What Do We Really Know About Whether Health Insurance Affects Health?

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December 20, 2001

This work was supported by a grant from the Robert Wood Johnson Foundation. We are grateful to Dana Goldman, Emmett Keeler, Willard Manning and participants in the Agenda Setting Meeting of the Coverage Research Initiative, Ann Arbor, Michigan, July 9 – 10, 2001, for helpful comments and suggestions.

I. Introduction

Almost 18% of non-elderly Americans - approximately 42.6 million – lacked health insurance during 1999 (AHRQ, 2000). The uninsured are the focus of policy concern primarily because health insurance is believed to contribute to better health by improving access to medical care. Literally hundreds of studies document the fact that the uninsured have worse health outcomes than do the insured; these studies have formed an important part of the case for policies to expand health insurance coverage in the U.S.

Very few of these studies, however, establish a *causal* relationship between health insurance and health. Causation is difficult to establish because we almost never observe truly random variation in health insurance status. Instead, people who have health insurance and people who do not almost certainly differ in many ways in addition to the difference in their health insurance coverage. Moreover, the causal relationship between health insurance and health is likely to run in both directions; health status may affect insurance coverage and insurance may affect health. This makes it difficult to determine whether a correlation between health insurance and health status reflects the effect of health insurance on health, the effect of health on health insurance, or the effect of some other attribute, such as socioeconomic status, on both health insurance and health status.

Our goal in this paper is to review the evidence on the causal effect of insurance on health; what do we really know about how health insurance affects health? In doing so, we distinguish between what we call "observational" studies – those that do not account for the problems identified above – and what we call "experimental" and "quasi-experimental" studies, in which health insurance coverage varies randomly, so as to minimize these problems. As we discuss in more detail below, we do not believe that it is generally possible to make any causal

inference about the effect of health insurance on health from observational studies. Therefore we devote most of our attention to reviewing the findings of experimental and quasi-experimental studies, since we believe these studies do provide evidence on the nature of the causal relationship between health insurance and health.

Three other obstacles to answering the question posed in the title are worth mentioning, although our analysis does not focus on them. The first is that health insurance is a complex, multi-dimensional good. A generous indemnity policy with first-dollar coverage and a bare-bones catastrophic coverage policy are not likely to have the same effect on health.[1] A precise answer to the question "what is the impact of health insurance on health?" would require a much more complete specification of what is meant by "health insurance" as well as a careful enumeration of other relevant factors such as income. For example, is health insurance provided as a public benefit funded by a payroll tax? Or is the purchase of private health insurance simply mandated for all individuals? These are very different scenarios and their implications for health may be very different. Since our review of the literature focuses on experimental and quasi-experimental studies, we are able to draw causal inference about the impact of health insurance on health from a limited range of situations, such as the expansion of Medicaid eligibility in the 1980s and early 1990s. Our ability to extrapolate from this to the hypothetical health effects of a different kind of insurance expansion, such as a Medicare buy-in for individuals aged 55 to 64, is limited.

Second, health itself is also a complex, multidimensional construct, and our ability to measure it is imperfect. In practice, the measures of health in most of the studies we discuss may not be very powerful in the sense that they may fail to detect significant changes in true, underlying health. Mortality rates, for example, are a blunt instrument to measure health; studies

that rely on these (as many do) may fail to capture changes in health-related quality of life. The less powerful our measures of health are, the more cautious we need to be in interpreting the results of studies that find no effect of health insurance on health.

Third, the most plausible pathway through which health insurance may have a causal effect on health is through improved access to medical care: having health insurance increases the quality and/or quantity of medical care, which in turn improves health. Since the impact of health insurance on health therefore depends on an intermediate factor (medical care), focusing on health insurance and health without considering medical care will allow us to say at most *whether* there is any causal link between health insurance and health. If we find no effect of health insurance on health, this may be because health insurance does not in fact affect access to medical care, or because medical care has no measurable effect on health, or both. Therefore our analysis of the causal effect of health insurance on health is only a starting point that leaves many interesting questions, such as the mechanisms explaining the presence or absence of a causal effect of medical care on health, unanswered.

Any one of these three issues could by itself be the subject of a lengthy discussion and all are certainly relevant to the question posed in our title. In this paper, we choose to focus instead on the endogeneity of health insurance because it is among the least carefully considered and potentially most important issues to be addressed in reviewing the evidence on whether health insurance affects health. Our critical review of the literature on this question suggests that when we restrict our attention to studies that convincingly address the endogeneity of health insurance, the bulk of the evidence suggests there is a small, positive effect of insurance coverage on health outcomes among the populations most likely to be the targets of public coverage expansions:

[1] For evidence that this is true, see our discussion of the RAND experiment below.

infants, the elderly, and the poor. There is also evidence to suggest that in some cases, expansions in health insurance may not result in measurable improvements in health.

Our discussion proceeds as follows. In Section II we describe a basic framework for thinking about the links between health, health insurance, medical care, and other relevant factors. This framework highlights the endogeneity of health insurance. In Section III, we classify studies with respect to how they approach the problem created by the endogeneity of health insurance. We define three types of studies, which we term "observational", "quasi-experimental," and "experimental". In this first group of "observational" studies, which includes most of the literature examining the relationship between health insurance and health, the endogeneity of insurance status is either ignored or at best addressed by controlling for observable differences between people with and without health insurance. In the second group of "quasi-experimental" studies we include the much smaller number of studies that rely on naturally occurring situations in which variation in health insurance coverage is plausibly exogenous: for example, changes in public policies that result in changes in insurance coverage. In the third group, we include the only true randomized "experiment" examining the effects of health insurance on health, the RAND Health Insurance Experiment.

Section IV discusses the observational literature. We begin by reviewing briefly what we know about the determinants of health insurance coverage and then discuss what this implies about our ability to draw causal inference about the effects of insurance on health from observational studies. We conclude that observational studies offer no basis for causal inference. Section V examines the far smaller literature that relies on quasi-experimental variation in health insurance status to identify the effects of health insurance on health. We divide these studies into small-scale and large-scale analyses. Here our analysis suggests that we can find some valuable

insights into the question we have set out to answer, but that the interpretation of these "quasi-experiments" is not always straightforward and the range of situations about which we have meaningful data is limited. Most, but not all, of these studies find that expansions of health insurance result in improvements in health.

In section VI, we discuss the one true randomized experiment examining the effects of health insurance on health in the U.S., the RAND Health Insurance Experiment. Here again we find evidence that health insurance can improve health. Important caveats accompany this finding; the two most important are that the RAND experiment compared plans of differing benefit generosity rather than insurance versus no insurance, and that health improvements were evident only for vulnerable subpopulations. Nonetheless, the RAND experiment provides a key piece of evidence that health insurance can improve health.

