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Why Some Health Policies Don’t Make Sense at the Bedside
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Cost-effectiveness analysis and other forms of decision analysis are becoming more common in the medical literature and are increasingly influential in the development of health policy. Nevertheless, many clinicians find it difficult to apply policies developed from these analyses to individual encounters with patients. We examine the assumptions behind these analyses and argue that the perspective they embody can make clinical strategies appear to be less risky in theory than they are at the bedside. We believe that this problem underlies the intuitive concern many physicians have about policy analyses and calls into question the value of these analyses in shaping clinical practice. These analyses aggregate the benefits and burdens of alternative interventions across different individual persons. Thus, overall population risk appears blunted, as it would in a diversified portfolio of stocks that react differently to financial forces or in a herd of cattle that react differently to veterinary interventions. The assumptions behind these analyses make sense if aggregate outcome is what matters, but not if one cares about each individual investment or animal. Because such aggregation tends to understate individual risk, when applied to human health policy, it may misrepresent the interests of patients and cannot be assumed to provide useful guidelines for decision making at the bedside.


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When cost-effectiveness analysis, decision analysis, and other forms of health policy analysis were first introduced as tools for clinical decision making, some physicians complained that the quantification the analyses required was artificial, simplistic, and dehumanizing (1–4). Perhaps some of these concerns have been overcome, because these analyses are becoming more common in the medical literature and are increasingly influential in the development of health policy and clinical guidelines. Nevertheless, many clinicians find these analyses difficult to apply during individual encounters with patients.

Concerns about these analyses take many forms. One common concern stems from the recognition that patients can vary widely in their preferences, and, thus, that analyses using an average set of goals may not represent the interests of all patients. Another concern is that analyses that include monetary inputs, such as cost-effectiveness analyses, are difficult to apply to individual patients, who usually face a personal cost that differs from the cost used for the analysis. A third concern is that the interests of society are often distinct from those of individual patients and, thus, that some policies developed to further societal goals can seem ill-suited to some patients’ interests.

These limitations of policy analysis are, in general, well understood. In this paper, however, we discuss a fourth, more subtle, interpretation of clinicians’ concerns. Medical decisions appear to be less risky from the perspective taken in a policy analysis than they do from the perspective taken by physicians, patients, and other decision makers who must apply policy at an individual level. Even if all patients have similar values and preferences, the individual effect of costs can be adequately measured, and the goals of society are aligned with those of individual persons, policy analyses can inadequately reflect the risks faced by individual patients. This is because policy analyses focus on the outcomes of groups rather than on the outcomes of individual persons. Because clinicians treat patients one at a time, this difference in perspective can make the results of policy analyses difficult to apply and may explain the gap sometimes seen between health policy and clinical practice.

We believe that this problem helps to explain the intuitive concern that many physicians have about policy analyses, and that it calls into question the value of these analyses in shaping clinical practice. Although there has been some discussion in the medical literature of differences between individual and group perspectives, much of this discussion has focused on the ways in which outcomes are framed or the manner in which information is presented (5). Deber and Goel (6) have discussed some of the failings caused by presenting only central tendencies—a common practice when outcomes are presented from the population perspective—but the implications of these concerns for clinical policy analysis are not generally well understood.

Managing Risk in Financial Settings

Every medical decision entails the chance that something will go wrong or that a different choice would have been better. Similarly, when an investor buys stock, there is always the chance that the price will fall or that a different investment would have done better. Investment risks provide a model for understanding the risks faced by physicians and patients in medical settings.

Consider a person with $10,000 and a choice between investing in a stock or a bond. Both investments are likely to provide some return, but both have some risk, as shown in Figure 1 (top). The stock has an expected return of $700 ± $600; the bond has an expected return of
Figure 1. Distribution of potential dollar returns for investments in stocks or bonds assumed to be normally distributed. Top. Individual return anticipated after investment in a single stock with an expected return of $700 ± $600 or in a single bond with an expected return of $600 ± $100. Middle. Aggregate return anticipated for 100 individuals investing in 100 similar stocks or 100 similar bonds when the return of each individual stock or bond is assumed to be independent of that of the others. Bottom. Individual returns anticipated for each investor in the pool or fund represented in the middle panel. The distributions, narrower compared with those in the top panel, reflect the risk reduction provided by diversification. An investment in stocks rather than bonds is relatively more attractive in the bottom panel than in the top panel.

