

THE ORTHOPAEDIC FORUM



TOPICS IN MEDICAL ECONOMICS II: SPECIALIZATION

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Specialization within medicine, a trend that is nearly a century old, is still a hotly contested subject. Within orthopaedics, for instance, we are debating the merits of a new Board of Spine Surgery and new Certificates of Added Qualifications. The concern about specialization extends to academic medicine as well, where the so-called “triple threat”—the physician who excels at clinical care, teaching, and research—is threatened with extinction by those who concentrate in only one of these three areas. Traditionalists may decry this trend toward increasing specialization, but the better response is one of wonder. We must ask: Who is killing the generalist—and why?

David Ricardo suggested the answer¹. Ricardo, a London merchant (and the father of modern economics) provided an enduring explanation of specialization nearly two hundred years ago. He showed that specialization arises and thrives because it helps to generate wealth. As such, specialization is not necessarily the product of individuals who are colluding to take unfair advantage; the “invisible hand of the market”—people acting out of enlightened self-interest—is enough to guide its evolution.

The Evolution of Specialization

There are cases, certainly, in which a di-

vision of labor is obvious to all. If a market has two producers, such that producer 1 is better at making product A, while producer 2 is better at making product B, we need no fancy theories to tell us how these producers should behave. Using Ricardo’s methods, we can explicitly calculate the advantages to 1 and 2 if each produces that which each makes best. However, Ricardo’s special insight was that even when one producer is indeed best at everything, specialization and trade can still be advantageous to everyone—including the superstar.

Ricardo presented his assessment in terms of political economics (that is, economics involving countries that produce commodities and engage in international trade), but his analyses can apply to the simple setting of two orthopaedic surgeons at work—call them Dr. Cox and Dr. Gene—and only two possible operations, hip and knee replacement. Just as countries can decide which products to make, these doctors may opt to do both operations or they may choose to specialize in one procedure. Following a line of reasoning similar to the one that Ricardo offered for national industries, we can prove the hypothesis that medical specialization benefits both doctors—that specialization is, in economists’ terms, “efficient”—even if one doctor is objectively better at perform-

ing both operations. In the simplified case, it is easy to see the benefits of specialization that can be extrapolated to a world with more than two doctors and more than two operations.

To make this analysis explicit, we need a way to quantify how effectively each doctor performs each operation. In real life, effectiveness is the product of many variables, but for the sake of these calculations I will use the time that it takes the doctor to complete the operation as an indicator of his productivity. (The model could also allow price and quality to vary, but prices are often fixed and quality is hard to measure. Moreover, after considering all of the sunken costs of attending medical school, residency, and further training, the time needed to perform an operation really is the doctor’s marginal cost of “manufacturing” the surgical procedure.)

We can use this model to compute the gains in efficiency that result from specialization. Beginning with the simple scenario in which each doctor excels at one operation, it can be stipulated that Dr. Cox can perform a hip replacement in one hour and a knee replacement in two hours. Dr. Gene’s profile is the opposite: he can perform a knee replacement that is equal to that performed by Dr. Cox in terms of price and quality in only one hour, but an equivalent hip replacement takes him

TABLE I Division of Labor Between Surgeons

Workload	Dr. Cox	Dr. Gene
Equal division of labor		
8 hip replacements	4 @ 1 h/hip = 4 h	4 @ 2 h/hip = 8 h
8 knee replacements	4 @ 2 h/knee = 8 h	4 @ 1 h/knee = 4 h
Total operative time	12 h	12 h
Division of labor with specialization		
8 hip replacements	8 @ 1 h/hip = 8 h	0 @ 2 h/hip = 0 h
8 knee replacements	0 @ 2 h/knee = 0 h	8 @ 1 h/knee = 8 h
Total operative time	8 h	8 h

two hours. Even at first glance, it is apparent which doctor should do which operation. A calculation in the mode of Ricardo can be used to make that determination exactly and to measure the gains of specialization precisely.

