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Delivering Health

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Ari B. Friedman
December 19th, 2010

[Introduction](#)

[How does health influence insurer profits?](#)

[Health, costs, and demand](#)

[The case of prevention](#)

[Moral hazard and the demand for health contracting](#)

[Why are insurers the right level of the health system?](#)

[Implementation](#)

[Discrete occurrences](#)

[Health status measures](#)

[Nuances, alternatives, and extensions](#)

[Information](#)

[Add bonus incentives to indemnity plans](#)

[Futures market](#)

[Conclusion](#)

[Bibliography](#)

Introduction

From at least the late 1930's onward, when the NIH began granting extramural research funding, 'health research' has largely meant investigation into technological innovations in health. Research into care delivery systems, when it was funded at all, received a tiny fraction of the national budget. This funding disparity continues to this day, with the 2009 AHRQ budget of \$325M palling in comparison to the NIH's \$30B allocation. This same disparity is reflected in medical training, with the majority of student time spent learning about biomedical mechanisms, and little time spent learning about the evidence base for interventions designed based on those mechanisms. The same disparity can also be observed in the health delivery system, where new interventions are reimbursed at a relatively high rate, are consequently rapidly adopted, and are occasionally later found to have been harmful, as was the case with the indiscriminate use of lung volume reduction surgery.

Attention is finally beginning to focus on methods of improving care delivery, as is the case with procedure checklists (Hales and Pronovost 2006), Value-Based Insurance Design (Fendrick and Chernew 2006), and behavioral interventions being pioneered in our department (Volpp et al. 2009). However, even these long-overdue and under-funded attempts to improve the delivery care may not be enough to ensure these novel interventions' adoption. Care delivery interventions are put forward as though proof of clinical superiority is sufficient to ensure their adoption. This is most emphatically not the case.

Non-clinical interventions have long been saddled with higher burdens of proof than clinical interventions. This is eloquently stated for one under-appreciated type of care, prevention, by Warner and Warner (1993): “In common practice, the adoption of curative care seems to require evidence of safety and efficacy at the least, and cost-effectiveness at the most; while adoption of preventive care seems to require evidence of cost-effectiveness at the least, and [...] cost-savings [at the most].” The same might easily be said about all non-curative forms of health interventions, including prevention but also delivery system reform (where even small changes are met with physician resistance in no small part because no new revenue accompanies the change), pay for performance, and attempts to change patient behavior (e.g. smoking cessation was extremely poorly covered until recently, despite evidence of its efficacy). Such a bias towards some forms of health delivery and away from others has many potential explanations of varying plausibility in the health economics and health services research literature, including supplier-induced demand and consumer bias towards things that “look like healthcare.” Yet one explanation has received little attention in either the academic or policy realms: the structure of insurer profit incentivizes them to fund certain types of care over other categories of intervention.

This paper will briefly explore the current relationship between the health of the consumer and insurer profits. Classic models of insurance are considered, and found to predict that the insurer will be concerned with enrollee health only to the degree which the insured individual believes that her health depends on the particular interventions covered by the insurance firm. These models also predict certain types of care will not be insurable, even in the presence of appropriate levels of consumer demand. I then review how moral hazard, income effects, and churn exacerbate the bias against certain types of care if those types of care are not insurable and other types of care is insured.

Having demonstrated the failure of the current system to place similarly cost-effective interventions of different care types on an equal financial footing, I propose an alternative model, based on weaving consumer health into the insurer profit function. First I defend the role of insurers as the appropriate level of the health system in which to make this change, thereby contrasting this proposal with previous well-known proposals such as Accountable Care Organizations. Next, various health measures and their effect on market participants’ incentives are investigated. Specific market structures are proposed for each health measure considered. Finally challenges and extensions are discussed.

How does health influence insurer profits?

Health, costs, and demand

In order to understand insurer behavior, we must understand insurer profit. An insurer considering investment in cost-effective care can anticipate that their profit will be affected by the increased costs of providing the care and by the potential increase in demand for providing the care. Absent cost-savingness (which I will avoid discussing in this essay because it is rare¹), the only way the

¹Although cost-savings to the insurer are rare, it is critical to note that this only arises because the full utility loss of the insured is not paid out when an insured event occurs. If it were, as will

customer's health enters the insurer's profit function is through potentially increased demand for insurance contracts. Therefore, if consumer demand does not transmit cost-effectiveness information in such a way that insurers will respond appropriately, then there is no countervailing mechanism by which the insurer is incentivized to correct the imbalance for the sake of their customers' health.

