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The Causal Effect of Health Insurance on Utilization and Outcomes in Adults

A Systematic Review of US Studies

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Background: No current consensus exists on the causal effect of gaining or losing health insurance on health care utilization and health outcomes.

Objective: To systematically search and review available evidence of estimated causal effects of health insurance on health care utilization and/or health outcomes among nonelderly adults in the United States.

Research Design: A systematic search of 3 electronic databases (PubMed, JSTOR, EconLit) was performed. To be included in the review, studies had to have a publication date after 1991; a population of nonelderly adults; analyses comparing an uninsured group to an appropriate control group; and 1 of 3 study designs that account for potential reverse causality and provide estimates of causal effects (longitudinal cohort, instrumental variable analysis, or quasi-experimental design).

Results: A total of 9701 studies, including duplicates, were primarily screened. Fourteen studies fulfilled the criteria to be included in this review—4 longitudinal cohort studies using standard regression or fixed effects analysis, 5 longitudinal cohort studies using instrumental variable regression analysis, and 5 quasi-experimental studies.

Conclusions: Results of our review of empirical studies that estimate causal relationships between health insurance and health care utilization and/or health outcomes consistently show that health insurance increases utilization and improves health. Specifically, health insurance had substantial effects on the use of physician services, preventive services, self-reported health status, and mortality conditional on injury and disease. These results both confirm and contradict comparable results from the RAND Health Insurance Experiment, the gold standard on relationships between health insurance, utilization, and health.

Key Words: health insurance, uninsured, causation, utilization, outcomes

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The lack of health insurance in segments of the US population and its potential effect on health care utilization and health outcomes continues to be the focus of intense local, regional, and national policy debate. The most recent census of uninsured Americans, a record high of 47 million citizens in 2006, was reported on the front page of the *New York Times*.¹ Influential reports from the Institute of Medicine² and the National Coalition on Health Care³ call for universal coverage to confront a potential health crisis. Twenty-one states have taken legislative steps to enact notable health care reform policies, expansions, or state-level universal insurance coverage plans.⁴

While many citizens and politicians believe that some form of universal health insurance coverage is needed, evidence to support such a costly and fundamental change to the health care system is sparse. Several comprehensive reviews (Table 1)^{2,5–15} have addressed associations between insurance and health care access, utilization, and/or outcomes. However, the collective evidence from these reviews is hampered by nearly universal employment of cross-sectional research designs. Although such designs highlight disparities in US health care, they are unable to identify causal relationships.^{9,12,16} Further, the direction of associations is unclear as poor health outcomes may lead to a loss of health insurance or its gain. An additional difficulty in determining causality is that although the lack of health insurance may cause poor health, it is equally possible that lack of insurance serves as a proxy for unobservable factors that are correlated with both the probability of being insured and utilization patterns or health.

The most influential study of health insurance and the only widely accepted experiment conducted in the field is the RAND Health Insurance Experiment (RAND HIE).^{17–19} The RAND HIE randomly assigned 5809 people into insurance groups with 0% (free care), 25%, 50%, and 95% first dollar cost-sharing schedules. Results of this landmark study indicated that for the typical person, cost-sharing reduced the use

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TABLE 1. Reviews of Studies of the Consequences of Health Insurance

Author	Topics Investigated	General Conclusions*
American College of Physicians: No health insurance? It's enough to make you sick (1999) ⁵	Utilization Outcome	Insured more likely to have a regular source of care and use preventive services; less likely to delay care-seeking, report they did not receive needed care, experience adverse health outcomes, require avoidable hospitalizations and emergency care, and experience lower mortality rates
Andrulis (1998) ⁶	Socioeconomic status Access to care Outcome	Higher socioeconomic status and insurance is associated with increases in access to care and quality of care, and lower mortality rates
Brown et al (1998) ⁷	Utilization Outcome	Insured use more medical services and have lower mortality rates
Buchmueller et al (2005) ⁸	Utilization	Insured have more outpatient visits per year, increased receipt of preventive care, and increased inpatient utilization
Hadley (2003) ⁹	Utilization Outcome	Insured receive more preventive and diagnostic services, more care, have a less progressed disease state when diagnosed, and lower mortality rates
Hoffman & Paradise (2008) ¹⁰	Access to care Outcome	Insured have greater access to care, better care for chronic conditions; and less unmet health care needs, delayed care, avoidable hospitalizations, progressed disease states, preventable health problems, and premature mortality
Howell (2001) ¹¹	Medicaid expansions Pregnant women	Medicaid expansions led to increased coverage of pregnant women, some increase in prenatal care, and weak evidence for improved birth outcomes
Institute of Medicine: Care without coverage (2002) ²	Utilization Outcome	Insurance coverage is associated with having a regular source of care; increases in preventive services, and appropriate care for chronic conditions; and better health outcomes
Levy & Meltzer (2004) ¹²	Causation	Consistent evidence from a non-systematic search that health insurance can improve health but unable to determine which interventions would be most effective
Office of Technology Assessment: Does health insurance make a difference? (1992) ¹³	Utilization Process of care Outcome	Insured have higher utilization rates, more likely to have adequate care and less likely to have adverse health outcomes
Ross & Mirowsky (2000) ¹⁴	Socioeconomic status Utilization Outcome	Insured have higher utilization rates for physician visits and hospital services, and lower mortality rates
Weissman & Epstein (1993) ¹⁵	Access to care	Insured are more likely to have a regular physician, receive preventive care, and have more ambulatory visits. They have shorter waiting times for treatment, and are less likely to delay important care and receive care from emergency departments or hospital outpatient clinics