In section VII we summarize the lessons drawn from our review of the evidence.

II. A Framework for Understanding the Relationship between Insurance and Health

The production of health is a complex process. Health depends not only on medical care but also on a host of other factors such as stress, income, health behaviors like smoking, beliefs about the effectiveness of Western medicine, and genetic predisposition to disease. Some of these, like income and beliefs about Western medicine, will also affect whether or not an individual has insurance coverage, which in turn affects access to medical care. Health itself also affects consumption of medical care, since individuals in poor health are more likely to seek medical care. Figure 1 presents a stylized diagram of the many relationships that exist between health, insurance, medical care, and other factors, which may or may not be observable.[2]

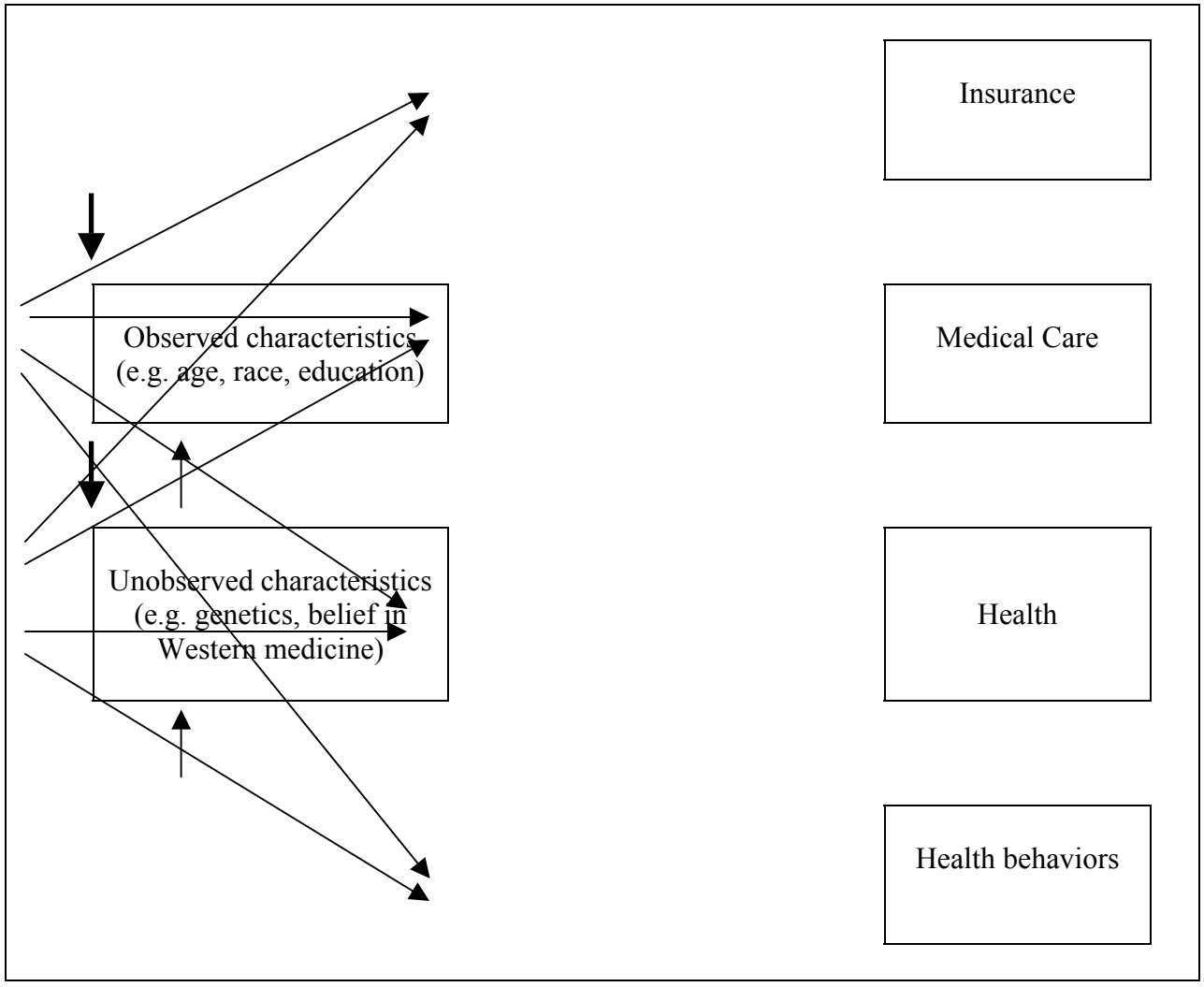
[2] One other effect is worth mentioning: there should also be an arrow running from insurance to health behaviors, to represent the "moral hazard" associated with insurance coverage. Moral hazard refers to a change in risk behavior

As noted earlier, identifying the *causal* impact of health insurance on health is complicated by the fact that health insurance is not usually assigned randomly to individuals.[3] Instead, as the schematic diagram above represents, health insurance coverage is directly affected both by health status itself and also by the same underlying factors that determine both health and the consumption of medical care. As a result, simple comparisons of outcomes for insured and uninsured individuals may reflect either a causal effect of health insurance or other differences between individuals with and without health insurance. A number of different approaches have been developed to address the problem of endogeneity. In the next section, we classify studies of health and health insurance based on whether and how they address this problem.

induced by the presence of insurance; in this context, for example, people with health insurance may be less likely than they otherwise would to take precautions such as wearing seat belts that would lessen their risk of medical expenses.

[3] This same "evaluation problem" arises in the evaluation of workforce training programs. There is a large literature discussing the evaluation problem in this context; see Heckman, LaLonde and Smith (1999) for a review.

Figure 1



III. Classifying Studies' Approach to the Endogeneity of Health and Insurance Status

Most studies in the literature simply ignore the endogeneity of health insurance; some attempt to address it using a variety of techniques. We categorize the literature into three groups based on the extent to which they address this problem.

The first group, which we call "observational studies," does little or nothing to acknowledge the endogeneity problem and contains by far the most studies. Most of these simply compare health outcomes for the insured to outcomes for the uninsured. Some use regression analyses to control for covariates such as income, age, gender, race, health behaviors like smoking, and comorbidities. We discuss these studies in Section IV. Our key finding is that such analyses – representing the vast majority of the studies of the association between health insurance and health – are confounded by both observable and unobservable difference between patients who do and do not have health insurance. This implies that these studies cannot provide much insight into the causal effect of health insurance on health. Moreover, the complexity of the underlying relationships makes it impossible to "sign" the bias that results from the omitted variables.