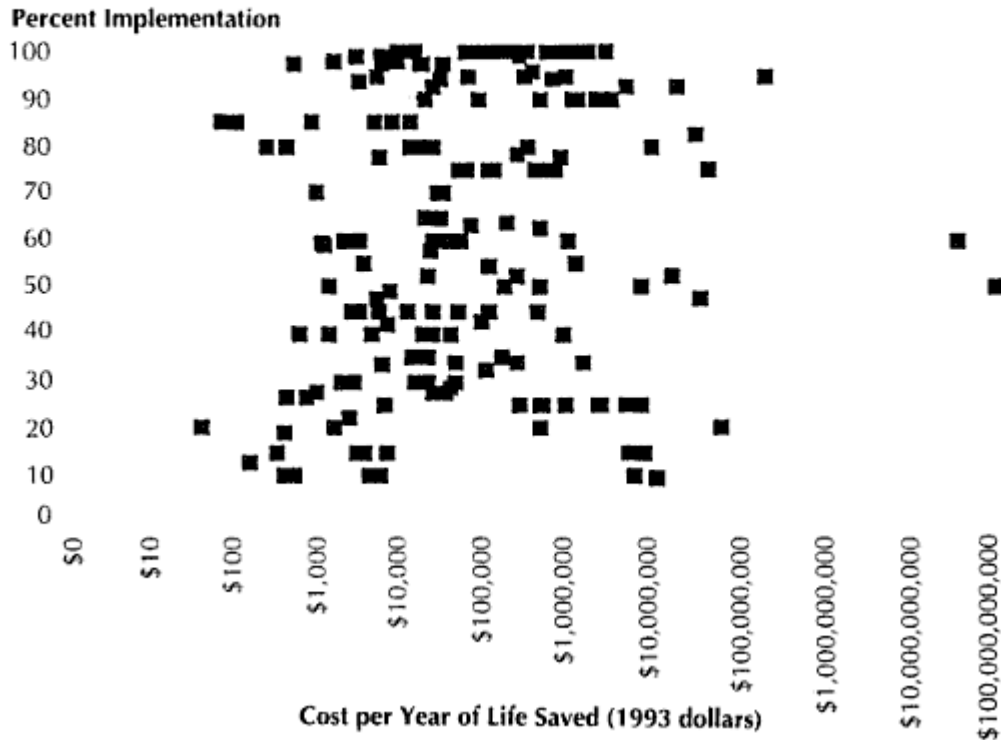
Pauly and Blavin (2008) explore how demand incorporates cost-effectiveness information. They find that if patient demand is based on correct information, optimal coinsurance follows the classic formulation (Zeckhauser 1970). In this case, where coinsurance differs across interventions according to price elasticity, the marginal clinical cost-effectiveness ratios differ across two illnesses. This divergence is in some sense a welfare loss due to moral hazard. This welfare loss, then, provides the first motivation for health contracting: even with full information, if insurance is desirable, consumers want to pre-commit to a given bundle of care in a given severity situation. If they cannot, the moral hazard means that not only will they be consuming more care than is desirable, but they will be consuming it in a fashion in which some diseases receive more cost-effective care than others.

This and other treatments of the demand for a particular intervention logically flow into questions of how demand for a particular intervention affects demand for health insurance contracts (which cover many other interventions as well, and which will be more expensive if the care is covered). In particular, a key question is how demand for health insurance is affected by an insurer's coverage decision for a single intervention, which may or may not be price elastic and may or may not be based on full information. The change in demand for health insurance contracts based on the coverage decision for a single intervention in turn determines whether or not that intervention will be covered. Therefore, demand may lead to distorted incentives for the insurer to invest in that intervention. This paper concerns itself primarily with the case of too few incentives for the insurer to invest in a given intervention relative to the optimum, because the health insurance literature has dealt at length with over-coverage of particular types of care and because as society expands its total wealth, purchasing health is a legitimate end if sufficient benefit is derived--a fact which cost-containment literature elides.

One example in which this lack of insurer incentive to invest in patient health appears to exist in the 'real world' is the puzzle of why insurers do not negotiate price of certain interventions relative to others based on cost-effectiveness--instead nearly every insurer simply takes the relative prices which Medicare pays. In other words, it seems that insurers are not at all sensitive to the health benefits that a particular intervention provides, since the Medicare RVU system is based on cost of inputs not value of outputs. This insensitivity to the quality of care being funded trickles through to the remainder of the health system, either by supporting low-value care, or by failing to enable providers who wish to deliver high-value care to do so. Evidence that such an effect occurs is presented in the following figure from Tengs and Graham (1996), which compares the extent to which an intervention is implemented in the health system with its cost-effectiveness and finds no relationship.

be discussed later, it would be both more common and we would therefore expect to see more insurer investment in prevention and high-value care.

Figure 8-1 Implementation of Life-Saving Interventions as a Function of Cost-Effectiveness



This distortion in funding from distorted demand might arise due to imperfect information. It is easy to see how imperfect information about plan coverage in every conceivable health state and the health impact of each potential intervention might allow a consumer to overlook some high-value interventions which she might want covered. This would mean that cutting back on some high-value interventions does not have a strong negative impact on insurer profit. The traditional solution to this is to stipulate coverage of “usual and customary care,” but that definition creates an inherent disparity in coverage between types of care traditionally found within the threshold of the physician’s office or hospital, and all other types of care. Evidence for an imperfection of consumer information abounds. Kenkel writes, “Information increases the probability that a consumer uses medical care.... Several results suggest that poorly-informed consumers tend to underestimate the productivity of medical care in treating illness” (1990). Consumers also tend to under-demand preventive care relative to its cost-effectiveness (Rosenzweig and Schultz 1983). Even the numerator of cost-benefit may suffer from a lack of consumer information, given poor availability of pricing information at the time of purchasing decisions (Reinhardt 2006). McGlynn et al. (2003) also identified evidence of under-utilization of valuable services.

One proposal to add information into consumer demand, Value-Based Insurance Design (VBID; Fendrick and Chernew 2006) fails to address why an insurer’s concern for patient health is profit maximizing. VBID is thus an interesting technique for an insurer incentivized to care about health to use, but insurers strongly incentivized to care about health appear to be uncommon. Instead, for most, at best VBID will be used to increase utilization of cost-saving interventions but not cost-effective interventions

(or to encourage substitution from one poorly cost-effective intervention to a more palatably cost-effective intervention: again it is cost containment that is being promoted). For VBID to work to increase health by a substantial amount, then, its use must be mandated, suggesting a bureaucratic nightmare in which insurers are forced to act against their incentives by a complicated series of rules.