$600 ± $100. Despite the higher return expected from the stock, individual investors might prefer the bond because it has lower variance.

An investor can reduce financial risk by creating a portfolio of investments. Because each stock or bond is unlikely to move in lockstep with other stocks or bonds in the market, variations in investment performance will tend to offset each other. The benefits of diversification are illustrated in Figure 1 (middle); the fund represented is assumed to have 100 investors, each contributing $10,000. Assuming that there are no administrative costs, a 100-stock fund would yield an expected return of $70,000; a 100-bond fund would yield an expected return of $60,000.

The risk faced by the fund as a whole depends on the correlation in performance among the stocks and among the bonds. When investments are not perfectly correlated, the risk faced by the fund is reduced. Figure 1 (middle) shows the outcome for the hypothetical case of independent returns. The distribution of potential returns is much narrower and less risky because the stocks and bonds move independently, and so poor performance of some stocks or bonds is offset by the better performance of others. A fund investing in 100 stocks can attract individual investors who dislike risk and would therefore not invest in only 1 stock.

Individual investors can enjoy these benefits because they share in the risk reduction achieved by the portfolio. The distribution of returns back to individual investors is shown in Figure 1 (bottom), which is identical to that shown in Figure 1 (middle) except in scale.

Managing Risk in Health Care Settings

The principles discussed above are basic to financial markets and represent well-understood mechanisms for managing risk in investment settings. The practices of some large-animal veterinarians use the same kind of risk reduction in a health care setting. For example, a dairy farmer might consider attempting to increase the aggregate milk production of a herd of cattle by altering the herd’s feed or by using hormonal manipulation. The in-
Interventions carry some risk because each cow might or might not respond with a greater return of milk. An intervention with a higher potential return but higher variance might be rejected for a single cow but accepted for a large herd. As long as the outcomes of the individual cows in the herd are not perfectly correlated, decreases in the dairy outputs of some cows might be offset by increases in the outputs of others, and so the intervention might be less risky than it would be if applied to a single cow. Just as an investor reduces risk by purchasing several stocks that react differently to market forces, a dairy farmer can reduce risk by considering the herd to be a diversified portfolio of cows that may react differently to any given health intervention.

Do Health Policy Analysts Treat People Like Cows?

The principles underlying portfolio theory are appropriate for investors or dairy farmers but may not be appropriate for decisions about human health. In particular, the assumption that outcomes faced by individual persons can offset each other effaces the moral distinction between these persons (7). We argue that conventional approaches to policy analysis often make this error: They take a societal perspective and inadvertently assume a redistribution of outcomes to individual persons that cannot be achieved.

Suppose you are invited to play a game in which a fair coin is tossed. If it lands heads up, you receive $100. If it lands tails up, you must pay $50. How much would you be willing to pay to play such a game once? The expected value of the game is $25 (a 50% chance of gaining $100 and a 50% chance of losing $50). Because of the chance of losing $50, however, some might pay less than $25—or perhaps $10—for the opportunity to play this game once. They pay a price lower than the expected value to compensate for the chance of losing. How much would you be willing to pay to play the game 100 times? The expected value of playing the game 100 times is $2500 (100 × $25), but those willing to pay only $10 to play the game once might be willing to pay much more than $100 to play the game 100 times. Although each flip of the coin is just as risky, the group of 100 independent coin flips is much less risky. (Under certain conditions, rejecting the opportunity to play once for anything more than $10 would imply that one must reject the opportunity to play 100 times for anything more than $1000 [8, 9]. Nonetheless, playing once seems riskier, and perceptions may be as important as reality.) To the extent that people like to be compensated for assuming risk, they should pay different amounts per game if they are playing the game once or 100 times (10).

Many health policy analyses treat risky interventions like coin flips. In cost-benefit and cost-effectiveness analyses, for example, the expected benefits and burdens of a medical strategy are assumed to be distributed uniformly over the population (11). The risk to each person, however, is greater than the risk perceived from an aggregate perspective because each person is unlikely to bear the average burden and receive the average benefit (12). When you flip a coin 100 times, you care not about the outcome of each flip but about the average outcome. When you recommend a medical intervention 100 times, however, you ought to care about the outcome in each case. In neglecting the distribution of outcomes across individual persons, health policy analysts implicitly treat human populations in the same way that veterinarians treat herds of cattle, which is to say that they see them as an opportunity to diversify.