The second group consists of "natural experiments," also sometimes called "quasi-experiments." These analyses rely on a policy change or some other exogenous event to introduce variation in health insurance coverage that is plausibly unrelated to health and other underlying determinants of health insurance coverage. These situations offer an opportunity to estimate the causal effect of insurance on health. Some natural experiments are quite small in scale: for example, the cancellation of veterans' health care benefits for a small group of individuals. Small natural experiments are perhaps best thought of as case studies; we discuss several of these below. Other natural experiments are much broader in scale, such as the passage of Medicare in the U.S., or of Canada's National Health Insurance plan. In Section V, we discuss in detail all of the quasi-experimental studies of which we are aware.

The third group consists of true social experiments in which health insurance coverage is randomly assigned to individuals and subsequent health outcomes are compared across

experimental groups. This group corresponds to randomized clinical trials in the field of medicine, the gold standard of biomedical evidence. Only the RAND health insurance experiment falls into this category. We discuss it in Section VI.

Which studies provide credible evidence that can be used to make inferences about the *causal* impact of health insurance on health? As we have mentioned, and explain in more detail below, we believe that only the quasi-experimental and experimental analyses offer any basis for making such inferences.[4] Since these studies are far less numerous than observational studies, and their results are often quite different than those of the observational studies, this belief requires us to discount the stated conclusions of a great deal of published work. This belief does *not* mean that we think observational studies are uninteresting or without value. Quite the contrary: observational studies documenting differences in medical care use and health outcomes between insured and uninsured populations provide information that is essential both to researchers and to policymakers because they illustrate disparities health care utilization and health outcomes among identifiable groups that may suggest the need to better understand and ultimately address these disparities. But we do not always agree with the authors of these studies about whether inferences about the impact of insurance coverage on health outcomes that can be drawn from their findings. In the following discussion of these three groups of studies, we explain the reasons for our strong preference in favor of experimental and quasi-experimental evidence.

[4] LaLonde (1986) makes the argument for relying on experiments to evaluate the impact of workforce training programs. Heckman, LaLonde and Smith (1999) summarize the current state of the debate over the use of different econometric estimators to solve the evaluation problem using non-experimental data on workforce training programs.

IV. Observational Studies

Literally hundreds of studies have examined the association between health insurance status and health status, and these studies have been reviewed in several comprehensive review articles, including several within the past few years (OTA, 1992; Brown et al., 1998). These reviews have typically focused on important methodological issues such as how the sample of individuals with and without insurance is identified (e.g. identification at a site of care, in the community, etc.) and how health utilization and/or health outcomes are measured. While the health utilization studies clearly suggest increases in utilization among those with health insurance, these reviews also emphasize that increases in utilization need not necessarily translate into improvements in health. As a result, the reviews place less weight on results concerning effects on health care utilization than they place on results concerning effects on health. Nevertheless, the reviews are able to cite many studies that show a direct association between health insurance and health status. The heath outcomes that are demonstrated to correlate with health insurance range from death, to objective physiologic measures of health such as hypertension, to subjective measures such as self-reported health status, to name few (See Brown et al., 1998).

In reviewing these studies, Brown et al. state "[b]ecause there were no randomized trials, none of the articles reviewed fulfills criteria for the highest quality evidence." This statement is not, strictly speaking, true; the RAND Health Insurance Experiment, discussed in more detail below, meets these criteria. But it is *mostly* true, since there are hundreds of papers that attempt to study the effect of insurance on health using non-experimental data that do not account for the potential consequences of the non-random nature of insurance status. Brown et al. present the

results of these papers with very little comment on the implications of this non-experimental nature of insurance status other than that it prevents inference of "causal relationships". We agree with this assessment but perhaps place more emphasis on it than do Brown et al. Therefore, unlike Brown et al., we focus our analysis on studies that attempt to address this concern.

We place this emphasis on the experimental and quasi-experimental studies because we are concerned that studies that do not exploit some random or quasi-random variation in insurance status are not able to provide clear evidence of the actual causal connection between insurance status and health. This problem is most easily illustrated by considering simple comparisons of health status among persons with and without insurance. Depending on the population studied, these uninsured persons may be young healthy people in entry-level jobs that lack health insurance, or older persons not yet eligible for Medicare but with health conditions that prevent them from purchasing insurance. Thus the uninsured may be more or less healthy than others. This makes it difficult to determine by simple comparisons of the health status of the insured and uninsured whether any correlation between health insurance and health status reflects an effect of health insurance on health, an effect of health on health insurance status, or the effects of some third variable (such as age) on both health and health insurance status. The vast majority of studies suggest a positive correlation between health insurance status and health. This suggests either a true positive effect of health insurance on health or a dominant tendency for some other factors such as income or education to be positively correlated with both health and health insurance. However, there may also be important factors such as underlying illness that produce a downward (negative) bias on the observed relationship between having health insurance and

health status. These effects are just some of the many complicating the relationship between health insurance and health that are illustrated by the many arrows in figure 1.

In an attempt to address such issues, some studies attempt to use multivariate analysis to control for observable differences between persons with and without insurance. There is good evidence from a variety of sources that observable aspects of socioeconomic status such as education, income, and social integration are associated with improved health outcomes (Pincus, 1998; Ross and Mirowsky, 2000). These same variables are also often associated with health insurance status. In studying the effects of health insurance on health, controlling for these factors may be useful if variation in insurance status is determined solely by such observable variables. However, to the extent that observable differences are controlled for, the variation in insurance status that remains will be more heavily driven by unobservable differences between insured and uninsured people such as those illustrated above, and there is no guarantee that those unobservable attributes will be any less correlated with health outcomes than the observable attributes that have already been controlled for through multivariate analysis. The result may be that analyses that control for observable covariates need not be less biased than analyses that do control for such differences.

An interesting example is to consider the relationship between health insurance status and health around age 65. As the study by Lichtenberg cited below describes, one sees a marked improvement in health status at age 65 when people become eligible for Medicare. This seems to suggest a positive effect of health insurance on health. However, when one controls for the observable characteristic (age) that drives this variation and focuses in on persons with or

without health insurance just below age 65, the relationship between health insurance status and health may now be complicated by such factors as the effects of preexisting illnesses that may decrease health and make it less likely someone can obtain or afford health insurance and thus create a negative association between having health insurance and health. This helps illustrate the more general point that controlling for covariates need not improve our ability to accurately estimate the effects of health insurance on health.