Finally, models of demand and cost-effectiveness assume homogeneity of consumer preferences (or equivalently, individualized insurance contracts). This is necessary for tractability and so that the model approximates the situation observed with insurers (where pooling of risks is the norm for justifiable theoretical reasons). However, there is a welfare cost to the divergence from homogenous preferences which doubtless occurs in actual pools of insured customers. Suppose some individuals within an insurance pool have different willingness to pay or different information about cost-effectiveness. Yet no individualized contract is available for them. Then, even if the group's assessment of the value of some care is not inaccurate but merely different, the individual who differs will not be able to obtain the optimal coverage she desires.

I next consider a particular type of potentially high-value care in which certain features inexorably lead to utilization that is optimal economically but which is several times lower than the moral hazard-induced consumption of other substitute types of care: prevention.

The case of prevention

Preventive care's share of total health spending has been declining for decades (Berk and Monheit 2001), even as evidence about which risk factors are most important in affecting particular aspects of health proliferates. Explanations as to why preventive care has declined abound, but a substantial portion have centered around a lack of financial incentives to invest in prevention. In the classic Arrow (1963) model, built on the formal definition of insurance, preventive care is a predictable expense and therefore should not be insurable. Yet if consumers do under-invest in preventive care, and if insurers bear the cost of that under-investment, then there may be a case for covering such care, routine though it may be, under an insurance plan.

The recent U.S. Presidential election featured preventive healthcare prominently, with both Democratic candidates claiming prevention saves money (Des Moines Register 2007). The commitment to prevention extended beyond the campaign trail to the 2010 Affordable Care Act's provision of \$15 billion to the Prevention and Public Health Investment Fund (Fact 2010). Yet most prevention does not appear to be cost-saving, and various preventive care interventions have the same range of cost-effectiveness² as curative interventions (Neumann 2008). Furthermore, preventive care tends to be poorly covered by insurers, even when a particular preventive intervention is more cost-effective than a curative intervention which is covered (Warner and Warner 1993). Hence in the U.S. politicians overstate the case for prevention, whereas insurers appear to starkly under-value preventive care relative to its health benefits per dollar.

The debate among policymakers and academics has largely centered around questions of whether prevention should be mandated to be covered by insurance. Scant consideration has been given to what mechanisms might lead insurers to naturally cover prevention. Economic models have much insight to offer as to how market mechanisms might translate consumer preferences for health into insurance

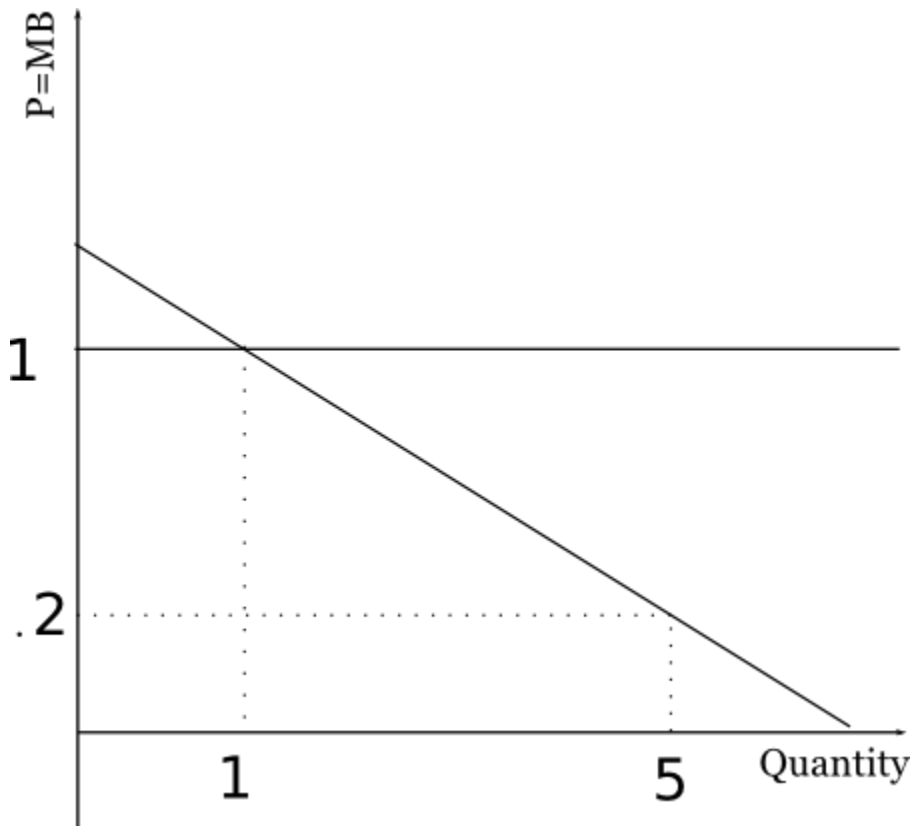
²This includes cost-saving interventions. For these purposes, consider cost-saving care as an intervention so cost-effective that it reduces other health spending.

financing of certain types of care and failure to finance others. The classic theory on the demand for insurance predicts that risk-averse consumers will be indifferent to insuring predictable events like prevention but will desire to insure events which arrive at random such as hospital admissions (Arrow 1963). After considering the administrative expenses and profit of insurance companies, as well as inefficiencies due to moral hazard (Pauly 1968), the basic theory predicts consumers should therefore not demand insurance coverage of prevention.