*Conclusions are presented in comparison to the uninsured, with the exception of Howell (2001) and Levy and Meltzer (2001).

of physician, hospital, and prescription services with little effect on health outcomes. These collective findings provide important insights into the role of cost-sharing on utilization and outcomes; yet, even the highest cost-sharing plan in the experiment had a stop-loss measure for individuals. The RAND HIE is now almost 30 years old and given substantial changes in knowledge, treatment, and technology, the results on the effects of cost-sharing, utilization, and health may no longer be applicable today. Accordingly, the question of whether extending health insurance to the uninsured leads to changes in health care utilization and/or outcomes remains an open question. Consistent with recent calls for evidence-based public health policy,^{20,21} this systematic review focuses on the evidence available to address this question.

In a much simplified model, insurance influences health care utilization and, in turn, health outcomes.^{2,9,13,22} However, associations between insurance, utilization, and outcomes are dynamic and inter-related. Although outcomes

may arise from insurance and utilization patterns, they may also influence individual decisions to take up insurance or seek care. Insurance coverage may encourage some individuals to consume more care (ex-post moral hazard) while the income risk protection afforded by insurance may lead others to under-invest in preventive activities (ex-ante moral hazard).²³ Use of medical care may be associated with improved health or iatrogenic complications. Further, countless variations in insurance plans—depth of coverage, cost-sharing arrangements, and economic incentives—have the potential to affect utilization and/or outcomes.

Health insurance, service use, and outcomes are influenced by a complex constellation of individual- and system-level characteristics. Individual-level characteristics include predisposing (ie, demographics and cultural background), enabling (ie, socioeconomic status and employment-based coverage), and need (ie, perceived or evaluated health status) factors.²⁴ System-level factors include organization and de-

livery of care as well as the political, cultural, and socioeconomic environment.²⁵

Reviews (Table 1)^{2,5–15} generally show that individuals with health insurance coverage have improved access to care,^{6,10} receive more ambulatory and hospital-based services,^{2,5,7–9,11,13–15} experience better health outcomes,^{2,5,10–13} and have lower mortality rates^{5–7,9,10,14} when compared with the uninsured. The insured are less likely to delay seeking care,^{5,10,15} less likely to require avoidable hospitalizations or emergency department visits,^{5,10} and less likely to receive care from emergency departments or outpatient clinics.¹⁵ They also experience shorter wait times for treatment,¹⁵ more appropriate care for chronic conditions,^{2,10,13} and have less progressed disease states when diagnosed.^{9,10}

Several factors complicate interpretation of the collective findings from extant reviews. The first is the problem of endogeneity of insurance (ie, health insurance may be related to factors that affect health but which were not included in the regression models leading to inaccurate conclusions of the effect of insurance) and potential self-selection bias. Health insurance status is determined by many unobserved factors and most studies use research designs and methods that cannot account for the potential effects of omitted variables. Possibly, the most important unobserved variable is the underlying health status of individuals. If individuals in the insured pool are healthier than individuals in the uninsured pool, the estimated effect of insurance on health will be biased upward in the cross-section; conversely, if individuals in the uninsured pool are healthier than individuals in the insured pool, the insurance estimate will be biased downward. It is difficult to determine the direction of the bias a priori because it is possible that sick individuals lose coverage and enter the uninsured pool and equally possible the uninsured pool includes young, healthy individuals who decide not to purchase health insurance. Accordingly, results from cross-sectional studies may both underestimate and overestimate the true effect of health insurance on health. Second, there are many conceptualizations of health insurance, utilization, and outcomes making meta-analysis or cross-study comparisons very difficult.²⁶ Health insurance plans vary in level of coverage and generosity, yet in many studies insurance status is captured by dichotomous measures. Health care utilization may be measured by access, visits, treatment type, costs, or length of hospital stay. Health outcomes include self-reported health status, clinical diagnoses, and mortality.

We undertook a systematic review of studies examining associations between health insurance and health care utilization, and/or health outcomes among nonelderly adults of working age in the United States. Unlike previous reviews,^{2,5–15} we systemically searched for studies that used research designs that could estimate causal effects of insurance coverage on utilization and/or outcomes in US adults. We contribute to the field of health insurance research by drawing conclusions based solely on these studies.