Other largely unobservable factors that may also complicate understanding the relationship between health insurance status and health include underlying belief in the efficacy of health care or valuation of health, and similar factors that could affect care-seeking behaviors. Some of the very best observational studies have attempted to address such concerns by considering plausibly exogenous health shocks such as motor vehicle accidents. For example, Doyle (2000) analyzes data on serious car crashes on Wisconsin. Using data from police accident reports linked to hospital discharge records, he finds that the uninsured are significantly more likely than either the publicly or privately insured to die following a car accident in which they were initially incapacitated at the scene of the accident. Although this study cleverly surmounts the problem of selection into initial treatment – both insured and uninsured accident victims are all taken to the hospital and, being incapacitated, have no say in the matter – such studies can never ensure that unobservable differences may not remain and affect outcomes. For example, in Doyle's study, it is possible that the even though the observable attributes of the auto accidents he observes occurring among insured and uninsured individuals are similar, that the accidents differ in some unobservable ways. Even if the accidents are truly identical, a positive bias in the relationship between health insurance and health might be created if insured persons are more compliant

patients or have better underlying baseline health status. Alternatively, a negative bias might be created if insured persons have better access to home care so that those insured people who are hospitalized are likely to have more severe injuries on average. There may be certain observational studies in which the such biases can be clearly signed or perhaps bounded in magnitude, but the complexity of the determinants of health status suggests that this will generally be a very difficult task, and we are not aware of any observational study that has been able to comprehensively address such concerns. It is on this basis that we focus instead on quasi-experimental and experimental studies in what follows below.

V. Quasi-Experimental Experiments

The quasi-experimental approach to solving the "evaluation problem" relies, as the name suggests, on a situation in the real world that approximates what might be achieved in a social experiment. In the context we have been discussing, such opportunities may arise when a "natural experiment" causes health insurance coverage to vary for some measurable reason or reasons *not* related to an individual's health status; when this variation is not correlated with other, unobserved determinants of health such as income; and when there are identifiable individuals whose coverage is not affected who can be used as a control group to pick up any secular (i.e. unrelated to the insurance changes) changes in health outcomes, such as those due to improvements in medical technology.

In this section we discuss all the natural experiments of which we are aware that provide credible evidence on the causal effect of insurance coverage on health. We classify natural experiments

into two groups: small and large. In discussing these studies, we pay some attention to effects on medical care utilization, but place greater emphasis on studies that seek to identify direct effects on health. We do so for the same reasons that others who have reviewed the effects of health insurance on health have done so: it is difficult to know whether increases in utilization will translate into improvements in health. The results of some of the studies we examine reinforce this point. An alternative justification for examining effects on utilization is to explain the absence of effects on health; if insurance affects health only through its effects on medical care and we *do not* observe effects on medical care, we should not expect effects on health. In the studies we examine, this is not relevant because we generally *do* find effects on health. In these cases, we try, where possible, to use results on utilization to better understand the mechanism by which health insurance affects health.

Small-scale natural experiments (case studies)

Lurie et al.: Medi-Cal cutbacks

Lurie et al. (1986) report that in 1982, California terminated Medi-Cal benefits for all 270,000 "medically indigent" beneficiaries, defined as those with "economic or medical need but … not eligible for assistance from a federal program for the aged, blind or disabled for families with dependent children." The authors examine changes in health outcomes for 186 patients at a Los Angeles clinic whose Medi-Cal benefits were terminated and compare them with changes in outcomes for a comparison group of 109 patients at the same clinic who were continuously covered by Medi-Cal. Those who lost benefits experienced on average a statistically significant increase in diastolic blood pressure (9 mm Hg six months after benefit termination, 6 mm Hg one

year after termination), while the comparison group experienced no significant change in blood pressure over this period. Self-reported health status also declined significantly for treatments but not controls. Lurie et al. do not focus much attention on the mechanism by which the loss of insurance may have effects, but do note a 45% decline in the use of outpatient services among those who lost benefits that might plausibly contribute to these declines in health outcomes.

The results in this study may be biased by the fact that the authors, alarmed at the increases in blood pressure observed at the six-month follow-up, intervened to help some of the subjects regain insurance coverage. But this would be expected to bias the results toward zero, and the authors nonetheless find significant increases in blood pressure one year after the termination of benefits. Since the termination of benefits was motivated by financial pressures on the state, it is possible that the state simultaneously cut back on other welfare programs that may have affected the treatment group (who were *not* categorically eligible for any Federal assistance programs) but not the control group. Though this hypothesis is plausible, we are aware of no specific evidence that such cutbacks occurred. It is also possible that whatever criteria led individuals to be excluded from Medicaid are also correlated with less favorable outcomes over time. For example, people who were continuously insured may have had more stable living circumstances and perhaps had a great interest in maintaining coverage and being compliant with medical advice; those persons whose benefits were cut might not have continued to be enrolled even without cuts. Nevertheless, overall this case study offers evidence that losing health insurance coverage is associated with declines in health status.

Fihn and Wicher: VA cutbacks

Fihn and Wicher (1988) report the results of a natural experiment involving the cancellation of Veterans' health benefits for a group of Seattle area beneficiaries in 1983. Because of a budget shortfall, regular outpatient services at the Seattle VA Medical Center (VAMC) were terminated for veterans who had no "service-connected disability", had not been admitted to the VAMC during the previous year, and had not had a scheduled outpatient visit in the past three months. Physicians could appeal these terminations on a case-by-case basis and, if they could demonstrate the "medical instability" of a given patient, his benefits would not be cancelled. As a result, 89 of the original 360 patients targeted for cancellation in fact retained their eligibility for outpatient services. These 89 patients were treated as the "control group." Twenty patients initially retained were later discharged and were excluded from the analysis; the remaining 251 individuals form the "treatment group" whose benefits were terminated.

The authors obtained follow-up data 16 months after termination on 69% (n=172) of the treatment group and 91% (n=82) of the control group. This does not include the 6% of the treatment group and 8% of the control group who had died. In addition to questions about access to medical care and general health status, the authors measured the subjects' blood pressure. Both systolic and diastolic blood pressure appear very similar for the treatment and control groups before the termination of coverage (the authors do not report a test of the hypothesis that the before-termination means differ across groups). At the 16-month follow up, the treatment group had increased statistically significant increases in both systolic (+11.2 mm Hg, $p<.001$) and diastolic (+5.6 mm Hg, $p<.001$) blood pressure. In contrast, the control group had experienced insignificant changes to both systolic (+0.5 mm Hg) and diastolic (-2.5 mm Hg)

blood pressure. In addition, a significantly higher fraction of treatments than controls reported at the 16-month follow up that their health was "much worse" than it had been at baseline (41% vs. 8%, $p<0.001$). At follow-up, the treatment group was also substantially less likely than the control group to identify a usual source of care (70% vs. 100%, $p<0.001$) and to be satisfied with their present medical care (41% vs. 100%, $p<0.001$). The treatment group was also substantially more likely to report having reduced the number of prescribed medications (including anti-hypertensive medications) (47% vs. 25%, $p<0.002$). Several of these effects were greater for persons with lower incomes.