Still other characteristics of the insurance market have been described which might act to discourage coverage of prevention, including rapid turnover of plan enrollees ("churn") which reduces the profitability of investing in even cost-saving measures, if those cost-saving activities incur a cost to the insurer up-front but pay off over several years—years over which the enrollee may have moved to a competitor's plan before the full impact of the investment is realized. Tax subsidies for insurance plans, as are found in the U.S., might oppose these intrinsic factors acting against coverage of preventive care, as might the purchasing power of a large insurer. Thus prevention is unlikely to be well-covered by insurance for economically sound reasons. The implications of doing so on the cost-effectiveness of care consumed is examined in the next section.

Moral hazard and the demand for health contracting

Insuring some types of care but not others creates demand for contracting on health delivery. When some types of care (such as prevention) are insurable and others are not, moral hazard on the insured care will not only distort the overall quantity of care consumed but will move the mix of care away from the optimum. A basic example of moral hazard makes this point clear. The following figure provides a graphical presentation of this example.



Assume there are two diseases, the acute/risky (o) with probability 0.1 and the certain/unrisky (u) which always occurs. Consider care u to be care which prevents future disease needing care o. We have already shown that u is unlikely to be covered by insurance and is therefore not subject to moral hazard.

Let the price of o and u be the same, \$1 per unit. Assume their demand curves D_o and D_u are the same: $D_o = D_u = -.2Q + 1.2$.

In the uninsured state they will consume until $MB/MC=1$, which is where $Q_u=1$ and $Q_o=1$. In the insured state (20% coinsurance), $Q_u=1$ and $Q_o=5$, at a cost of \$1.5. They then receive health benefits of 0.35. With the same information, in the same period, the individual could instead purchase \$1.5 worth of u, and get health benefits of 0.575, or \$0.75 of u and \$0.75 of o, and receive even higher health benefits. Therefore, the tragedy of moral hazard is not only that too many financial resources are put into health, but that those types of care which are insured receive preferential treatment which reduces the production of health even within an expanded budget.

One attempt to resolve this distortion is to mandate that health plans include care that is not naturally insurable, such as prevention. This was done for certain types of prevention in the most recent health bill. Such mandates have the advantage of putting all care on an even footing, but a footing that will lead to over-consumption of all care. As with all mandates, they are subject to regulatory lag, error, and capture. Regulators will likely not be at the forefront of potential interventions, will likely consider only effectiveness rather than cost-effectiveness, will likely favor interventions found within the current health system rather than the entire universe of options, and may be beholden to various special interests.

Another method of resolving the quandary caused by some care being insured and other care being entirely out-of-pocket, is by restricting supply to counterbalance the elastic demand. This was essentially the strategy of managed care. Yet despite the emphasis on health in the rhetoric surrounding the launch of managed care, when expanded beyond the non-representative sample of the initial HMOs on

which the bill was predicated, the ‘managed care revolution’ quickly came to focus on cost management to the exclusion of health maintenance. This was inevitable when scaling up a policy nationally in which insurer profit did not strongly increase when consumer health was improved. In keeping with the traditional assumption about non-profits, the initial HMOs behaved as though their customers’ health entered into their corporate utility function. When scaled nationally, however, such a situation could not persist, and entering firms behaved in strict accordance with their pecuniary incentives.

Still another way out of this dilemma is to write specific indemnity contracts for each severity-disease level, which deliver a fixed sum in each specific health state that approximates the full utility loss (the health costs plus the lost valuation of health from being ill). This concept suffers from an impossible plethora of states which much be described, valued, and priced *ex ante*. I propose instead contracting on health state improvement, in a variety of ways to be described. Furthermore, if consumers are imperfectly informed as to the effectiveness of various interventions, as was argued previously, then they might prefer a contract to ‘deliver’ a given number of units of a given health metric by a certain date. In so doing, they would not need to know about the effectiveness of care, but merely trust their health delivery financier’s recommendations. One additional benefit is that contracting may somewhat ameliorate the incomplete markets seen in health insurance. Insurers do not currently offer financial coverage against the utility losses of illness, even though those losses often greatly exceed the insurable financial loss (Tolley, Kenkel, and Fabian 1994). By contracting on an agreed-upon measure of health status, the total utility loss could be insured. As I will discuss, not only does this fill in the missing market for insurance, but the insurer is properly incentivized to fund high-value care.

Consumers therefore have some inherent desire to purchase health improvement directly, rather than purchasing activities which might improve health or financial coverage against the care needed to health disease. Entities which partially serve such a role exist in the current market: in some ways, health insurers serve as health delivery financiers more than indemnifiers against financial loss. For instance, insurers almost always cover annual physicals, even though such care has known need. Fuchs (1976) points out that consumers often prefer low-deductible, low-maximum coverage plans over the high-deductible, high-maximum plans which the Arrow model would find more favorable. Further support of the idea that individuals look to insurers for more than financial protection against uncertain losses comes both from the redistributive aspects of insurance which have enjoyed wide support (such as Medicare and to a lesser degree, Medicaid and community rating), and from the value added by being part of a “purchaser’s co-operative”--the bulk negotiation of discounts from providers. The value of this latter network is most cleanly illustrated in the dental market, where there exists a non-trivial market for dental discount cards allowing access to the insurer’s provider network at the insurer’s negotiated rates.

