technology can be evaluated. We hear a lot about evidence-based medicine, which is ideal if used appropriately, yet too many people demand it in a knee-jerk way. In the field of surgery, level I evidence is often impractical, extremely costly, and sometimes not even possible, and attempts to use it may lead to inaccurate conclu-

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Dr. Fogarty reported that he has no financial interests or relationships that pose a potential conflict of interest with this article.

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sions. If applied too broadly, the demand for level I evidence can impede innovation, so it is important to recognize that evidence-based medicine is only one way to get answers about a technology, especially in the surgical specialties.

Teaching and training

Teaching and training of new technologies is another challenge. The shelf life of a new surgical technology is approximately 5 years. Failure to recognize a new technology can lead to a loss of business, as in the case of cardiac surgeons who initially ignored catheter-mediated therapy. Other specialties are rarely willing to help surgeons adapt to new technology, for fear of losing business. So the issues at play can be pretty complex.

Who is to do the training? Because academic medical centers cannot afford to teach new technology, industry must take on this role. We need to recognize that industry offers a very valuable service in the process of teaching and training. As for potential downsides, surgeons should be smart and savvy enough to be able to evaluate whether a sales representative's presentation is solid or nothing more than marketing. If we cannot do that, our medical schools have egregiously failed in their mission.

If you do not have conflict of interest, you are not doing very much. It is impossible to get rid of conflict of interest if you are going to be a productive human being.

Cost

Cost is one of the most significant deterrents to innovation. The accelerating cost of innovation is difficult to imagine. For example, the first embolectomy catheter cost about $3,000 to develop back in the early 1960s. As its developer, I can tell you that it cost so little because I stole or borrowed—on a permanent basis—most of the equipment needed to make the catheter systems, which I sterilized in a preparation of glutaraldehyde (Cidex) and reused. Compare that cost to the cost of developing the drug-coated stent. If the costs of the drug, the device, and the clinical trials are all included, Johnson & Johnson's total cost of developing its drug-coated stent was more than $1 billion.

What is often not acknowledged, however, is that technology may be a solution to accelerating costs. Many startup companies fail to obtain funding simply because venture capitalists do not believe they will be able to make money based on the cost of product development and dissemination. Therefore, many potentially valuable technologies that could address large patient populations may never see the light of day. This is a very significant problem that must be addressed. Overregulation, when analyzed, is extremely expensive.

'Committeeism'

Another obstacle to innovation is likely to be familiar to all: what I call "committeeism," or the expansion or growth of multiple committees for multiple purposes. It is rampant not only among universities but within industry as well.

There is an overabundance of committees involved in technology evaluation and acceptance at hospitals in the United States, including the institutional review board (IRB), the conflict-of-interest committee, and committees in charge of everything from ethics to contracts to adjudication. The IRB is clearly the most valuable, but it is only as effective as its members. Through the *Federal Register*, the federal government has outlined what the functions of IRBs should be.[1] However, I have personally polled IRB members and found that very few are aware of these *Federal Register* guidelines for IRBs. As a result, individual IRBs come up with their own concepts for what they are supposed to do, and often they do not correlate with the *Federal Register*'s concepts, which obviously creates problems.

Of course, committees are necessary to some extent and they can bring value. In my experience, however, committees usually consist of a group of the unwilling picked from the unfit to do the unnecessary. Too often we come out of committee meetings with little more than the date and time of the next committee meeting—or perhaps with a newly created subcommittee, whose members are typically culled from those absent from the committee meeting. If we honestly reflect on the effectiveness of most committees, we will usually conclude that it is fairly marginal.

From the standpoint of the inventor or innovator, committees and consensus can constitute a significant deterrent. Invention is not done by committee. Patients are not treated by committee. Many committee members have never been involved in patient care, yet physicians are encumbered by committees and a point is often reached where the patient is not being served in the best way. Of course, oversight is needed, and we still need some committees, but the overall number and value of committees needs to

be reevaluated throughout the health care system. My experience suggests that fewer committees and smaller committees would serve us all better.