Three research designs were included as follows:

Longitudinal Cohort Studies. This design examines changes in utilization and/or outcomes over time as study participants

gain and lose insurance. These studies generally include 3 groups of individuals—a continuously insured group, an intermittently insured group, and a continuously uninsured group. This study design is more powerful than the cross-sectional research design because time-invariant unobserved differences across individuals in these groups can be ruled out as explanations for differences in utilization and/or outcomes. Consequently, one is able to infer a causal relationship between insurance status, utilization, and health.⁷

Quasi-experimental Studies. These studies exploit universal policy changes, program implementations, or external health shocks such as accidents to compare utilization and/or outcomes between insured and uninsured groups. In cases where policy leads to insurance expansion to previously uninsured individuals, researchers look for unequal *changes* in utilization and/or outcomes between the newly insured and a control group without insurance. In studies of health shocks, researchers compare treatment and/or outcomes for individuals with and without insurance. Carefully conducted quasi-experimental designs allow estimation of causal effects of insurance on health care utilization and health¹² and warrant greater consideration in comparison with other nonexperimental study designs.⁹

Instrumental Variable (IV) Analysis. IV analysis is a statistical technique that centers on finding a variable (an instrument) that is: (1) correlated with the treatment (ie, whether or not an individual is insured), and (2) uncorrelated with both observed and unobserved individual characteristics that are correlated with the outcome (ie, health care use or health status).^{16,27} IV analysis has a simple analog to the randomized control trial in that the randomization procedure that assigns individuals to treatment and control groups is the instrument. If performed correctly, the randomization procedure satisfies the 2 conditions of an instrument: (1) it affects the probability of being assigned to treatment or control groups, and (2) it is uncorrelated with individual characteristics that might affect the outcome. Identifying instruments in the real world that satisfy the first condition is a relatively easy task, but satisfying the second condition is more difficult.²⁸

In the absence of findings from randomized controlled trials, the 3 research designs above provide the best available evidence and insights into the causal effects of health insurance.

METHODS

We conducted systematic searches of English language papers in 3 of the largest on-line medical, social science, and economic journal literature databases: PubMed, JSTOR and EconLit. In PubMed, the search incorporated medical subject heading (MeSH) categories and key words to search for all possible between-category combinations of the following:

1. Two terms describing insurance: (a) insurance, health (MeSH); (b) medically uninsured (MeSH).

2. Three terms describing outcomes or utilization: (a) health status (MeSH); (b) outcome assessment (MeSH), and (c) utilization (subheading).
3. Three terms describing the study designs of interest, each entered as key words: (a) quasi-experimental; (b) longitudinal; and (c) instrumental variable.

In JSTOR, all combinations of the terms above were used (with the exception of *insurance*, *health* that was entered as health insurance) and all terms were entered as key words.

In EconLit, 2 separate searches were performed using the following parameters:

1. Insurance AND (medical OR health) AND (utilization OR outcome).
2. Insurance AND (medical OR health) AND demand.

The review proceeded sequentially. In the primary screening, we reviewed abstracts and titles resulting from the search and excluded irrelevant studies. The following screening criteria were applied:

1. Publication after 1991. Owing to the PubMed introduction of the MeSH categories of *medically uninsured* and *outcome assessment (health care)* in 1992, this criterion was applied to assure consistent MeSH categories across the review. Moreover, this restriction assures inclusion of studies that reflect fairly recent health care system arrangements (eg, managed care).
2. Analysis that included comparison to an uninsured control group.
3. A study (sub)population of adults age 18 through 64 in the United States. The upper age limit was chosen because Medicare provides near-universal health care coverage to adults over age 65 and the health status of adults over age 65 differs greatly from those below age 65.¹⁵ The lower age limit was chosen to restrict the sample to working-age adults and because children's health insurance and service use is predominately linked to that of their parents or guardians² and warrants separate review.
4. Use of either longitudinal, quasi-experimental, or IV study design to estimate the causal effects of insurance. Longitudinal cohort studies were limited to those following patients for at least 2 years.
5. The study outcome measured health care utilization and/or health.
6. Studies of Medicaid expansions in the late 1980s and early 1990s for pregnant women were excluded because these studies have been reviewed extensively elsewhere^{9,11,29-31} and results may not be generalizable to the greater US population.^{8,9,14}

All references cited in each study that met our inclusion criteria were similarly screened. Once a study was identified as meeting the inclusion criteria in the secondary screening, if applicable, a PubMed "related article" search algorithm was run, and results were screened with the primary and secondary screening methods described above. The search process—including primary screening, secondary screening, bibliography search, and the related article search (PubMed only)—was repeated until no new papers were identified.

All stages of the review were conducted independently, by at least 2 investigators. The first author (J.D.F.) completed all steps of the process. Inter-rater agreement was high for the primary screening ($\kappa = 0.95$). Discrepancies in the results of the independent reviews were few, and were resolved with consensus of the first 3 authors. Results are reported as significant if $P < 0.05$.