Why are insurers the right level of the health system?

Because much of the uniqueness of this proposal lies in its being implemented by insurers, rather than other entities within the health system, the discussion of why insurers are the proper implementers of this proposal merits elaboration. Consider first that no such contracting currently exists: one cannot ask one’s doctor for a payment or even a refund if the pill prescribed or procedure performed fails to achieve

the promised result, for instance³. Physicians and even hospitals may not serve enough customers to be risk-neutral, since they serve relatively few patients over whom risks might be spread. Insurers, by contrast, aggregate large pools of customers, and have as their core mission the assumption of (diversifiable) risk.

Insurers have some practical advantages in their current position within the health system, in that they gather considerable information on patients across many settings. For instance, they receive nearly all drug prescription data, even if the patient uses several pharmacies. Furthermore, insurers have the expertise to manage population-level statistical information and make decisions based on that information. No other segment of the current healthcare system is organized in such a way. Similarly, due to their size, insurers can spread fixed research costs over large numbers of contracts, providing the ability to investigate which types of care are most effective. Those investigations might be formal trials of new interventions on a randomly selected subset of their population base, or might be informal assessments of new interventions in the anecdotal manner in which firms in high-innovation industries tend to work.

The insurer as health contractor is a particularly appropriate arrangement for preventive care, since many preventive care interventions are not delivered by physicians or hospitals directly, and because financing is an oft-cited reason why preventive care counseling and delivery fails to materialize. Insurers are more likely to be neutral between dealing with hospital-based practitioners and arranging prevention using non-physician entities (e.g. fitness centers, home health, pharmacists).

Accountable Care Orgs (ACOs) attempt to fix some of the problems of traditional health insurance arrangements, but at the provider level they are still acting on too small a population to smooth out risks and average out fixed costs. Moreover, under current proposals they are not strongly incentivized to care about patient health for the same reasons I have argued health insurers may be under-incentivized to care about patient health. To the extent that ACOs are vertically integrated to include an insurance component, however, they might make excellent prospects for a contracting-on-health arrangement.

Finally and perhaps most intriguingly, insurers don't have access to any more information than the statistician developing the performance metric. By contrast, hospitals and physicians have more detailed information on patients than does the algorithm (such as a subjective assessment of the likelihood that a patient will comply with medication use), and can select patients expected to perform better than the algorithm predicts. Insurers, though, have limited ability to do so except in the limited circumstance in which they manipulate patients into selecting themselves, as with the common example of health insurers offering gym memberships in order to cherry pick healthier customers⁴. Therefore fewer unforeseen consequences are likely when targeting insurers for health contracting.

³In an exception that proves the point, Geisinger Health System offers 'warranties' on certain surgeries. Notably, the primary insurer with which it has such contracts is its own wholly-owned insurance firm.

⁴In a related twist on the classic gym membership offering, I recently saw an ad for a Medicare provider which is now offering free worldwide travel insurance, presumably in an attempt to cherry-pick the globe-trotting elderly, who one assumes would be healthier than average.

Implementation

Having established that consumers should have some inherent desire to contract for health delivery, and that those corporate entities currently known as ‘insurers’ are an appropriate counterparty with which to contract, this section investigates what such a contract might look like. Since a key aspect of a contract is verifiability (so that disputes on whether a contract has been violated or not can be mediated by a third-party), it is important to examine various measures of health, both from the standpoint of to what degree they measure what is intended to be measured and to what degree they can be manipulated by various market participants. Each measure of health has different implications for the degree to which contracting might replace indemnity insurance or its managed-care descendants.

In order for a contract to be enforceable, the end-point must be transparent to a third party who can mediate contract disputes. Individual indemnity contracts on specific health states would be verifiable but impractical to write contracts on due to the infinite variety of health states. Summary measures of health (‘disease burden scores’) can condense the number of potential states down to a single number, and are therefore promising mechanisms around which to build contracts. They are not, however, without significant drawbacks: notably measurement error resulting from a disconnect between the assumptions used to create the score and what the patient considers to be ‘health.’ Other possibilities for metrics on which to base contracts include risk scores, bundles of events, and mortality itself.

If contracts are independent of the current health insurer, the incentives of the contracting firm are towards neglecting high-value, low elasticity care. This occurs because the consumer will purchase such care anyway, shifting the cost on to the consumer or the indemnity plan. Consequently, for many of these proposals, the solution is to have the contracting firm and the health insurer be the same company (the contract would be implemented as a supplemental rider to the health insurance plan), which once again aligns the incentives appropriately.

The following table summarizes the proposed methods of contracting on health which I will discuss in the remainder of this section, as well as the *status quo* (Blue Cross-style or managed care) plan features:

	Event bundle	Burden	Risk score	Mortality	(<i>Status Quo</i>)
Responsiveness to small changes in health status	++	-	+	--	++
Improvability: Can be affected by insurer or patient in a way that improves health	++	+	++	-	++
Measurement error: Insurer or patient cannot improve the metric without improving underlying health status	++	-	++	++	N/A
Comprehensiveness: Ability to replace indemnity insurance	--	+	--	--	++

Insurer necessity: Cannot easily be performed by other elements of health system	++	++	--	++	++
Uniqueness: Does not currently exist in the health system	Exists, but not full utility loss	++	+	--	N/A
Price transparency: Standard formulas to allow risk calculation currently exist	+	--	++	++	+
Resistance to moral hazard	+	++	++	+	--