Conflict of interest

Conflict of interest represents yet another challenge to innovation. The dictionary definition of *conflict of interest* is "to be at odds." My practical definition is that it involves trying to serve more than one master.

Who has got conflict of interest? We all do. If you do not have conflict of interest, you are not doing very much. Should we get rid of our conflicts? We cannot—it is impossible to get rid of conflict of interest if you are going to be a productive human being.

Conflict of interest exists in practice. When a surgeon operates on a patient, is he or she doing it to benefit the patient or to make money? The honest answer is that it is probably for both reasons.

Likewise, conflict exists when physicians are involved in research, either basic or clinical. Why do we do research, and why do universities encourage it? In the case of basic research, is it done for discovery, or to pay for direct and indirect overhead? The reality is that it is done for both reasons. Similarly, clinical research is conducted for many reasons. One is to benefit patients. Another is to gain notoriety as someone who has benefited patients through innovation. A third reason is financial. In most cases, clinical research is probably done for all three reasons, and the particular emphasis will differ according to the individual.

In most cases, clinical research is probably done for all three reasons—to benefit patients, for notoriety, and for money—and the particular emphasis will differ according to the individual.

The concept of making money while benefiting patients is egregious to many academic medical centers today. But the reality is that if you develop useful technology, you will make money. That is just the American way. Should medical innovators start out with the motivation of making money? No, although some do. However, if their innovation provides a real service to humanity, there is nothing wrong with that approach, although financial rewards should come only as a byproduct of benefiting patients.

Institutional conflicts are present as well. Historically, institutions have had significant conflicts of interest, but only recently have these conflicts been scrutinized. Advertising of services is an example of an institutional conflict, with the goal being to attract patients to increase revenue. Whether or not this is bad depends on whether there is an overriding benefit to patients in the big picture, as well as on how the advertising is done.

Finally, there are personal conflicts as well. How much time do you spend at the institution? How much time do you spend seeing a patient? Doing clinical research? Spending time with your family? All of these things are technically in conflict with one another, and occasionally they can represent serious conflicts. Conflicts are inescapable, so to say that you do not have any is simply not consistent with reality.

Academia

The way that some major academic centers have responded to concerns about conflicts of interest has actually turned some of these academic centers—which are supposed to promote exploration and innovation—into deterrents to innovation. To innovate at these institutions has become extremely cumbersome, costly, and inefficient. I do not believe that these institutions—which include prestigious teaching centers such as my institution, Stanford University, and Harvard Medical School—really understand the effects that some of their policies are having. Nevertheless, these policies are taking a toll as these institutions do less and less in the way of medical innovation. In the process, the institutions are failing to fully serve their missions. An example of the mentality behind such policies is laid out in the following section.

A CLOSER LOOK AT CONFLICT: ONE WAY *NOT* TO GO

AAMC's 'rebuttable presumption' policy does not serve patients

The Association of American Medical Colleges (AAMC) is a group of academic institutions that helps to define policy for the conduct of research in academic medicine. A few years ago an AAMC task force came out with a policy for the oversight of financial interests in clinical research, which states the following: "Institutional policies should establish the rebuttable presumption that an individual who holds a significant financial interest in research involving human subjects may not conduct such research."[2]

This "rebuttable presumption" policy, which establishes the premise of guilt until innocence can be proven, is decidedly un-American. Although

patient harm or other abuses can occur when a physician performs clinical research using devices, procedures, or drugs in which he has a financial stake, such abuses are quite rare in my experience. This AAMC policy is not in the best interest of patients because it insists that innovators recuse themselves from research that involves the very technology in which they are the ones who are most expert and knowledgeable. As a result, patients who are candidates for a new procedure or a procedure that uses a new device will not be able to undergo the operation at the hands of the most capable person but must be sent to another surgeon. This is the case even if the patients are referred to the innovator by their own personal physician and even if another independent surgeon agrees that the proposed procedure makes sense.