The combination of worsened outcomes and declines in utilization that are especially prominent among lower income persons who lose coverage is certainly suggestive of a true effect of insurance on health, but there are also some clear problems with this study. In addition to the very small sample size, the treatment and control groups were not truly randomized, since they were determined by the selective exemption of some patients from benefit termination because of doctors' efforts on their behalf. One might expect that this would result in the control group representing sicker patients than the treatments, since they were those for whom doctors demonstrated "medical instability." This type of selection might result in a conservative estimate of the treatment effect if sicker patients would be independently more likely to experience declines in health status. In fact this seems not to have been the case; some comorbid conditions, such as coronary artery disease, were more prevalent among the treatment group. The authors attribute this "to the fact that physicians in the busy cardiology clinic allowed almost all targeted patients to be discharged and rarely appealed the decision" (p. 359). This points to the possibility that patients themselves may have played a role in advocating for maintenance of

their benefits in some cases. It is not unlikely that patients who are more concerned about their own health will be more likely both to advocate for maintenance of their insurance and to be compliant with a treatment regimen. If so, the relationship between continued coverage and health status could well reflect unobservable patient characteristics rather than the effects of health insurance. This feature of the study makes it very unclear how successful the "randomization" to treatment or control groups was at eliminating any correlation of treatment with unobservable determinants of health.

Another thing to note about the Fihn and Wicher study is that the natural experiment on which it is based may be more appropriate for studying the impact of *medical care access*, rather than *insurance*, on health. Eligibility for VA outpatient services functioned as a form of insurance, but in practice it may have been as if the usual source of care for these men had shut down. Thus, these men not only lost their previous insurance coverage, but also access to their usual set of health care providers with whom at least some of them had presumably established meaningful relationships. The impact of such events on health is interesting in its own right but may be fundamentally different from the impact of a change in *insurance* on health, and it is the latter effect that we are concerned with here.

Haas et al.: Healthy Start expansions

Haas et al. (1993a, 1993b) examine the impact of the Massachusetts Healthy Start program on maternal health. This program, begun in December 1985, provided health insurance coverage for pregnant women with incomes up to 185% of the poverty line. Medicaid coverage at that time in Massachusetts covered pregnant women up to 100% of the poverty line. In 1987,

according to Haas et al., 54% of women who gave birth and had neither private coverage nor Medicaid were covered by Healthy Start. The data consist of hospital discharge data merged to vital statistics records for nearly all live in-hospital births in Massachusetts in fiscal year 1984 (final n= 57,257) in fiscal year 1987 (final n = 64,346).

The research strategy of Haas et al. consists of comparing changes in medical care use and maternal and infant health for a treatment group consisting of women with neither private insurance nor Medicaid ("the uninsured") to changes in these outcomes for Medicaid recipients and for the privately insured.[5] Any change in these outcomes for the treatment group compared to either privately insured patients or Medicaid recipients is attributed by the authors to the expansions of insurance coverage among the treatment group that occurred between 1984 and 1987.

Haas et al. find no statistically significant changes in the following outcomes for the treatments compared to either privately insured or Medicaid controls: the incidence of adverse birth outcomes (low birth weight or prematurity), the fraction of women receiving satisfactory prenatal care, the fraction of women initiating care before the third trimester, and adverse maternal health outcomes (pregnancy-related hypertension, placental abruption, and a hospital stay longer than the infant's). In fact, the only outcome to show any significant change between 1984 and 1987 in the uninsured/insured differential is cesarean section rates, which increased for women in the treatment group from 17.2% to 22.4% (+5.2 percentage points) and for privately insured women from 23.0% to 25.9% (+2.9 percentage points). However, as the authors note,

there is no change in either maternal or infant outcomes corresponding to this change in procedure use.

One feature of the Haas et al. studies is that they assume that all the women newly insured by Healthy Start had been uninsured, and do not consider the possibilitythat some of the women might have had private insurance. To the extent that some of them had been covered previously by private insurance – and there is evidence for the subsequent Medicaid expansions that approximately one-third of newly eligible recipients had previously been covered by private insurance (Cutler and Gruber 1996) – the measured effect on birth outcomes may be smaller than if the expansions had truly reached a group of previously uninsured women. This is, however, not so much a problem with a design of the study as a feature of the expansions themselves. If the expansions did not result in net increases in insurance, then it would not be surprising that there was no improvement in health outcomes. We will discuss this in more detail below in the context of the Medicaid expansions.

Taken as a whole, these three case studies provide mixed evidence on the effect of insurance on health. The Lurie et al. and Fihn and Wicher studies strongly suggest that cutting back on insurance coverage in a vulnerable, low-income population has the potential to increase blood pressure significantly. On the other hand, the Haas et al. studies suggest that expanding coverage to pregnant women may not affect health outcomes for them or their infants, even though it may result in changes in medical care utilization.

[5] Haas et al. use the term "the uninsured" to describe their treatment group, but this may be somewhat misleading. The "uninsured" group was presumably entirely uninsured in 1984; by 1987, however, 54% of this group consists of

Large-scale natural experiments

The literature contains studies relying on five large-scale natural experiments: the passage of Medicare in 1965, expansions of Medicaid eligibility in the 1980s and 1990s, the passage of National Health Insurance in Canada, the variation across states in the generosity of insurance coverage for HIV patients, and the much lower rates of health insurance coverage among self-employed workers than among wage-and-salary workers. In this section we discuss each of these studies in detail.

Lichtenberg: The enactment of Medicare

Lichtenberg (2001) uses data from U.S. Vital Statistics, the National Hospital Discharge Survey, the National Health Interview Survey, the National Ambulatory Medical Care Survey to examine the effects of Medicare on the health of older Americans by looking for evidence of abrupt discontinuities in health care utilization and outcomes at age 65, when people typically first become eligible for Medicare. He finds evidence that utilization of ambulatory care and, to a smaller extent, inpatient care, increases abruptly at age 65.

Lichtenberg then examines whether there is a reduction in morbidity and mortality at age 65 relative to the trends in outcomes prior to that age. The results show a reduction in days spent in bed of about 13% as well as a 13% reduction in the probability of death after age 65 compared to what they would have been in the absence of Medicare.

Healthy Start recipients. We will refer to this group as the treatment group instead.