Discrete occurrences

Two of these measures, mortality and bundles of potential events, represent discrete occurrences. Consumers would purchase a contract from their current health insurer to receive a fixed payout if a given event occurred. The events would be chosen such that their occurrence is indisputable and the health loss which occurs as a result is unequivocal, as is the case with acute myocardial infarction or mortality. Therefore, proposals built around these measures are essentially indemnity contracts with an emphasis on insurance for the full utility loss, and on integration with the current health insurance system. These two characteristics work together to more appropriately align the insurer's incentives with the patients'. By increasing the payout for adverse events, insurers are more strongly disincentivized to allow those events to occur. By integrating the contracting on these metrics into traditional health insurance plans, the health insurer is encouraged to focus efforts on reducing the risk of the event occurring. Since the events are chosen such that they represent a real health loss, this results in net improvement in health.

Mortality is a commonly used measure of health status, since it is commonly available, unambiguous, and incontrovertibly bad. However, mortality is a rare occurrence, making it difficult to study and insensitive to small changes. Given that insurance firms are the preferred entity for health contracting, and that insurers are set up to average out rare risks, the rarity of mortality is not a problem. Mortality also fails to capture many outcomes which affect health, broadly categorized as non-fatal suffering. An indemnity contract on death is hardly a unique concept--life insurers write such contracts by the millions. The uniqueness of this proposal comes solely from its integration with existing health insurance. This begs the question of why life insurers do not attempt to reduce the probability of death of their customers. One possibility would be legal barriers which prevent such investment. Another might be if consumers do not typically insure the full utility loss⁵, which would mean that activities to modify the probability of death are too expensive (particularly when combined with churn). Or it may simply be that they expect their customer to also carry health insurance out of self-interest (an elasticity argument). One way to view this contract then is that it effectively dramatically lowers the life insurer's cost of altering the probability of death, because funds are being spent on healthcare already by the same firm.

⁵A priori, we would expect life insurance not to typically cover the full utility loss, because the payout cannot be enjoyed by the deceased.

By combining health insurance with life insurance, a supplemental contract on mortality moves the utility loss of death to within the health insurer's profit function, thereby strongly incentivizing them to spend health dollars more wisely on items which deliver mortality reduction.

Because death is rare and insensitive to small changes in health, a similarly verifiable measure which captures non-fatal outcomes is desirable. One such metric is that commonly seen in clinical trials: select a few outcomes, and consider the effect on all of the outcomes. For instance, cardiovascular clinical trials often use as their outcome the occurrence of any of several enumerated severe cardiac events. The advantage of this method is that it is sensitive to small changes in quality. The primary disadvantage is that the weighting between events is either arbitrary (generally all listed events are given equal weight, even though they likely have different import for patient welfare) or non-existent (often certain events are considered independently). For certain bundles of events, methods exist to predict baseline risk. For instance, the QRISK cardiac risk score predicts the likelihood of a severe cardiac event in the next ten years with an R^2 of 36% (Hippisley-Cox et al. 2007). Individuals will likely have many theories as to how to reduce their risk of the underlying event, but it is unclear if those theories will be correct. The risk score incorporates the current state of knowledge about event prevention. Therefore, there is little leeway for the individual or the firm to 'game the system'.

This type of health measure most cleanly lends itself to contracting, because the outcome is well-defined, individuals are unlikely to be able to make themselves appear lower risk than they are when purchasing a contract, and the event occurrence is not overly subjective. The existence of risk scores for certain conditions makes the contracting firm's pricing decisions fairly deterministic, and means competition will likely drive profits towards zero. Should the event occur, it would be possible to insure the full utility loss, since the event occurrence is independently verifiable in case of a contract dispute. Critically, the resolution of the missing market for insurance against the full utility loss aligns the interest of the insurer and the insured. Because the insurer stands to lose substantially more money if the patient becomes sick, the insurer has a much stronger incentive to invest in prevention. Once again, adding a full-utility indemnity contract to health insurance has improved the insurer's incentives to invest in the health of their patient.

A substantial problem with the discrete occurrence formulations is that insurers have incentives to invest in prevention but not in high-value acute care. In these contracts, once an event occurs, the indemnity must be paid out regardless of the severity of that event. While this aids the verifiability of the contract, it provides no incentive for the insurer to fund care which reduces the severity of disease once it occurs. For that, a more comprehensive measure of health status is needed.

Health status measures

This analysis conceives of a health status measure at a future point in time as a random variable, which is a function of insurer investment in health, consumer investment in health, plus random variation. A contract based around health status measures either implicitly or explicitly will be a contract on the change in health status over time. Unlike the contracts previously discussed, these contracts could potentially stand alone because they cover a variety of health shocks, or they, too, could be tied to traditional health insurance. The individual would contract for a certain health status by a certain date-- for instance, that they would have the same number of units of health five years from the date of the contract signing. Should the individual's health measurement be below that 'strike valuation,' the firm would pay some specified amount per unit of health loss. The valuation of each unit of health loss could

be societal--in which case some individuals will likely be over-incentivized to improve their health and others under-incentivized, relative to the optimum--or individual--in which case a maximum would likely have to be in place in order to prevent under-investment of effort by the individual in their health. The contracting firm's profit is therefore: $\text{Profit} = \text{ContractFee} - \text{PreventionCosts} -$

$\text{Pr}(\text{Sick}) * \text{PaymentForGettingSick}$. Once contracted, the firm will therefore invest in any prevention which sufficiently reduces the expected illness payment more than it increases costs.