Let's say that eight patients need a hip replacement and eight need a knee replacement. These two doctors could work most efficiently if Dr. Cox performed the hip operations and Dr. Gene performed the knee operations. An ostensibly fair division of labor—four knees and four hips per doctor—leaves them both at a disadvantage: each will have to work for twelve hours, rather than the eight that would be required if Dr. Cox performed the hip surgery and Dr. Gene, the knee surgery (Table I). Accordingly, if one doctor is skilled in performing one operation, and the second is skilled in another, specialization clearly makes sense.

(As noted below, specialization will flourish only if there is a mechanism for Dr. Gene and Dr. Cox to share their gains. In the absence of this mech-

anism, or if Dr. Gene and Dr. Cox do not trust each other² or if they seek to maximize wealth at the expense of efficiency³ [i.e., work overtime], there will be no specialization and both doctors will be at a disadvantage.)

Specialization Despite Imbalance

Of course, the happy occurrence of commensurate but dissimilar skills is probably an anomaly. The insight that Ricardo provided is that specialization still works in an environment that lacks such divisions of talent. The fact is that even if there is one superstar—a doctor who excels at everything—specialization can still benefit all.

Consider the surgeon, Dr. Deft, who is able to perform a hip replacement in two hours and a knee replacement in one hour. Dr. Schlub, his less skillful colleague, needs three hours to perform a hip replacement and two hours to perform a knee replacement. By objective criteria, Dr. Deft is better at performing both hip and knee replacements. Nonetheless, specialization can

be advantageous here too, because Dr. Schlub has a *comparative advantage* in performing hip replacements. This can be seen if we measure so-called opportunity costs. In an analysis of such costs, one correctly considers not only the time that it takes to perform an operation but also the number of operations that the given surgeon could have performed in the time spent—the cost of opportunities foregone.

Although Dr. Schlub's production cost for a hip replacement is greater than that of Dr. Deft, Dr. Schlub's opportunity costs are lower. When Dr. Schlub elects to perform a hip replacement, he gives up the time (opportunity) necessary to perform only 1.5 knee replacements. In contrast, Dr. Deft's opportunity cost for a hip replacement is two knee replacements; that is, if he performs a hip replacement, he loses the time in which he could have done two knee replacements. Dr. Schlub's opportunity cost is 25% lower; accordingly, a division of labor in which Dr. Deft performs the

TABLE II Division of Labor Between Surgeons with Incommensurate Skills

Workload	Dr. Deft	Dr. Schlub
Equal division of labor		
14 hip replacements	7 @ 2 h/hip = 14 h	7 @ 3 h/hip = 21 h
24 knee replacements	12 @ 1 h/knee = 12 h	12 @ 2 h/knee = 24 h
Total operative time	26 h	45 h
Division of labor with specialization		
14 hip replacements	0 @ 2 h/hip = 0 h	14 @ 3 h/hip = 42 h
24 knee replacements	24 @ 1 h/knee = 24 h	0 @ 2 h/knee = 0 h
Total operative time	24 h	42 h

knee replacements and Dr. Schlub performs the hip replacements can be profitable for both doctors.

Imagine that Drs. Deft and Schlub staff a clinic in which twenty-four patients need a knee replacement and fourteen need a hip replacement. (These numbers are chosen to avoid messy fractions—one cannot, or at least should not, perform four-ninths of an operation—but the principle applies regardless of the count.) A seemingly fair division of labor—50% of the workload for each—would result in the assignment of twelve knees and seven hips to each doctor. Such an arrangement gives Dr. Deft twenty-six hours of work, as he would need twelve hours to perform the knee surgeries and fourteen hours to perform the hip surgeries. According to a similar calculation, Dr. Schlub would need forty-five hours to complete his work (twenty-four hours for the knee surgeries and twenty-one for the hip surgeries). However, if the doctors were to specialize, Dr. Deft could perform all twenty-four knee replacements in twenty-four hours, and Dr. Schlub could perform all fourteen hip replacements in forty-two hours. That is, with specialization both doctors are better off, even though by objective measures Dr. Deft is the better knee surgeon *and* the better hip surgeon (Table II).