Lichtenberg also examines whether the increase in health care utilization and the improvements in outcomes around age 65 over time are associated with each other. Indeed, he finds that conditional on age and the death rate in the previous year, the short-run elasticity of the death rate with respect to the number of physician visits is -0.095, and the long-run elasticity is -0.497 so that a sustained 10% increase in the number of visits will reduce the death rate by 5%. Some further insight into this association may be provided by the fact that the number of physician visits in which at least one drug is prescribed also increases suddenly at age 65. Better characterizing which drugs are prescribed might be particularly useful in understanding how these additional visits might result in improved health. Another interesting finding is that the increase in the consumption of hospital services at age 65 is preceded by a decline in hospital utilization at ages 63 and 64, suggesting that at least some of this increase results from postponement of hospitalization in the prior two years.

Lichtenberg's findings suggest a powerful effect of Medicare on both utilization and health outcomes, but alternative interpretations are possible. One is that 65 is also a common age of retirement, and retirement may result more time available for health care and thus improved health. To address this argument, Lichtenberg points out that 62% of workers have already retired by age 64, but this does not rule out the possibility of a spike in retirement at age 65 that might result in a (negative) spike in mortality. This possibility could be tested definitively by determining whether the spike in utilization and decline in mortality at age 65 are present for people who remain employed. Lichtenberg does not perform this test, however, he does examine whether there is a difference in the discontinuity of mortality rates at age 65 prior to the year 1965 (when Medicare began) compared to after 1965. He finds no evidence of a discontinuity

prior to age 65, but strong evidence after 1965. It seems likely that this reflects a change due to the implementation of Medicare, but it is also possible that it reflects a change in the spike in retirement at age 65, which might also have intensified with the establishment of Medicare. A related set of tests might also examine whether discontinuities in outcomes might differ for people depending on whether they have health insurance prior to age 65, and this is a valuable area for future work. Lichtenberg's preliminary findings suggest there is a significant effect of health insurance on health for persons at retirement age.

Currie and Gruber: The Medicaid expansions

Expansions of Medicaid eligibility by the Congress provide another natural experiment in which insurance coverage varies in a way that is plausibly considered exogenous. Three papers by Janet Currie and Jonathan Gruber estimate the health effects associated with expansions of Medicaid eligibility that occurred between 1979 and 1992.[6] Two of these papers (Currie and Gruber 1997, Currie and Gruber 1996b) focus on the impact of eligibility expansions for pregnant women and infants on birth-related health outcomes; the third (Currie and Gruber 1996a) analyzes the impact of eligibility expansions of coverage for children on children's health outcomes.

[6] Two other papers have examined the Medicaid expansions. Lykens and Jargowsky (2002) use the 1988 and 1991 National Health Interview Surveys. They describe two sets of results, one at the individual level and one using mean values of children's insurance eligibility and health outcomes at the primary sampling unit (PSU) level. The results of the individual-level analysis do not show a significant effect of eligibility on children's health, while the PSU-level analysis does; it is unclear whether this discrepancy results from an ecological fallacy or from the presence of "network effects", as the authors hypothesize. Lykens and Jargowsky do not report the results of a test of the network effects hypothesis (e.g., individual-level regressions including the mean value of insurance eligibility as an explanatory variable), so it is impossible based on their evidence to rule out the ecological fallacy. Kaestner, Joyce and Racine (2001) compare the incidence of hospitalizations for ambulatory care sensitive (ACS) diagnoses (e.g., asthma) for children from low-income and higher-income areas in 1988 and 1992. They find mixed evidence of reductions in ACS admissions for the children in groups most likely to have experienced gains in coverage; as the authors acknowledge, their research design biases the result toward zero. Another issue is that their measures of the incidence of ACS hospitalizations are calculated as the ratio of total ACS hospitalizations to (1) all children's

Although the timing of the expansions for pregnant women and for children was slightly different and the outcomes examined in the papers differ, all three papers use the same identification strategy. All the papers attempt to exploit the fact that some states expanded Medicaid eligibility more than others did, and did so at different times. The basic idea is that by correlating the magnitude and timing of the eligibility expansions with the magnitude and timing of changes in health outcomes it is possible to determine whether there is any causal effect of insurance on health.

More specifically, Currie and Gruber construct a variable that they refer to as "simulated" Medicaid eligibility in a given state and year, which is equal to the fraction of a nationally representative sample of relevant individuals (either children or women ages 15 - 44) who would have been eligible for Medicaid under that state's rules in a given year. This variable is a measure of the generosity of the state's Medicaid program that is independent of the economic conditions prevailing in the state in the year, for example, or of any demographic fluctuations in the size of the population eligible for benefits. Their econometric approach consists of regressing various health outcomes against this measure of "simulated" eligibility.

In their analysis of the impact of expansions of children's coverage (1996a), they examine the following outcomes for children: the probability of no doctor visit during last year, the probability of any doctor visit in the past two weeks, the probability of a hospital stay during last year, and the child mortality rate (deaths/10,000 children). Of these outcomes, only the last one

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hospitalizations or (2) contemporaneous births, which makes it difficult to interpret the outcome variable as a measure of children's health.

is a measure of child health while the others measure health inputs (utilization). Currie and Gruber conclude that there were significant increases in these health inputs as a result of the expansion of eligibility for children and that there was a corresponding significant reduction in child mortality of 1.277 deaths per 10,000 children, relative to a baseline mortality rate of 3.087 deaths/10,000 children. Thus, they conclude, expanding children's health insurance coverage improves child health as measured by the reduction in mortality rates.

The two studies focusing on expansions of coverage for pregnant women and infants (1996b, 1997) take the same basic approach but use variation in the timing and magnitude of eligibility expansions for pregnant women and the effect of these expansions on health outcomes for infants born to these women (low birth weight, infant mortality) and the use of obstetric services (specifically, cesarean section). Currie and Gruber (1996b) find a small, weakly significant effect of the Medicaid expansions on the incidence of low birthweight and a larger, significant effect on infant mortality. The estimates suggest that a 30 percentage point increase in eligibility (the actual magnitude of the eligibility change resulting from the expansions) was associated with an 8.5% decline in the infant mortality rate.