Unlike the discrete occurrence contracts discussed in the last section, the firm would also have an incentive to invest in acute care, since what matters is not the occurrence of a single event but rather the delivery of a given quantity of health by a certain date. For instance, with a full-utility-loss indemnity contract against the occurrence of an MI, the firm would not be expected to fund acute care which reduces disability after the MI occurs. By contrast, with an appropriate health status contract, the firm might be expected to fund additional care (not covered by traditional health insurance) which might reduce the probability of subsequent heart muscle damage, such as a behavioral payment to induce the patient to more consistently take their beta-blocker and aspirin upon discharge. With a perfect health status measure, this approach would be ideal. The choice of health status metric matters a great deal, however, and each available method carries drawbacks and benefits.

One broad category of health status measures are disease burden metrics such as QALYs and DALYs. These attempt to combine morbidity and mortality through a series of weightings which relate the severity of various non-fatal outcomes to death⁶. Weighting between outcomes is obtained through either i) surveys asking participants from the general public to play a standard gamble, ii) convening expert panels do determine relative disease severity, or iii) determining standard gambles in those who have the condition or have experienced the complication. Results between the methods often differ, and some arbitrary system for deciding between them must be devised. Weights for interactions between each complication or outcome and co-morbidity and secondary diagnoses would ideally be included as well. Current burden metrics would likely suffice for supplementary contracts, but to provide standalone health contracts which might potentially supplant the current system of health insurance, new measures incorporating substantial quantities of detailed clinical information would have to be developed. For instance, in the post-MI case discussed earlier, detailed measures of heart function such as the cardiac ejection fraction, would dramatically increase the sensitivity of the measure to investment in health.

New measures should be engineered to be more difficult to manipulate, which would likely limit their comprehensiveness. For instance, self-reported well-being may provide some information about health status, but its measurement is entirely under the control of the individual who stands to benefit from changes in its level; therefore, self-reported measures should largely be excluded. Unfortunately, this will also limit the comprehensiveness of such summary measures of health status, as entire categories of disease such as mental health and rheumatic disease will likely be under-evaluated in the resultant 'tamper-resistant' metric.

As with any metric used to evaluate people or aggregations thereof, the participants will attempt to optimize the outcome over time. Were we certain that disease burden metrics truly represented health, that optimization would be the desired result. Given that the weights used to combine outcomes are quite variable depending on methodology used, though, this method is distinctly imperfect. It is therefore

⁶One way to view contracts built around these measures then, is that summary measures of health are essentially reducing N health states down to M states, where $N \gg M$, allowing effective contracting on a reasonable number of outcomes.

possible that the patient or insurer could improve the metric without improving their underlying health status. Careful metric design may minimize this problem. Other design changes, such as placing contract payouts in accounts which can only be used for health spending, also serve to blunt perverse incentives. Furthermore, burden metrics remain fairly insensitive to small changes in quality, which is largely a consequence of attempting to take into account all outcomes⁷. Finally, the weights used to aggregate individual health states into burden metrics may not represent an individual consumer's valuation of those health states⁸.

An alternative measure of health status is a risk score. Instead of using the risk scores referenced earlier to price insurance against event occurrence, a contract could use the risk score itself as a measure of health. In practice, this is currently feasible only for cardiovascular disease. Since risk scores capture the vast majority of the information on cardiovascular risk available, they might be used in lieu of the events they were intended to predict. Unfortunately, the elements which make up a risk score tend to be elements which are known and unchanging (such as age and sex) or are substantially under the control of the insured, such as smoking status. It is therefore hard to see how the majority of the determinants of a risk score are insurable. Therefore contracts built around risk scores are unlikely to exist independent of an insurance plan.

Nevertheless, there is still a case to be made for insurers to incorporate contracting on risk scores into their health insurance plans in order to appropriately incentivize them to improve patient health. Because there is a substantial component of cardiovascular risk scores which is itself at risk, there is still an insurance aspect to such a contract. For instance, in the QRISK score, left ventricular hypertrophy is not under the direct control of an individual and is subject to the vagaries of fate. For such an arrangement to work, the contracts must be incorporated into health insurance plans⁹, since there is a dearth of actual risk scores for non-cardiovascular disease and therefore the comprehensiveness of contracting on risk scores is limited. Since cardiovascular disease is the leading cause of mortality (Miniño et al. 2010) and disease burden ("Global" 2008), however, doing so seems worthwhile.

⁷While at first glance the larger number of outcomes would not seem to impact the sensitivity to small changes in health (after all, thresholds for what really matters could simply be set lower), after considering that the more categories one adds the more random variation one is likely to see, it is clear that the signal to noise ratio for a given small change in health decreases as more categories are added.

⁸For instance, one person might believe that losing their sight represents a much greater loss of health than losing a leg, whereas another might feel the opposite way. One potential solution to this is to make weights individualized for each contract. On the plus side, there is then less argument about what "health" really is, and if preferences are consistent then utility is maximized. The dilemma is that preferences about outcomes are not stable; in particular, those without any given condition often estimate the condition to be far worse than the same individuals once they have developed the condition (personal communication, CJL Murray). On the downside, there is potentially more adverse selection. We might also expect higher transaction costs and no secondary market for reinsurance or contract transfer, because each contract is custom.