RESULTS

In total, 9701 studies were identified: 367 using the PubMed MeSH category and keyword search strategy; 7582 using the PubMed "related article" algorithm; 917 using the JSTOR search strategy; 353 using the EconLit search strategy; and 482 from reference lists of selected papers. Fourteen studies fulfilled all screening criteria: 4 longitudinal cohort studies using standard regression or fixed effects analysis (Table 2),³²⁻³⁵ 5 longitudinal cohort studies using IV regression analysis (Table 3),³⁶⁻⁴⁰ and 5 quasi-experimental studies with a nonequivalent control group or nontraditional design (Table 4).⁴¹⁻⁴⁵

Insurance Status and Health Care Utilization

Of the 14 studies identified, more than half examined relationships between health insurance and utilization.^{34,39-43,45} Utilization measures included outpatient physician visits, hospital use, emergency department use, specialty care use, and preventive care.

Five studies found that health insurance led to increased use of outpatient physician services by 8–40%.³⁹⁻⁴³

Three studies examined the effect of insurance on use of emergency department (ED) services.⁴¹⁻⁴³ Insurance and emergency service use are potential substitutes as the uninsured might delay care to the point where a medical condition reaches the level of an emergency or use EDs as their primary care source. Steiner et al found insurance led to a reduction in the use of ED care.⁴³ In their study, the newly insured group experienced an 18% decrease in the proportion of individuals who used the ED; whereas, in a comparable control group of individuals with self-pay insurance status, there was only a 4% decrease in use of ED services during the study period—suggesting a net decrease of 14 percentage points in the share of individuals with ED use attributed to insurance. Kwack et al could not reject the hypothesis that there was no difference in ED use between a managed care insurance group and a group of uninsured individuals.⁴² Carlson et al found no differences between ED use among groups who lost insurance, had disrupted insurance, and remained continuously insured.⁴¹

Five studies examined the effect of insurance on hospital service use.^{39,40,42,43,45} Kwack et al⁴² reported no difference in hospital service use between individuals with and without health insurance, whereas Johnson and Crystal³⁹ and Meer and Rosen⁴⁰ each found that health insurance increased hospital service use by approximately 7%. Steiner et al found that the share of individuals who were hospitalized decreased by 34% in the newly insured group.⁴³ In the uninsured group, the share of individuals hospitalized decreased by only 12% over the same time period, suggesting that insurance reduced the probability of hospitalization by 22 percentage points.

TABLE 2. Summary of Studies Estimating Causal Effects of Health Insurance Employing Longitudinal Cohort with Standard Regression or Fixed Effects Analysis

Design	Author	Sample and Data	Purpose	Measures	Findings	Direction and Magnitude of Effects
Longitudinal cohort with standard regression	Baker et al (2001) ³²	7577 participants in the Health and Retirement Survey 1992–1996; ages 51–61 years in 1992; interviewed 3 times at 2 year intervals	To test relations between insurance status and major declines in overall health and development of new physical difficulties	Insurance: Continuously insured (ref), intermittently uninsured, continuously uninsured Outcome: Self-reported overall health, physical functioning	Continuously uninsured and intermittently uninsured were more likely than continuously insured to experience a major decline in health or a new difficulty walking or climbing stairs	Major health decline: RR = 1.41–1.63 (95% CI 1.11–2.08) New physical difficulty: RR = 1.23–1.26 (95% CI 1.01–1.54)
	Baker et al (2002) ³³	6072 participants in the Health and Retirement Survey 1992–1996; ages 51–61 years who had private insurance in 1992; interviewed 3 times at 2 year intervals	To investigate relationships between continuity of insurance, health status, and physical functionality	Insurance: Continuously privately insured, loss of insurance, transition from private to public insurance Outcome: Self-reported overall health, physical functioning	Those who lost insurance had greater risk of a subsequent decline in overall health but no increased risk of decline in physical functioning compared with those with continual insurance	Major health decline: RR = 1.82 (95% CI 1.25–2.59; lost insurance group only) New mobility difficulty: not significant (RR = 1.26, 95% CI 0.90–1.68)
	Sudano & Baker (2003) ³⁴	7300 participants in the Health and Retirement Survey 1992–1996; ages 51–61 years in 1992; interviewed 3 times at 2 year intervals	To examine associations between intermittent lack of insurance and use of preventive health services	Insurance: Gained insurance, lost insurance, continuously uninsured, continuously insured (ref) Outcome: use of mammography, pap test, cholesterol test, influenza vaccination, prostate exam, breast self-exam between 1994 and 1996	Continuously uninsured and previously insured were less likely than continuously insured to use all measured preventive services except breast self-exam and influenza vaccination (previously insured only). Newly insured were not more likely to use preventive services except for influenza vaccination, prostate exam, and breast self-exam	Mammography: RR = 0.63–0.86 (95% CI 0.53–0.95) Pap test: RR = 0.70–0.89 (95% CI 0.59–0.99) Cholesterol test: RR = 0.67–0.91 (95% CI 0.57–0.98) Influenza vaccination: RR = 0.71 (95% CI 0.56–0.88; uninsured only) Prostate exam: RR = 0.53–0.68 (95% CI 0.42–0.86; uninsured and previously insured only) Breast self-exam: not significant (RR = 0.89–1.00, 95% CI 0.77–1.16)
Longitudinal cohort with sibling fixed effects	Quesnel-Vallee (2004) ³⁵	2877 National Longitudinal Survey of Youth (NLSY) respondents, followed since 1979, who were aged 40 between 1998 and 2000 (full sample) and 227 NLSY sibling clusters (sibling sample)	To test associations between insurance and health status using sibling fixed effects models to account for unobserved factors shared by siblings	Insurance: Number of years uninsured, publicly insured and privately insured between 1989 and 1996/1998 Outcome: self-reported physical health status	In the full sample with OLSR there was an inverse association between years without insurance or with public insurance (compared with private insurance) and health at age 40. In the sibling sample with OLSR, there was an inverse relationship between years publicly insured and no significant relationship between years uninsured with health at age 40. Controlling for sibling fixed effects, the association with public insurance was not significant, whereas having no insurance was significantly and inversely associated with health	Self-reported health (5-point scale): –0.15 points (RSE 0.04) for each year uninsured No significant effect for public insurance