In their second paper focusing on the expansions for pregnant women (Currie and Gruber 1997), Currie and Gruber focus on specific mechanisms through which the effect on infant mortality documented in their earlier work might operate. They find that the impact of the eligibility expansions on infant mortality depended on how close the infant's mother lived to a "high-tech" hospital with a Neonatal Intensive Care Unit: the expansions had effects for infants closest to these high-tech hospitals. Interestingly, they find that the use of cesarean section, fetal monitors,

induction of labor, and ultrasound technology was affected differently by the eligibility expansions for teens and high school dropouts compared to the rest of the sample. Use of these technologies increased for teens and dropouts but decreased for more highly educated women as a result of the eligibility expansions. Currie and Gruber attribute this to the fact that many of the more highly educated women may have shifted from private insurance coverage to Medicaid (Cutler and Gruber 1996). There was, however, no decline in infant health associated with these reductions in procedure use.[7] This is consistent with a broader literature suggesting that the rate of delivery by cesarean section may be too high (Menard, 1999), and raises the question whether the increases in the use of cesarean section in teens and high-school dropouts due to the Medicaid expansions should be considered a desirable outcome.

Hanratty: The enactment of National Health Insurance in Canada

Hanratty (1996) studies the impact of Canada's national health insurance program on health outcomes. The natural experiment here is that different Canadian provinces enacted universal coverage at different times between 1962 and 1972; as Hanratty says, "it should be possible to identify the impact of national health insurance from variations across provinces in the dates of its implementation" [p. 277]. She uses county-level data on infant mortality and individual-level data on low birthweight and estimates regressions controlling for demographic and economic characteristics (age, average income, and urban location in county-level data and marital status and parity in the individual-level data). The results suggest that there was a significant reduction

[7] This result, as Currie and Gruber point out, is consistent with the interpretation that the availability of a fixed "lumpy" amount of public insurance coverage at a very low price induces women to drop private coverage that may have been more generous but was also far more expensive, resulting in a net *decrease* in the quantity of insurance these women have, with a corresponding reduction in the use of medical procedures. To the extent that this reduction in use might be considered a desirable outcomes (Menard, 1999), it is ironic that a benefit from the Medicaid expansion stems from an unintended *reduction* in coverage for person previously privately insured.

of 4% in the infant mortality rate as a result of national health insurance and a smaller reduction in low birth weight of about 1.3%.

While Hanratty's findings suggest an effect of health insurance on health outcomes, it should also be noted that it is also possible that there were systematic difference between persons in the different provinces not captured by the covariates controlled for that might also explain the observed differences in health outcomes. For example, it is possible that the differential adoption of new technologies by physicians in the various provinces both led to a demand for universal coverage and to improved health outcomes. If this is the case, one would expect to see differential improvements across the provinces in advance of the establishment of universal coverage. Hanratty investigates this possibility by testing for improvements in health outcomes across provinces in advance of the implementation of national health insurance, and does not find evidence of such effects. This does not exclude the theoretical possibility that there was a sudden acceleration in the use of beneficial technologies that generated a sudden demand for national health insurance, but this seems unlikely.

Goldman et al: Health insurance and mortality for patients with HIV

Goldman et al. (2002) use state-level variation in Medicaid eligibility and benefit generosity for HIV patients as instruments to estimate the impact of insurance coverage on mortality. Using data from the HIV Cost and Service Utilization Survey, they find that insurance lowers the probability of six month mortality by 71 percent following the survey's initial round of interviews in 1996-1997. They estimate that this effect is 85 percent in data following the survey's second round of interviews, which were conducted after the introduction of Highly Active Antiretroviral Therapy (HAART). They hypothesize that the larger estimate in the later

period is due to the increased benefit associated with insurance coverage after the introduction of HAART. Their study provides strong evidence that health insurance can have a dramatic effect on mortality among patients with HIV.

Perry and Rosen: Health insurance and health of self-employed workers

Perry and Rosen (2001) take as their point of departure the differential tax treatment of employment-based health insurance for self-employed workers compared to wage earners: health insurance premiums received as a fringe benefit of employment are entirely deductible from the worker's taxable income, while the self employed can deduct only some fraction (currently 60%) of premiums from their taxable income. This difference, in addition presumably to other differences in the small versus large group markets for insurance, results in much higher rates of insurance coverage among wage earners (81.5% in 1996 for those under age 63) than among the self-employed (69%).

Perry and Rosen investigate whether this difference in insurance coverage leads to any detectable difference in health outcomes. In order for this to be a valid natural experiment, they must demonstrate that self-employment status itself is not affected directly by health status. For example, if very healthy people who place a low value on health insurance precisely because they are healthy are disproportionately likely to become self-employed *because* they do not value the tax subsidy to health insurance for wage-earners, then the variation in health insurance is endogenous and the natural experiment is not valid. Perry and Rosen therefore go to some lengths to document the fact that self-employment status, and transitions into and out of self-

employment, do not seem to be driven by the health of either the self-employed individual or the health of his or her children.

Based on the strength of this evidence, it appears that the difference in rates of health insurance coverage for the self-employed compared to wage earners forms the basis for a valid natural experiment, so that it will be possible to draw causal inferences from this situation. Specifically, any differences in health status between the self-employed and wage-earners can be causally attributed to differences in health insurance coverage. However, Perry and Rosen fail to find any differences, on average, between the health of the self-employed and the health of wage earners. Using data from the 1996 Medical Expenditure Panel Survey (n=8,986), they fail to find significant differences in self-reported health status or in the probability of any one of a number of conditions (including viral infections, headaches, cardiac conditions, upper respiratory infections, respiratory disease, skin disease, intestinal disorders, and arthritis).

The authors conclude that the public policy concern over low rates of insurance coverage among the self-employed may be misplaced; or at least that the concern should not be motivated by fear of adverse health outcomes. Whether this conclusion is warranted depends to some extent on how much of an effect of insurance on health one considers important. For example, the most broad measure of health Perry and Rosen consider (self-reported health status good or better (versus fair or poor) has a sample mean of 0.93, and the estimated marginal effect of self-insurance is 0.0118 with a standard error of 0.00706). Perry and Rosen do not report a 95% confidence interval for this effect, but if one approximates the 95% confidence interval as two standard errors, it includes effects of about 0.026. Even the mean estimated effect of 1.18%

might not be considered small given that only about 7% of the sample rates in health as fair or poor, but clearly the upper bound on the confidence interval is not insignificant given the sample means. This tends to argue for a more conservative interpretation of the Perry and Rosen results – i.e. that they lack the statistical power to exclude a potentially meaningful effect of health insurance on health. An equally valid interpretation of this study is that for this population (employed adults), the health impact of lower rates of health insurance is not sufficiently large to show up in average differences in a sample of this size. Importantly, however, this does not exclude a substantial effect of health insurance on health.

It is difficult to summarize the results of the quasi-experimental studies since they rely on very different situations and look at very different populations: infants (both American and Canadian), children, the "medically indigent", HIV patients, veterans, and 65-year olds. But with the exception of Haas et al. and Perry and Rosen, these studies find evidence of significant improvements (declines) in health outcomes as result of expansions (contractions) of insurance coverage.