The key point is that specialization can evolve even in the absence of a symmetrical division of talent. To paraphrase a common textbook example, even if Sir John Charnley were able to type faster than his secretary did, it would be better for both of them that Sir John stick to hip surgery and let his secretary do the typing; his advantage in the operating room is greater than her disadvantage at the typewriter. In other words, the secretary has a comparative (though not absolute) advantage at typing. To type his own letters, Sir John cedes the opportunity to perform hip surgery. On the other hand, his secretary makes no such sacrifice.

A related point is that the advantages of specialization are not synonymous with objective excellence. In the example above, Dr. Schlub is the “hip

specialist” even though Dr. Deft is the objectively better hip surgeon. (Needless to say, skills are not static; by dint of practice, Dr. Schlub may become the better hip surgeon, but at the outset, by definition, he is not.) The confusion of the terms “excellence” and “comparative advantage” may be relevant to the debate about so-called Centers of Excellence—health systems designated by Medicare to concentrate on performing high volumes of one or two types of operations. A more accurate but less euphonious term may be “centers not necessarily excellent but willing to accept lower fees because of comparative advantages in the cost of production.”

Forces For and Against Specialization

Specialization does not require central planning. In the above example, Drs. Deft and Schlub worked in the same clinic, with each responsible for half of the work. It is not necessary to posit a director of the clinic who, realizing the efficiencies of the trade, mandates the division of labor. Free markets and the barter of goods promote specialization: producers will concentrate their efforts where their comparative advantage is greatest. Of course, in cases in which the gains of direct barter are not equal, some so-called side payments may be needed. Dr. Deft, in the example above, is able to save two hours by the trade, whereas Dr. Schlub saves three. Dr. Schlub may want to buy lunch for Dr. Deft to make the trade equitable and to ensure that it takes place.

Side payments are implicit in the arrangement of a group practice in which, for example, the spine surgeons cede some of their income to the pediatric surgeons. This is not charity: even with the yoke of a subsidy payment, the spine surgeons come out ahead. Because of the advantages of specialization, it is cheaper for them to pay their partners than to be saddled with work they do less profitably. (In fact, depending on the size of the subsidy and the relative profitability of each specialty, it is possible that the spine surgeons should be considered the beneficia-

ries—and not the benefactors—in this arrangement.)

A similar application of comparative advantage exists in academic medicine. Dr. Polymath may be the world’s best surgeon, best teacher, and best researcher—but she can’t do all three simultaneously. She will therefore be at a comparative disadvantage in some arena. Her colleague who has a PhD may be only half as good a researcher as she is. By the same token, this colleague without medical training cannot perform surgery and hence has a lower opportunity cost. The scientist may be willing to perform research for, say, 20% of a surgeon’s salary. Buying one-half of the productivity for one-fifth of the price is a bargain, needless to say.

Specialization, as I have shown, offers powerful advantages, but there are, of course, good reasons why complete specialization does not evolve. For instance, there may be barriers to trade. Drs. Deft and Schlub, for example, may not be allowed to exchange patients—or don’t trust each other to reciprocate in terms of referrals. Also, the gains from trading may be insufficient to offset the frictional costs that such trades create.

Another factor militating against specialization is that a wide-ranging approach may offer gains elsewhere. A hip surgeon who performs an occasional knee procedure may be able to manage a femoral fracture that extends to the knee, whereas the pure hip specialist might be at a loss in such a case. Likewise, a researcher who also practices clinical medicine, for example, may be capable of insights that a laboratory-based researcher may never have.