Financial Risk and Health Risk

In investment settings, financial returns are easy to redistribute equitably among investors. In health settings, however, redistributions of clinical outcomes are unattainable. Makers of health policy may be able to put individual patients into a common financial risk pool, but they usually cannot put them into a common health risk pool.

The inability to offset risks between persons helps to explain why some of the products of aggregative reasoning—such as cost-benefit analyses or clinical guidelines—often seem inappropriate to the management of individual patients. A recommendation not to order an extra test to detect a rare disease may be hard for some physicians to accept when they are treating patients who face the risks of the disease one at a time. The concern expressed by some clinicians in response to the recent recommendation (13) not to screen for ovarian cancer with CA 125 and transvaginal sonography reflects this tension: The benefits of such a recommendation accrue not to many average patients but to a few diseased patients (14-18).

Roke (19, 20) has described the “prevention paradox”: Preventive strategies applied to the population may have large effects on overall health but seem unattractive at the individual level, where effects are small. In contrast, more targeted interventions little for population health but may offer great promise of individual gain. Hux and colleagues (21) found that when faced with interventions that have only small mean population effectiveness, internists were more enthusiastic when presented with a wide range of possible effects stratified over a heterogeneous population than when presented with mean effects for the population as a whole.

Other findings also reflect this tension. For example, Redelmeier and Tversky (22) compared the choices made by physicians who were presented with a clinical vignette described as a single case with the choices of physicians to whom the clinical vignette was described as a common clinical problem. In one experiment, they found that physicians were more likely to order an extra test to detect a rare condition in an individual patient than in a group of patients. Although such differences might seem illogical, one possible explanation for them is that the physicians considering the group of patients intuitively saw an opportunity to diversify.

This reasoning appears to make sense if, as one expects, individual persons tend to react differently and unpredictably to the same medical intervention. When viewed as a group, their individual outcomes tend to offset each other. Therefore, from a population perspective, one sees less risk when using a single strategy repeatedly (in this case, the strategy of not ordering an extra test) than when using it once, just as the coin flip gamble appears more attractive when one gets to flip the coin 100 times. But health policy recommendations are
implemented at the bedside, where, in most cases, patients get only one flip of the coin. If health policy analyses are to be useful, they must reflect risks and benefits as seen from that perspective.

These differences in perspective are not overcome simply by using utility functions to capture patients' preferences for risk. In general, patient utilities—whether assessed using standard gambles or other techniques—reflect the preferences of patients for different clinical outcomes and the associated chance of achieving undesired outcomes. One response to the concerns raised about public policy analyses, therefore, is that differences in risk perspective are already captured by the utility functions used for the analysis. This is true only if the argument of the utility function is the distribution of outcomes seen from the individual perspective—for example, if the utility function is applied to the distribution represented in Figure 1 (top) rather than to that represented in Figure 1 (bottom). More commonly, however, public policy analyses are presented and judged by their aggregate outcomes.

How Else Might Diversification Be Achieved?

In addition to diversifying by using a single strategy repeatedly over different individual persons, one can diversify by using more than one strategy.

The approach of some large-animal veterinarians to the management of dairy farms provides an example of this form of diversification in the health care setting. To reduce the health risk of a herd of cattle, some veterinarians advocate following different strategies with different cows. Rather than treating all cows in the same way, they might change the feed for some cows and the hormonal therapy for others. If one knew in advance which strategy would be the best, one would follow that strategy uniformly in all cows and achieve the greatest improvements in health. But, because all strategies carry some risk and because the outcomes of different strategies are not perfectly positively correlated, the combination of strategies across different animals can produce overall improvements in the health of the herd that are less uncertain than those that would be produced by a strategy that treated all cows in the same way (23–25). The goal of the portfolio approach is to identify a combination of interventions that provides the greatest return for a given amount of risk.

The rationale for using different strategies with different cows is not that some cows have different preferences, or even that farmers have different preferences for different cows, but that a diversified approach is less risky overall. This rationale conflicts with the basic tenets of human health policy. In human health settings, arguments for using different strategies for different patients almost always derive from the understanding that patients have different preferences, not from the understanding that population risk can be blunted by using a mix of interventions across different persons. If portfolio theory were proposed as an effective method for designing human health policy, then to reduce risk to the population as a whole we might encourage variation in medical practice rather than trying to eliminate it. In fact, however, regional variation in medical practices is seen not as a way to reduce the aggregate health risks of a population, but as a signal that someone is doing something wrong.