Results presented are statistically significant ($P < 0.05$).
ref indicates reference group; RR, relative risk; OLSR, ordinary least squares regression; RSE, robust standard error.

TABLE 3. Summary of Studies Estimating Causal Effects of Health Insurance Employing Longitudinal Cohort with Instrumental Variable Analysis

Study Design	Author	Sample and Data	Purpose	Measures	Findings	Direction and Magnitude of the Effect
Longitudinal cohort with Instrumental Variable (IV) analysis	Busch & Duchovny (2005) ³⁶	Low-income age 18–64 years old previously uninsured mother participants in the 1996–2002 Current Population Survey who lived in Medicaid expansion states and received a breast exam (n = 92,137) or pap smear (n = 83,198)	To measure the effect of Medicaid expansions on preventive cancer screening for previously uninsured mothers who did not previously receive these services	Insurance: Medicaid, none (ref) Outcome: breast exam, pap smear in previous year IV: Time variation in states' expansion of Medicaid eligibility	Medicaid eligibility expansions for previously uninsured mothers led to an increase in preventive cancer screening	Breast exam: 29% increase Pap smear: 29% increase
	Goldman, Bhattacharya, McCaffrey, et al (2001) ³⁷	Participants in the HIV Costs and Services Utilization Study (n = 2864 at baseline and 2466 at first followup) over age 18 years with at least one visit for regular care in early 1996	To measure the effect of health insurance on the mortality of the HIV+ population in care	Insurance: any, none (ref) Outcome: mortality 6 months after baseline and follow-up interviews IV: (1) state has a "medically needy" program to extend Medicaid eligibility to qualified persons exceeding usual income limits; (2) state income eligibility threshold for Aid to Families with Dependent Children	In IV models, having insurance lowered the probability of 6 mo mortality at baseline and at follow-up	Probability of 6 month mortality at baseline: 71% lower Probability of 6 month mortality at follow-up: 85% lower
	Hadley & Waidmann (2006) ³⁸	3564 participants in the Health and Retirement Survey 1992–1996, ages 55–61 years in 1992, and followed biannually until age 62–63 or the year 2000	To investigate the endogeneity bias on the estimated effect of health insurance at age 63 or 64	Insurance: percent time insured during the survey period Outcome: mortality, self-reported health status, activities of daily living IV: exogenous identifying variables that influence insurance coverage but not future health (spouse's prior union membership, immigrant status, involuntary job loss)	Positive effect of continuous health insurance on estimated health and survival	Mortality by age 65: 7% with actual coverage, 5% with full coverage (observational model), 4% with estimated full coverage (IV model) Excellent health (self-report): 13% with actual coverage, 15% with estimated full coverage (observational model), 17% with full coverage (IV model)
	Johnson & Crystal (2000) ³⁹	7018 survey participants ages 51–61 years at the onset of the study, interviewed in 1992 and 1994	To investigate the relationship between baseline health insurance and subsequent utilization	Insurance: employment-based coverage, private non-group insurance, no insurance in 1992 (ref) Outcome: physician visits, no. and length of hospitalizations, nursing home stays IV: predicted insurance plan type based on job characteristics and other common demographic variables	Individuals with employment-based coverage had a higher likelihood of any physician visit, more visits on average, higher likelihood of hospitalization, lower out-of-pocket costs, and higher premium-related costs	Any physician visit: 7% higher likelihood Mean annual visits: 3.4 vs. 2.4 Hospitalization: 7% higher likelihood Out-of-pocket costs: \$50 less per year Premium-related costs: \$650 more per year
	Meer & Rosen (2004) ⁴⁰	23,851 participants in the Medical Expenditure Panel Survey with overlapping 2 year panels (1996, 1997, and 1998) each including 2 annual interviews	To investigate the relationship between health insurance and utilization	Insurance: any, none Outcome: physician use, non-physician use, hospital use, preventive services use IV: self-employment status	Positive effect of health insurance on utilization	Office-based visits: 31% higher Night in hospital: 7% higher Prescriptions: 32% higher Preventive services: 32%–48% higher

Results presented are statistically significant ($P < 0.05$).