⁹It is not inconceivable that the uninsured might prefer standalone contracting on cardiovascular risk scores to no health insurance whatsoever, however.

Nuances, alternatives, and extensions

Several aspects and extensions have yet to be considered thus far. Some alternatives to contracting, such as the provision of information, fall short. Others, such as external funding to achieve health goals, represent interesting extension of the model to new circumstances. Finally, the viability of standardized futures contracts transferring the risk amongst insurers, re-insurers, and market participants is evaluated. These models are all discussed in this section.

Information

Providing information about insurer quality would seem to be a viable alternative to incentivizing insurers to pay for health. For instance, if the fundamental problem is that demand does not sufficiently transmit cost-effectiveness information because the estimate of effectiveness varies too much, then government or physician associations might be charged with providing cost-effectiveness information. Given the variety of health states which must be covered, however, such a proposal would prove difficult and extremely costly. Furthermore, education has been tried in various contexts with less than perfect results.

Plan quality report cards have a very small effect on plan enrollment (Beaulieu 2002). Other kinds of information such as surgical report cards also seem to have little effect on consumer behavior (see for example Romano and Zheng 2004). In addition, merely providing information does not provide the insurance against changes in health status which contracting on health status does. Finally, provision of information has been a leading proposal for many of the perceived failings of the provision of health in this country. If education were to work, it would have worked already; residual problems are unlikely to be readily solved with further education, barring enormously expensive and complicated educational campaigns. Even the existence of an “educational campaign” implies external funding to improve information. By contrast, contracting requires external (and not necessarily governmental) intervention about a single topic, the reliability of the health status metric chosen. Beyond that, the consumer is essentially contracting to force the insurer to improve their information set by providing appropriate prices for care.

Add bonus incentives to indemnity plans

A close relative of adding health delivery contracts to health insurance plans would be having a third party such as the government pay insurers to deliver a given health status by a given date. This discussion leaves aside the normative debates which are central to such a proposal--except to say that there appears to be some societal support for improving the health of at least some segments of the population--and focuses on the positive question of how this would differ from health contracting initiated by the insured individuals. It would seem that the two primary differences are that more information could be mustered by the buyer to aid contracting decisions, and that incentives are less sharply aligned.

The additional information arises because the decision-maker for the purchaser would be making the decision for large numbers of individuals, and could therefore afford the fixed cost of investigating optimal contracts. In addition, to the extent that individuals violate expected utility maximization by mis-estimating small probabilities, the decision-maker here might do better by taking a population-level perspective on small risks. On the other hand, individuals have the most incentives to care about their

own health, and may have priorities and values that differ from the average. Finally, as a replacement for other forms of government-provided health insurance, contracting on health might allow provision of the most essential elements of healthcare to a larger number of uninsured at less cost, at the expense of entirely neglecting those aspects of health not covered by the health status metric.

Futures market

If insurers are at risk for consumer health status, particularly if that status is insured at some large valuation approximating the full utility loss, they might wish to participate in reinsurance markets. An alternative to reinsurance as a means to finance and bear the risk of these contracts would be to develop standardized contracts, bundle them together, and offer them to the futures markets, in a manner similar to mortgage-backed securities (MBS). By assuming mean-variances preferences for returns, pricing of these options could easily be calculated according to CAPM derivatives such as Black-Scholes. By opening the market for these contracts more broadly and lowering transaction costs, such a financial instrument would lower costs to the insurer to finance and bear the risk of these health delivery contracts. It may even allow for greater competition on the insurer side as well, since smaller entities with expertise in statistics and health but without the expertise or capital to actually bear the risk might be able to join the market.

Unfortunately, such a market is likely to be marred by potentially disastrous incentives, in the same way that being able to pass the risks of eventual default off to the purchasers of MBS's may have encouraged banks to issue poor-quality loans. Such deliberate exploitation of market risk may be less of a problem in this market if contracting firms are not privy to information which would predict health risk but which is not part of the contract. Yet even if insurers have no additional information, if risks are allowed to be resold then the role of adding contracts to health insurance plans to properly incentivize the spending of the whole health insurance plan is mitigated. Consequently, such an extension of the contracting proposal would lower the cost of each contract only at the expense of removing much of the benefit of contracting on health delivery.

Conclusion

Insurers have traditionally been seen as providing indemnity against the financial risk of uncertain health care expenses. This arrangement has led to considerable focus on cost containment and less emphasis on improving the health of the insured; health improvements have been seen as the purview of other parts of the health system such as physicians and hospitals. Yet an emphasis on cost containment is somewhat unsatisfactory: spending money on health is a valid way to spend the surplus in a world of rising incomes, and insurers have a role to play in health delivery not easily filled by other providers.

Contracting on health status provides a method of overcoming some of the drawbacks of the current health insurance system. In particular, health contracts would more strongly incentivize insurers to improve their customers' health. In so doing, they would naturally cause insurers to adopt many of the top-down methods currently being investigated but which may never be implemented because their implementation is not profit-maximizing to the insurer, such as disease management or small payments for behavior change. Insurers might even be expected to invent new methods of improving the delivery of health to their customers, once proper incentives are put into place. Perhaps most promising is the possibility that "non-compliance" would no longer be seen as an exogenous issue of personal

responsibility--firms would have an incentive to investigate and implement methods to increase adherence such as automated reminders to take pills and make doctor's appointments. Finally, aligning incentives may reduce skepticism towards innovative proposals put forth by insurers, since insurers would truly see improvements in enrollee health in their best interest.

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