VI. Randomized experiments

The final category, randomized experiments, includes only the RAND Health Insurance Experiment (HIE). Though the HIE, having run from 1974 through 1982, is now twenty years old, it continues to be of importance because it remains the only study in the U.S. of its type. The HIE studied 2,005 families containing a total of 3,958 people between the ages of 14 and 61 who were free of disability that precluded work. These families were randomly assigned to

either a free care plan or one of several plans that required varying copayments. No significant effects on a wide range of measures of health status were found for the average patient, with quite narrow confidence intervals (Brook et al. 1983, Newhouse et al. 1993).[8] Health benefits were found, however, for persons with poor vision and for persons with elevated blood pressure. Specifically, visual acuity increased by 0.2 Snellen lines for persons with poor vision and diastolic blood pressure went down by 3 mm Hg for persons with hypertension. The reduction in blood pressure was converted into an estimated relative risk of dying based on epidemiological estimates of the effects of risk factors such as hypertension on mortality. This suggested that a person in the highest quartile of mortality risk would have an annual risk of dying of 2.11 relative to the average participant in the study if s/he was in one of the cost-sharing plans compared to a relative risk of only 1.90 if s/he was in a free care plan. This 10% reduction in mortality risk was significant at $p<0.05$ and was found to be primarily due to reductions in hypertension. Further analysis suggested that the reduction in blood pressure among low-income persons with hypertension in a free care plan occurred because they were more likely to visit the doctor than were those in cost sharing plans, and as a result were more likely to have previously undetected hypertension diagnosed. (Keeler, et al., 1985).

Several caveats accompany the RAND experiment. One caveat is that the analyses do not control for the presence of multiple comparisons (that is, hypothesis tests for multiple health outcomes). Also, these results are now twenty years old, and it is possible that changes in medical technology may make the effects of insurance different than they were when the experiment was conducted. Another caveat is that the minimum insurance policy was not no

[8] The study was not powered to be able to detect effects on mortality because the cost of such a large sample would have been prohibitive.

insurance, as is experienced by people who are truly uninsured, but a "catastrophic coverage policy," so that we cannot say anything about the effect of the complete absence of insurance.

Nonetheless, these results retain their relevance because the HIE remains the only randomized study of the effects of health insurance on health. The results are also particularly interesting because the control of hypertension is likely one of the major causes of the reduction in cardiovascular mortality, which has been the main reason for the decline in adult mortality rates in the US over the past several decades (Cutler and Kadiyala, 1999). If one believes Lichtenberg's conclusion that Medicare increased ambulatory care utilization and improved mortality, and Cutler and Kadiyala's conclusion that the control of hypertension is a key reason for the decline in adult mortality over this period, it raises the interesting possibility that Medicare reduced mortality at least partially by improving the control of hypertension.

Section VII. Discussion: So what do we know?

Observational studies of the effect of health insurance on health clearly suggest an association between the two, but provide little evidence on whether this relationship is causal. We focus on quasi-experimental and experimental studies whose results provide a basis for drawing causal inference. The results of small quasi-experimental studies provide only mixed evidence that health insurance affects health, while larger quasi-experimental studies and the RAND Health Insurance Experiment provide consistent evidence that health insurance improves health. Only one large-scale quasi-experimental study (Perry and Rosen) fails to show a relationship between

health insurance and health, and this study may not have adequate power to rule out the possibility that health insurance improves health. Taken as a whole, these high-quality studies of the health effects of health insurance strongly suggest that policies to expand insurance can also promote health.

Another lesson from this literature is that the size of the effect of health insurance on health depends very much on whose health we are talking about. Vulnerable populations such as infants and children on the fringes of Medicaid eligibility or low-income individuals in the RAND experiment have the most to gain from more resources, and do appear to benefit from them. But the effects for higher-income adults and children seem to be smaller; moreover, it is difficult to extrapolate from these studies to the potential health benefits of completely different policies such as a Medicare buy-in for people ages 55 to 64, for example, so that it is very hard to predict the benefits associated with innovative policies. It is also worth noting that most of the insurance expansions studied included coverage of ambulatory care, and that many of the outcomes that were found to improve (such as blood pressure control and HIV mortality) in response to insurance coverage are outcomes that are plausibly affected by ambulatory treatment. In other words, these studies do not allow us to say what the independent effect of catastrophic insurance coverage alone might be.

We are left with the conclusion that health insurance can improve health but remain unable to say exactly which interventions related to insurance will do so most effectively. This uncertainty is even greater when we consider interventions directly targeting health or access to medical care as well as those aimed at expanding insurance. Expanding insurance is not the only way to improve health. There is no evidence at this time that would allow us to say whether money aimed at improving health would be better spent on health insurance or on inner-city

clinics, community-based screening programs for hypertension, or advertising campaigns to encourage good nutrition, to name just a few possibilities.

Table 1

Experimental and Quasi-Experimental Studies:
What do they find about how health insurance affects health?

Fihn and Wicher 1988: Cancellation of VA outpatient benefits associated with significant increases in blood pressure.
Lurie et al. 1986a, 1986b: termination of Medi-Cal benefits associated with significant increases in blood pressure, especially among persons with lower incomes.
Haas 1993a, Haas 1993b: Expansions of Healthy Start in Massachusetts to women between 100 and 185% of poverty; no effect on birth outcomes relative to privately or publicly insured women.
Currie and Gruber 1996a: expansions of Medicaid among children associated with declines in child mortality.
Currie and Gruber 1996b: significant decline in infant mortality associated with expansions of Medicaid to pregnant women; smaller decline in the incidence of low birth weight.
Currie and Gruber 1997: expansions of Medicaid to low-income pregnant women had positive effect for those living close to neonatal intensive care units; procedure use (e.g. fetal monitors) increased for high-risk mothers (low education) and decreased for more educated mothers, but relative birth outcomes did not change.
Hanratty 1996: Canadian National Health Insurance; improvements in infant mortality and smaller improvements in the incidence of low birth weight.
Lichtenberg 2001: improvements in mortality among 65-year olds associated with the passage of Medicare in 1965.
Perry and Rosen 2001: The self-employed are far less likely to be insured than wage earners, but appear to suffer no adverse health outcomes as a result.
Brook et al 1983; Keeler et al 1985: Persons randomized to health insurance policies that provide free care versus only catastrophic coverage experience no change in health outcomes, except for reductions in blood pressure for low income persons with hypertension, and small improvements in corrected vision.
Goldman et al. 2001: More generous state-level policies to increase access to effective HIV therapies reduce mortality among HIV+ individuals.

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