IV indicates instrumental variable.

TABLE 4. Summary of Studies Estimating Causal Effects of Health Insurance Employing Quasi-Experimental With Non-equivalent Control Group or Non-traditional Study Design

Study Design	Author	Sample and Data	Purpose	Measures	Findings	Direction and Magnitude of the Effect
Quasi-experimental with non-equivalent control group design	Carlson et al (2006) ⁴¹	2783 survey respondents, age 19 years and older, enrolled in Oregon Health Plan for at least 30 days before program changes were implemented	To examine effects of disrupted and lost insurance coverage on unmet health care needs, utilization, and medical debt in the first 10 months after implementation of new health plan changes	Insurance: continuous insurance (ref), disrupted coverage, lost coverage Outcome: primary care visit, unmet health care needs, medical debt	Individuals with disrupted coverage (Disrupted) and lost coverage (Lost) were less likely to have primary care visits and more likely to have unmet health care needs and medical debt	Primary care visit: disrupted OR = 0.66 (95% CI 0.44–0.99), lost OR = 0.18 (95% CI 0.13–0.24) Unmet health care needs: disrupted OR = 1.85 (95% CI 1.28–2.67), lost OR = 5.55 (95% CI 4.17–7.38) Medical debt: disrupted OR = 1.99 (95% CI 1.35–2.93), lost OR = 3.06 (95% CI 2.28–4.12)
	Kwack et al (2004) ⁴²	1676 low-income previously uninsured patients who visited an urban teaching hospital from 1997–2001	Investigate the effect of a managed care program extended to low-income uninsured adults at an urban teaching hospital over the course of 4 years	Insurance: new managed care program, commercial (ref), none Outcome: physician or departmental visits Exogenous event: participants were enrolled in a managed care program	Program participants were variably more likely to have more primary care visits and less emergency department visits after program implementation when compared to the uninsured. There was a decrease in hospitalized days of Program participants in year 1 when compared with the uninsured. There was no change in specialty care visits. The authors concluded that implementation of the program did not consistently change overall use of emergency department visits or inpatient hospital stays over the 4 years of the program.	Changes post-program implementation: no significant differences in emergency, inpatient, outpatient or specialty clinic use by insurance type following program implementation
	Steiner et al (2002) ⁴³	1225 medically indigent patients at an urban teaching hospital from 1994–1996	Analyze the impact of a capitated, managed care program for medically indigent adults	Insurance: new program for MI, M, or U (ref) Outcome: physician or departmental visits Exogenous event: a capitated managed primary care clinic was opened for all medically indigent patients who visited an urban teaching hospital	There was an increase in the number of primary care visits per capita, decrease in number of emergency department visits per capita and decrease in number of patients who identified the emergency department as their only source of care, among qualifying indigent patients compared to self-pay uninsured patients, pre- and post-program implementation. There was no difference in specialty clinic visits, hospitalizations per capita and percent change in cost	Changes post-program implementation: % with primary care visits: +185% (MI), +50% (M), –50% (U) % with specialty care visits: –19% (MI), +2% (M), +5% (U) % with emergency department use: –18% (MI), –3% (M), –4% (U) % with hospitalization: –34% (MI), +12% (M), –12% (U) % change in costs: –31% (MI), –11% (M), –6% (U)
Quasi-experimental with non-traditional study design	Braveman, et al (1994) ⁴⁴	Hospital discharge data for 96,587 adults 18–64 years old who were hospitalized for acute appendicitis in California, 1984–1989	Examine differences in incidence of appendiceal perforation by insurance coverage among patients with acute appendicitis	Insurance: private (ref), Medicaid, none Outcome: appendiceal perforation following hospitalization for acute appendicitis Exogenous event: acute appendicitis	Compared with adults with private insurance, those with no insurance or with Medicaid coverage were more likely to have a ruptured appendix, controlling for socioeconomic status and other important confounding variables	Ruptured appendix: OR = 1.46 (95% CI 1.39–1.54, uninsured)
	Doyle (2005) ⁴⁵	Police accident reports linked to hospital discharge abstracts for 10,842 motor vehicle accident (MVA) victims in Wisconsin from 1992–1997	Investigate resource use and health outcomes of individuals in response to severe MVAs	Insurance: private medical insurance (and no automobile insurance), uninsured (ref) Outcome: length of hospital stay, total charges, mortality Exogenous event: MVA	Uninsured individuals had fewer facility charges, fewer days of care, and higher mortality rates compared with controls involved in MVAs who had private medical insurance but lacked automobile insurance	Care after MVA: 22% fewer charges, 20% fewer days of care Mortality post MVA: approximately 40% higher

Results presented are statistically significant ($P < 0.05$).
MI indicates medically indigent; M, Medicaid; U, uninsured; MVA, motor vehicle accident.