Diversification is appropriate in veterinary settings but inappropriate in human health settings because large-animal veterinarians are primarily concerned with the health of the herd and care less about the health of each individual cow. In contrast, physicians ought to care about the health of each of their patients.

Guidelines for Clinicians and Policy Analysts

We argue that many policy analyses implicitly assume that diversification is attainable at the individual level when it is not. Because these analyses understate the risks and benefits seen by individual clinicians and patients, they cannot be assumed to provide useful guidelines for decision making at the bedside. Thus, their clinical application may be difficult or inappropriate. Although we suspect that, in many cases, the implications of a good analysis can probably be used as a guide for the individual patient, clinicians and policymakers should consider several elements before reaching this conclusion.

First, they must be sensitive to the correlation structure of the clinical outcomes represented in the policy analysis. The more individual patients vary in their responses to treatment, the less a population-based analysis should be trusted for individual decisions. The opportunity to diversify increases as the clinical outcomes of different patients become less positively correlated. Because policy analyses inherently offset risks across individual persons, in these situations, they will understate the risks that actual patients face.

Second, they should note how many people will be affected by the interventions. In general, the larger the number of persons involved, the more risk reduction is possible from the population perspective and the more likely a given reduction in this risk is unattainable to individuals.

Third, they must be cautious about close calls (26). When the expected outcomes of alternative strategies appear similar, errors inherent in the perspective of the analysis are more likely to have swayed the recommendation one way or the other. The direction of the bias is impossible to define in the abstract; readers must evaluate these analyses using their own judgment and intuition on a case-by-case basis.

Finally, they should be cautious about recommendations that do not consider population diversification strategies when these may indeed be applicable. If two strategies are truly close calls on the basis of the expected outcome to the individual patients, then the population perspective can be legitimate. Under these circumstances, the opportunity to diversify serves the important societal goal of risk reduction at no cost to individual persons—either by making use of natural and unpredictable differences in the responses of individuals to a single treatment plan, or by using different treatments that have similar expected outcomes with different patients.

Those who conduct and report policy analyses can help clinicians reach appropriate conclusions by considering these four points in advance. They can assist further by not merely reporting their results in terms of means and expectations, but by also reporting the distribution of
potential outcomes that individual patients might face, or by providing some other measure of variance seen from the individual perspective.

Conclusions

Population-based health policy analyses inherently aggregate the benefits and burdens of alternative interventions across different individual patients. Policies that result from these analyses raise several concerns.

First, patients can vary widely in their preferences, so analyses that use an average set of goals may not represent the interests of all patients. Second, analyses that include monetary inputs, such as cost-effectiveness analyses, are difficult to apply to individual patients, who usually face a personal cost different from the cost used for the analysis. Third, the interests of society are often distinct from those of individual patients, and so some policies developed to further societal goals can seem inappropriate for some patients’ interests.

In this paper, we have discussed an additional problem. The assumption that benefits and burdens can be aggregated and then redistributed across individual persons in a population leads naturally to models in which benefits and burdens borne by different individual persons are presumed to offset each other. In turn, overall population risk is blunted, as it would be in a portfolio of stocks or cattle when financial or veterinary outcomes are less than perfectly positively correlated. But these perceptions are illusory at the individual level. Because health outcomes cannot be distributed across persons, these perceptions inevitably understate the risks seen by patients and misrepresent an important element in clinical decision making at the bedside.

We believe that this problem is genuine and that it underlies the intuitive resistance of many clinicians to these studies. As special forms of health policy analysis, such as cost-effectiveness analysis, become more influential in the establishment of health policy, gaps between policy and the actual decisions of physicians and patients take on a new significance.

Health policies can serve many agendas. Sometimes, a policy is put forth to serve important societal goals, such as cost-containment or the control of contagion. These policies may or may not coincide with the interests of patients. Other policies, such as clinical guidelines, are designed to automate or standardize approaches to important and common clinical problems. The purpose of these policies is to guide clinicians toward good decisions and good management strategies so that they can better serve their patients. Policies of this type—no matter how many patients they cover or how widespread their implications—in the end are implemented by patient. Unless these policies reflect the risks as seen from this perspective, they will be out of touch with the true interests they are meant to represent.

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