Some doctors, furthermore, may elect to continue general practice merely to prevent the atrophy of their skills. They may choose to be slightly less efficient, perhaps, so that they may retain skills that would otherwise be lost. This approach may have a direct economic advantage, as it may help to ensure against unemployment. Just as some investors diversify their capital investments as a hedge against unrest in one segment of the market, it may be

smart to diversify one's human capital and retain varied clinical skills in case the demand for one specific procedure evaporates.

A final consideration is that general clinical practice (or including teaching and research in one's surgical career) may simply be more enjoyable than a specialized practice. Granted, some doctors may take comfort in their mastery of one area, yet others may become bored if every patient whom they see has the same problem or needs the same operation. Of course, the doctor who chooses general practice for his or her own pleasure should be willing to accept a lower wage than the subspecialist with highly honed skills.

Policy Implications

This analysis of specialization is presented, clearly, from the perspective of the doctor. I haven't said what is good for everybody else. Patients, for instance, may be better off if they are able to go to one doctor for all of their health problems. (And in a small town, even if specialization were theoretically advantageous, there may not be enough work for two doctors. The lone surgeon may thus be compelled to pursue general practice.) Consideration of all perspectives is certainly a reasonable approach. Still, the mere existence of the costs to others, either patients or fellow physicians, is not a reason to outlaw a given method. That is, just because specialization inflicts costs on some, it does not follow that it should be limited on that account alone. It may be best to allow specialization but to create mechanisms for distributing the gains that result.

This perspective was offered by the economist Ronald Coase, whose work in this area was awarded the Nobel Prize in 1991. Coase suggested that "costly" approaches are not necessarily inefficient or unfair—as long as there are appropriate side payments made from the winners to the losers⁴. Let's say that a certain arrangement allows A and B to gain \$20 each but

causes C to lose \$10. Does that mean that we should outlaw this arrangement just to make C happy? Perhaps not. A mandated payment of \$10 from both A and B to C places them all \$10 ahead. The crux of the analysis, then, concerns not only who wins and who loses but the magnitude of those wins and losses and whether they can be distributed equitably.

Specialization, in sum, can flourish even if there is one player who is best at everything—because that superstar cannot do everything at once. His or her high opportunity costs give less efficient producers a comparative advantage in some tasks. Specialization develops because gains can be realized by all parties—even those universally skilled like Dr. Deft. Leaders who are considering the question of establishing new specialty boards and subspecialty certificates should be reminded that specialization and trade are, in some sense, the result of a natural evolutionary course.

Needless to say, Ricardo's insights shed no particular light on the question of whether there *should* be a Board of Spine Surgery or a Certificate of Added Qualifications in the subspecialty fields—these are really questions of monopoly regulation. However, they do explain why it is likely that a community of doctors will evolve into pockets of subspecialty practices. In that sense, establishment of a board or a Certificate of Added Qualifications does not create specialization but only recognizes the specialization that occurs without them. They are the effect, not the cause, of specialization. Even without special Board recognition, spine surgeons will choose to perform spine surgery primarily (and pay for the privilege) because it is an efficient way to practice.

However, we should not worship exclusively at the altar of efficiency: efficiency is not everything! For example, medical societies have decided that all doctors must participate in continuing

medical education, even though doing so may not be efficient in the short run. Perhaps the entire system of medical education and licensing is, by some measure, inefficient. So we must look beyond that one aspect alone.

Specialization demands scrutiny. We should ensure that the gains in efficiency exceed the losses on other fronts, and that the rewards of specialization do not unfairly accrue to only a small group. Regulation of specialization is therefore a legitimate response in some cases. Yet to take the reactionary pose and to assume that specialization brings no advantage—to wax nostalgic about the "days of the giants," when surgeons fixed a femur, delivered a baby, and then took out a gall-bladder on the same day—is to ignore wisdom that has endured for 200 years.

NOTE: My thinking about specialization was greatly influenced by David Friedman's book *Hidden Order: The Economics of Everyday Life*. I also thank the three reviewers of this article for their comments and insights.

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