The only party whose interest is served by this ridiculous policy is the institution, as the goal is to prevent potential adverse publicity. In this, too, the policy is misguided, since bad publicity for an institution can come from cases involving new procedures and old procedures alike.

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Conflicts must be accepted and managed

The AAMC has come out with a related policy maintaining that conflicts of interest among researchers are to be avoided at all costs. I take that to mean that researchers are supposed to just die, since conflicts of interest are inherent in our existence and represent a critical element in all relationships. It is true that most routine daily conflicts are not serious, but to deny conflicts when they exist serves no useful purpose. We have conflicts and we have to learn how to manage them, consistent with protecting the interests of individuals. In the case of physicians, these individuals are our patients.

THE NECESSARY WORK OF DEFYING CONSENSUS

Much of what is done in health care—developing rules and regulations; issuing recommendations, standards, and guidelines; working to increase compliance—is aimed at creating order and consensus. While a certain degree of order and consensus is necessary, of course, these are not the factors needed to spur improvements and advances. Improvement requires people who are willing to challenge, who will defy consensus and tell us what we are doing that is not so good.

This is the natural tendency of the inventor and the innovator—to go against the grain, to go outside the standard of care and do something that is new, that is not in compliance, and that may or may not be accepted. This is why, in my view, it takes more courage than brains to be an innovator. No one likes to be ridiculed or to be told that they are not in compliance and are perhaps endangering patients' lives. Of course, inventors and innovators often do not help themselves in this regard, as they tend to be odd ducks by nature and do not always express themselves well. Still, their function of defying consensus is necessary to virtually all medical progress.

A WAKE-UP CALL FOR INNOVATION IN AMERICA

I will conclude by returning to my broad topic of whether the United States will maintain its preeminence in medical technology. As I said at the outset, I cannot answer that question in the affirmative, largely because of the breakdown in cooperation and collaboration among practitioners, academia, and industry for the reasons I have outlined above.

The signs of our waning preeminence cannot be missed. The manufacturing of medical technologies is going offshore, with significant economic implications. More importantly, clinical studies are now increasingly moving offshore. I was recently involved in 9 months of offshore clinical studies to collect the necessary data to submit a device for US approval, because the studies were prohibited from being performed in the United States. Despite this prohibition, it is these offshore studies that reveal any deficiencies in the technologies being assessed and that allow those deficiencies to be corrected for the benefit of US patients. And US patients themselves are increasingly going offshore for medical care—either to obtain medications or to undergo procedures that involve a device that cannot be used in the United States.

As a result of the above developments, significant investment is going offshore, taking with it a great deal of interest in innovation. Meanwhile, that interest in innovation is decreasing in the United States because it is being deterred, delayed, and encumbered by overregulation. This practice is not in the best interest of our economy and certainly not in the best interest of patients in this country, and not enough people are aware of this considerable problem.

I will be happy to take questions from the audience.

DISCUSSION

Question from audience: Is it possible that changing some laws could allow us to increase innovation and enable more clinical research?

Dr. Fogarty: I think it is possible, but laws cannot be changed unless people become aware of the issues. I want to spend the rest of my life making people aware of issues that deter innovation. That is the reason I started the Institute for Innovation: to create an environment in which innovation can take place efficiently, honestly, effectively, and with proper oversight to ensure consistency with the relevant rules and regulations. Many of the rules and regulations are self-imposed. Most of them are misunderstood by the people to whom they apply.

The rapidity of technologic change clearly outpaces the ability of the Food and Drug Administration (FDA) to keep up. The FDA has a difficult time attracting people who have the background and experience to assess the value of clinical investigation. My approach to the FDA is to be as collaborative as possible. I will approach the FDA and simply ask what they want me to do to support a submission for product approval and then assure them that I will do it if it is possible. That is a good way to make clear that your intent is to be collaborative for the benefit of the patient.

It takes more courage than brains to be an innovator.