Doyle examined the effect of health insurance on hospital length of stay conditional on having a serious motor vehicle accident, finding a 20% increase in length of stay.⁴⁵

Three studies focused on relationships between health insurance and the use of preventive services such as mammograms, flu shots, pap smears, breast exams, and cholesterol screening.^{34,36,40} Sudano and Baker found that those who lost insurance were less likely to use preventive measures, with the exception of influenza vaccination, when compared with the continuously insured.³⁴ Those who gained insurance did not increase their use of the assessed preventive services. As the number of episodes without insurance between 1992 and 1996 increased, service use declined, resulting in a dose-response effect. Meer and Rosen used self-employment status as an instrumental variable and found a varied but consistent positive effect of insurance on utilization of most general health services.⁴⁰ Busch and Duchovny used time variation in states' expansion of Medicaid as an instrumental variable and found a 29% increase in both breast exams and pap smears.³⁶

Insurance Status and Health Outcome

Seven of the 14 studies estimated relationships between insurance and health outcomes, including mortality, self-reported health status, and formulated health scores.^{32,33,35,37,38,44,45} All 7 studies found that individuals with insurance had better health outcomes. Comparison of the insurance estimates across studies is complicated by vastly different outcome measures and by the focus in some studies on specific subpopulations, including HIV-positive individuals,³⁷ accident victims,⁴⁵ and patients with acute appendicitis.⁴⁴

Baker et al (2001) found that both the continuously uninsured and the intermittently insured were more likely to experience a major decline in health—defined as change in self-reported health status from “excellent,” “very good,” or “good” to “fair” or “poor” categories—when compared with a continuously insured control group.³²

Two studies^{35,38} examined effects of insurance on self-reported health status. Hadley and Waidmann used spouse's prior union membership, immigrant status, years in the United States (if foreign-born), and involuntary job loss within the last 5 years as instruments for health insurance status.³⁸ Using estimates from the IV model, they predicted that giving everyone in the sample health insurance would increase the percentage of individuals who reported excellent health from 13.3% to 16.6% and the percentage reporting very good health from 29.8% to 33.9%. Quesnel-Vallee examined differences in self-reported health status among siblings with and without health insurance coverage, finding insurance increased self-rated health measured on a 5-point scale by 0.15 points on average.³⁵

Three studies analyzed effects of insurance on mortality within specific subpopulations.^{37,44,45} Goldman et al examined the effects of insurance on mortality for individuals with HIV, using differing state eligibility standards for public insurance programs to instrument for health insurance status.³⁷ Results of the IV analysis indicated that insurance lowered the probability of death by 71% at baseline and 85% at follow-up. Doyle found, for individuals involved in a severe automobile accident, insurance lowered the probabil-

ity of 30-day mortality by 1.5 percentage points compared with the sample death rate of 3.8%.⁴⁵ Braveman et al found that individuals without insurance who were admitted to the hospital with acute appendicitis had 50% higher odds of rupture when compared with individuals with private insurance.⁴⁴

DISCUSSION

Surprisingly few studies have examined links between health insurance coverage and health care utilization and/or outcomes using designs that can estimate causal relationships. In this systematic review, only 14 studies met our criteria.

Consistent with the RAND HIE, we find that insurance affects the use of physician services. The RAND HIE found that individuals in the 95% coinsurance plan had a per-capita physician visit rate of 2.73 and individuals in the 25% coinsurance plan had a per-capita physician visit rate of 3.33.¹⁷ This 22% increase in physician visits is within the 8–40% range identified in our sample of studies.

Other findings differ from those of the RAND HIE. We did not consistently find that insurance increased hospital or emergency service use. Most importantly, and in contradiction to the RAND HIE, we find that health insurance leads to better health for both the average person and for individuals who are newly diagnosed with a disease.

We posit several reasons for the differences between studies we identified and the RAND HIE. One explanation is the RAND HIE follow-up period (up to 8 years) was typically longer than the follow-up period of studies in our review that examined hospital utilization measures (4 years or less on average). Given hospital stays are rarer events than physician visits, individuals in our studies may simply not have been tracked long enough to find significant differences. The studies we identified also had much smaller sample sizes than the RAND HIE and possibly insufficient power to find insurance-related differences in outcomes.