Another problem is that regulatory and reimbursement approvals should be simultaneous and take parallel paths, but that is not the case. While the FDA covers the regulatory piece, the Centers for Medicare and Medicaid Services (CMS) covers the reimbursement piece, and it has a different charter and operates on a separate timetable. What happens is that old technologies are being rewarded by being reimbursed but new technologies are not being rewarded because they are not being cleared for reimbursement quickly enough. Ultimately CMS will pay for these new technologies, but if a product is a 510(k) submission (a premarket submission to the FDA to demonstrate that a new device is at least as safe and effective as an existing device),[3] the interval from the time of concept to implementation is usually 7 years. This delay cannot be tolerated, since it means that many patients are being deprived of the potential of effective technology as a result of regulation.

Question from audience: I agree with many of your criticisms and your concern about bureaucracy getting in the way of innovation. However, I really object to your use of the term "the American way," which implies that there is an "un-American way," which I guess is the way that is different from your way. Also, you seem to imply that the medical-industrial complex has as its primary purpose good patient care. But this complex does not have any fiduciary responsibility to patients, so what do you base your implication on?

Dr. Fogarty: Industry does not want a bad outcome, just as a physician does not want a bad outcome. If you have related to industry throughout your career, you will come to see that this is absolutely the case. Now, are there bad occurrences within the framework of industry? You bet there are, but they are not common and they are not intended.

Question from audience: Let me reframe the previous questioner's question. Companies have a fiduciary duty to stockholders to make a profit. The best way to do that is to develop good products that benefit patients. But when you have a product that is just as good as someone else's but you can find a way to sell more of it, you have a fiduciary duty to do that as well. Your duty is to make money, and if there are times when your product does not really benefit patients or is to the detriment of patients, your duty is still to make money. So to say, by definition, that all that people care about is maximizing patient care just doesn't make sense.

Dr. Fogarty: Let me ask you: how often have you related to and worked with industry?

Questioner: I don't think that is relevant.

Dr. Fogarty: It is very relevant. You have to know how other parties think and why they think that way. When responsible people in industry can identify a consistent occurrence of adverse events related to their technology, they do something about it. Now, some don't, and may hide it…

Questioner: And there have been multiple cases of that.

Dr. Fogarty: I am not denying that, because it is certainly true, and they have done so for bad reasons. But that does not mean all of industry functions that way, because it doesn't. It is the frequency that you have to look at. I would suggest that it is relatively infrequent, although sometimes it is very egregious. It is the same way with physicians.

Question from audience: Perhaps regulation is actually beneficial to industry, in that it creates a barrier

to entry. For example, when Johnson & Johnson has to spend a billion dollars to develop a drug-eluting stent, it can be highly confident that there are very few other entities capable of reproducing that feat. As a result, it will have a lot of market presence for many years to allow it to recoup its investment. How would you respond to that?

Dr. Fogarty: You are right—I have seen companies take products that obviously warrant a 510(k) submission and try to submit them as PMA (premarket approval) candidates for precisely the reason you suggest. That type of thinking does go on, but those who really understand economics recognize that that is not a good way to go. From my perspective, competition is good, and to eliminate it by any mechanism is not good. If you are going to have competition, you want to have good competition because you can learn from it. Overregulation that creates barriers to entry is not in the interest of patient care and it encumbers competitive companies, certainly from a time standpoint.

Comment from audience: I enjoyed Dr. Fogarty's talk, but I would like to add one comment: we should not confuse duty with ethics. One's duty is to make money, but one's ethics are to be honest, and we each have to decide what we are going to follow. That is true in industry, and it is true in medicine. I have worked with a lot of companies, and most of them are ethical and have the patient's best interest at heart. I have seen companies spend millions of dollars on products that never came into clinical use because clinical trials showed them not to have value. Most companies cannot sustain that because they will disappear. The bottom line is that I have seen very high ethics within industry, as I have in medicine. The problem is that when ethics are violated, it hits the news and then unfortunately gets generalized to the entire profession or industry.

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