While 2 studies^{39,42} found no differences between the insured and uninsured in hospital utilization, 3 studies^{40,43,45} found significant differences. Steiner et al found that a managed care insurance plan lowered the use of hospital services relative to the uninsured.⁴³ Because the Steiner et al insurance results are for a managed care plan, we compare these results with the RAND HIE health maintenance organization (HMO) results. Consistent with Steiner et al, Newhouse reported RAND HMO results showing that individuals in the Group Health Cooperative plan were 22% less likely to be hospitalized than individuals in the 95% cost-sharing plan.¹⁷

In the case of health insurance effects on health, results of the RAND HIE indicated that poor individuals in low cost-sharing plans had better health outcomes on certain measures than their counterparts in high cost-sharing plans. However, no differences were found in health outcomes for the average person. Results of all studies identified in our review suggest that individuals with health insurance have better outcomes than individuals without health insurance. One clear difference between some studies identified in our review^{37,44,45} and the RAND HIE is the assessment of insur-

ance effects among individuals who are already sick (eg, with HIV, appendicitis, or car accidents). It is possible, indeed likely, that health insurance effects on health are statistically harder to identify in populations where the average individual is healthy.

A second explanation for why we find insurance-related health effects is that the findings are spurious. A priori, several of the instruments identified in the IV analysis papers may be invalid as they are likely correlated with omitted variables that affect health outcomes or may be weak and lead to inconsistent results,²⁸ even in large samples.⁴⁶ Although several papers included statistical tests designed to assess whether the instruments can be rejected and found that they could not, these tests are weak—many are underpowered and null results should be interpreted with caution. Such tests cannot definitively show that the instruments are not correlated with potentially important omitted variables. In the case of poor instruments, IV analysis can exacerbate bias arising from standard cross-sectional statistical models. For instance, Meer and Rosen used self-employment status as an instrument for health insurance status.⁴⁰ The authors show that on measurable characteristics, self-employed individuals are not different from individuals who are wage-earners or unemployed. Yet, it is reasonable to conjecture that there are unmeasured differences between the 2 groups, possibly in location of care received, care-seeking patterns, and health behavior. Using only the variation in insurance status derived from self-employed status could further bias the estimate of the insurance effect on health in the positive direction.

Our findings can also be compared with those of previously published reviews incorporating cross-sectional studies (Table 1). With our stringent review criteria, one concern is that we may have missed important studies that inform the debate about the causality of health insurance or limited our ability to draw meaningful conclusions. Yet, despite strict inclusion criteria, our review yielded the greatest number of causal studies of health insurance of any review to date. Of the prior reviews, only 4 provide summary estimates of utilization and/or health effects.^{5,8,9,13} Three reported that utilization of health care services was 1.5–4.5 times lower for the uninsured.^{5,8,13} The causal studies in our review approach the lower limit of this summary range. Three of the previous reviews reported that the uninsured are 1.2–3.2 times more likely to suffer a poor health outcome.^{5,9,13} Again, the causal studies in the current review have findings at or below the low end of this range. Other researchers have noted that limitations of cross-sectional studies,^{7,9,12} whereas in this review we demonstrate both the direction and magnitude of the bias. The less rigorous study designs seem to overestimate the insurance effect on utilization and outcomes.

The ability of the designs included in this review to estimate causation must be weighed. Longitudinal analyses are unable to account for reasons underlying the change in insurance status, which include changes in medical care preferences, health behaviors, and/or employment benefits. Similarly, results of quasi-experimental studies allowing individual choice in accepting the intervention may introduce bias in results. Along with the methodological issues noted

earlier, IV regression might also exacerbate problems with ordinary least squares estimation (measurement error in dependent variable in first stage) and make estimates more biased. Furthermore, some of the studies reviewed^{33–36,40,41} did not specifically exclude members of the nonelderly Medicare population for whom poor health might bias estimates of the effects of health insurance.

The generalizability of the collective findings of the review must be considered. We limited our review to the working-age population; consequently, our findings are limited to US adults. Our results and conclusions apply generally to gaining or losing health insurance and we are unable to draw conclusions about utilization and/or outcome effects of first-dollar cost sharing, other specialized insurance arrangements for the continuously insured or unique plan features. Future reviews designed to address these topics are warranted. Some of the causal studies in our review analyzed subsets of populations or unique regional policy implementations. Five analyzed data within specific adult age ranges,^{32–34,38,39} 2 analyzed data from a single hospital,^{42,43} 2 analyzed data from a single demographic group,^{36,45} and 2 were limited to a single disease.^{37,44} We advise readers to consider these potential limitations to external validity.

CONCLUSIONS

We examined empirical studies of relationships between health insurance, utilization, and/or outcomes that used either longitudinal cohort, quasi-experimental, or IV research designs—designs better able to identify causality than traditional cross-sectional research. The set of studies that satisfied our criteria was quite small. We consistently found that health insurance causes increased health care utilization and improves health, although the magnitude of the effects are smaller than those in previous reviews that included cross-sectional study designs. These findings confirm some of the RAND HIE findings on utilization while contradicting the RAND HIE findings on insurance effects on health.

A better understanding of the causal effects of health insurance is required if policy-makers are to effectively promote health. Results of this review suggest that policies extending health insurance to the uninsured would cause increases in health care utilization and improved health outcomes.

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